From Family Business to Business Family

--A Comparative Analysis of Production Networks in Taiwan's Garments and PC Industries

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Abstract

The Taiwanese model of economic development is generally viewed as a successful story resulting from the efforts of "family" firms. With the rise of high-tech industry in Taiwan, business networks built by "family" firms are now yielding their pride of place to new types of network. This study detects possible changes in the status of "family firms" in Taiwan from the variation in network and governance structures between PC and garments industries. We find that the PC firms often search subcontractors in open market. Their control mechanisms are more institutionalized, using systematic methods to evaluate both relationships and product quality. However, the role of subcontractors in Taiwanese PC industry cannot be characterized as a market one, since its cooperation plan is long lasting. The comparison between these two industries shows some evidence of change from "family business" to "business family" in the process of technological upgrading.

***Key words*: Production networks; PC industry; Network structure; Governance structure; Subcontracting.**

The Taiwanese model of economic development is generally viewed by scholars as a successful story resulting from the efforts of small and medium-sized "family" firms (in the broad sense, "family" includes extended family member and close friends, etc. see Hamilton and Gao 1990; Chen 1994). This is true because they are significant forces in Taiwan's economic development for two reasons. First, they have accounted for most of Taiwan's exports, which have been the main engine pushing the island's economy forward (for example, the figure stood at 66.7% in 1980; 74.8% in 1981; 75.9% in 1982; 73.3% in 1983; 71.8% in 1984; 71.1% in 1985; see Luo 1997). Second, they are equal partners with big firms in Taiwanese organizational networks in which big firms generally do not dominate (Hamilton 1989; Hamilton, Zeile and Kim 1990; Luo 1997).

However, these two facts are changing. With the rise of high-tech industry in Taiwan, business networks built by "family" firms and characterized by "embedded ties" (Uzzi 1996,1997) are now yielding their pride of place to new types of network. From virtually no computer industrial foundation, Taiwan now stands as the most important PC-manufacturing base, the third largest producer of computer and peripherals in the world. Taiwan achieved this status in less than 15 years. In 1980, Taiwan's total output in computer industry was less than US$ 100 millions. Since then, Taiwan's PC industry has been growing double digits every year. In 1987, Intel sold almost 10% of its products to Taiwan. 1988, 64% of key parts were domestically produced (Institute for Information Industry 1997). In 1996, total output of the PC industry was around US$ 25 billions. Taiwan's worldwide market share in PCs and peripherals also took commanding lead. To take a few examples, it was estimated that in 1997, lap-top computer's world market share was around 25%, notebook 30%, motherboard 60%, scanner 68%, mouse 65%, and computer case 74% (Institute for Information Industry, 1998).

How could Taiwan achieve such a prowess in the PC industry within ten years? Among many key determinants contributing to Taiwan's success, the unique network relationship coordinating Taiwanese firms were definitely one of the most important factors. However, the network is obviously a different form of structure than in the past (Cheng and Jou 1996), since PC industry in Taiwan presently demonstrates several unique features. First, many PC and peripherals firms are big firms listed on the Taipei stock market, and so are many of their subcontractors. Second, they are ODM (original design manufacturing) firms for those world famous brand names, such as IBM, HP, Compaq and Dell etc.. Third, they have clear and documented internal regulations, which need to follow ISO9000 global standards, so as to be qualified for competing contracts from those big brand names. Fourth, the

technological standards in PC industry are high, which forms a high-level entry-barrier for subcontractors. Lastly, facing fierce competition in the global markets, Taiwanese PC firms generally take rigid quality control and large economic scale as important concerns in choosing subcontractors.

To demonstrate this change of network forms clearly, the following study compares Taiwan's PC and garments industries, with emphasis on how the network structures of Taiwanese firms have evolved in recent years. Garments industry is chosen because it represents the most typical network of small "family' firms and many excellent second-hand data has been collected in previous thought-provoking studies.

I. Theoretical Background for Designing Questionnaire

A. Governance Structure

The first concern of this paper is the governance structure of a production network. Following the publication of Coase's thought-provoking article in 1937, transaction cost has become a main theme of economic studies on institutions and organizations. If there is no transaction cost, as assumed by those theories with consideration of only scarcity and competition, then free competition is the most efficient way to allocate economic resources. Any restriction on competition, whether it be in the form of institution or synergetic relationships, has no reason for existence (Coase 1937; North 1990). Since transaction costs exist and are sometime vital in economic decision-making, institutional studies has therefore become an important area of research in economics.

Among so-called New Institutionalism economists, Williamson helped the thinking of this school to more forward an important step by linking organization structure with transaction cost. In his famous problem "markets and hierarchies", minimizing transaction cost is proposed as the rationale behind organizational structuring (Williamson 1975). In his argument, transaction cost is a result of the bounded rationality and opportunism of actors, and information searching and malfeasance control in transaction emerge to the center of this doctrine (1981). Markets and hierarchies respectively provide controls for malfeasance in transactions, but also incur costs. An intentionally rational actor will choose the most cost-efficient

way to carry out his/her transactions, therefore transaction cost is a determinative factor in deciding where a transaction should be executed – in markets or in organizational hierarchies, and this in turn determines the form of organizational structure (1975, 1979).

Williamson (1985, p.79) furthermore extended his argument, and proposed four forms of transaction contracts—classical contracts, neo-classical contracts, relational contracts between two firms, and relational contracts within hierarchies, each form of which is accompanied with a most efficient governance structure—market, trilateral, bilateral (or network), and unified governance (or hierarchy). The natures of a transaction, which can be featured by its frequency and asset-specificity, determine the form of contracts of the transaction, and the governance structure of the contract is thus also determined.

For explaining the different natures of the three forms of governance structure—market, hierarchy and network, Heide categorizes governance structure of a contract into eight dimensions--relationship initiation, role specification, nature of plan, nature of adjustment, monitoring procedures, incentive system, means of enforcement and relationship termination (1994). We find that this analysis framework is a useful conceptual tool for our comparison of subcontracting contracts between PC and garments industries, although both can be categorized as networks. We regroup this research framework into five dimensions and introduce the concepts of our questionnaire design as follows:

(1) Relationship Initiation

"What was the original social relationship leading to joint economic action?" is the question here asked. In comparison with searching for a trade partner, case by case, in market governance, network is thought of selecting partners by the standard of their value contributed. Since embeddedness theory (Granovetter 1985; 1992) has come to the center in both sociological and management studies, economic ties are often viewed as being embedded in social life. The overlapping of economic action and social relationships is now a main concern of Network Theory. On the other hand, rather than social relations, strategic alliances for resources exchange are generally thought as the main source of joint economic action in hi-tech industries. For example in the bio-tech industry, 2323 alliances were observed in the U.S.A.(Barley, Freeman & Hybels 1992), and in the IC industry of Silicon Valley, 350 alliances were found among semiconductor designers and producers (Saxenian 1994). The process of searching for subcontractors is thus one of the main concerns in our survey.

(2) Roles of Subcontractors

In dimensions of role specification and nature of plan, Heide identifies market behavior as short-term transaction relations without any long-term cooperation plan, and networking behavior as long-term relations with multiple roles involved (Heide 1994). The mutual services between subcontractors and buyers have been revealed in our open question survey to show the role specification of the subcontractor in their long-term cooperation plan. In addition, in our questionnaire, two quantitative variables are utilized to measure whether market or network behavior is adopted in the plan. They are duration of transaction relationship and multiple relations, i.e. both sides sharing finance, marketing or R&D services with each other, in addition to production connections.

(3) Monitoring Procedures and Means of Enforcement

The dimensions of monitoring and enforcement are related to control mechanism. It is important to investigate the cost of controlling a network, since lower costs are an important factor, even if not the solo one, in determining whether a firm chooses to do business using a market, hierarchy or network model. (Powell 1990). Control mechanisms are strategies employed by a center to insure the cooperation of its subcontractors. It may include some of the methods utilized in daily management to govern production processes across firm boundaries, evaluate inter-firm relations, or decide an appropriate course of action when a relationship turns out to be unsatisfactory.

(4) Nature of Adjustment

Nature of adjustment is defined as the form of negotiation process. An open question is asked for understanding how both sides of subcontracting reach an agreement if there were any change of plan. We found that bargaining power plays a key role in this process. In network theory, Burt has an excellent study on bargaining power in his “structural hole” theory. He asserted that monopoly or united firms have bargaining power over dispersed firms with holes among them (1992). Abstracting Burt's theory, we define bargaining power in a production network as a function of two variables. First is the degree to which a given center depends on a subcontractor, which is indicated by the proportion of the center’s total purchases made from the subcontractor. Second is the dependency of the subcontractor on the center, measured by the proportion of the subcontractor’s total sales to the center. Generally speaking, a center is powerful if its purchases are not concentrated, its subcontractors are heavily dependent on it, and there are numerous other subcontractors available as substitutes.

(5) Incentive and Relationship Termination

These two dimensions are related to reward and punishment. Market behavior rewards each transaction with only monetary payment and terminates relationship after completion of discrete transaction. On the contrary, a reward system of network behavior includes social reward, economic cooperative plans and monetary payment, and takes terminating relationship as a serious punishment.

B. Network Structure

The second concern of this paper is the network structure of a production network. Perrow in his paper "Small-Firm Networks"(1992） listed many types of organizations. In addition to integrated firms, the list includes integrated multidivisional firms, conglomerates, subcontracting systems, joint ventures, holding companies and small-firm networks. In Perrow's system of categorization, joint ventures and holding companies are mostly related to R&D, and financial relationships, rather than to productive networks, while integrated firms and integrated multidivisional firms are single firms rather than network organizations. So we classify the structures of productive networks into three types: conglomerate, subcontracting system and small-firm network. This classification is fairly close to what management scholar Robert Howard (1990) uses--"kingdom type", "hybrid type" and "republic type".

Generally speaking, conglomerate types have several horizontal centers each with its vertical subcontracting system. These centers are integrated by the ways of cross stock-holding, mutual financing, interlocked ownership and common control. Subcontracting system has only one center that divides up an integrated job and subcontracts the parts out to its dependent or non-dependent subcontractors. It generally has a form of center-satellite structure. In most cases, a center produces final products and the subcontractors are dependent on the center. Small-firm networks have been a research focus of sociologists since The Third Italy (Lazerson 1993; Piore and Sabel 1984) and Taiwan provided prototypes of this network structure (Hamilton, Zeile and Kim 1990; Ka 1993）. Horizontal subcontracting and unstable center-satellite relationships make for a small-firm network with a weak center. Different firms may emerge as a center taking orders and controlling entire labor processes. But at other times, these same firms may take subcontracted work from other small companies.

Network size is naturally an important measure in defining any type of network (Marsden 1990). The geographical distribution of subcontractors a given center has is

the main concern of this paper, since regional subcontracting network is now a focus of studies on industrial district. For example, in a comparison of the development paths for Silicon Valley and Boston, Saxenian (1994) attributed the success of Silicon Valley to its local environment, in which a firm generally forms subcontracting networks and alliances, rather than building a vertically integrated structure.

II. Research Design and Data Collection

Our survey relied on in-depth interviews in the filling out of questionnaires. We conducted extensive interviews with PC companies, focusing especially on monitor and PC firms (in this paper, the term PC industry is considered to include monitor and PC firms). The target firms are the leaders in Taiwan's PC industry in terms of their share in global markets. In Taiwan, most previous research focused on labor-intensive industries. Such studies generally conducted in-depth interviews of a qualitative nature, examining Taiwanese enterprise activities from the standpoint of its basis in local community structure (Chang and Pan 2002). Our survey places equal emphasis on qualitative and quantitative data. While conducting in-depth interviews and case studies, we have also designed a questionnaire, which converts interview information into quantitative data. In this way, we aim to provide a general picture of PC industry networks through analyses of quantitative data.

We selected our target firms from a multiple database, using the manufacturers' database of the ITIS Website, the "Member Directory" jointly published by the Taiwan Electronic and Electrical Manufacturers Association and Taipei Computer Association, and related information from the Market Intelligence Center of the Institute for Information Industry. Samples were first taken from the largest five or ten manufacturers of the above-mentioned two products. Most primary manufacturers were available for interviews. We also interviewed a larger amount of medium-sized firms, which were purportedly sampled. The data collection for this total of 31 firms, among which only 2 firms, Leo and Taitung, are desktop PC firms and not included in quantitative statistics. Others are 11 notebook PC firms and 18 monitor firms, as shown in Table I. This survey continued for 6 months. Finally, both analyses of qualitative and quantitative data have been done to delineate the features of Taiwan's PC firms' networks.

Table I. The 29 Interviewed Taiwanese PC firms

	Notebook PC Large Firms	Notebook PC Medium-sized Firms	Monitor Large Firms	Monitor Medium-sized Firms

Industrial Structure	Top 10 Concentration ratio 87% , top 5, 71%		Top 10 Concentration ratio 70% , top 5, 47%	
Interviewed Firms' Name	Inventec、Compal、Mitac	Clevo、Twinhead、Veridata、Smart、Cojin、Crete、Chicony、Dual	Ctx、Delta、Acer、Mag、LITE-ON、ADI、TECO	Raite、PHILIPS、Jamicom、Chun、Essex、Bridge、Sampo、Proton、Fair、Topfly、A Plus Info(鴻智電子，沒問題)
Established Year	1975~1983	1982~1995	1979~1990	
Yearly Sales	More than 300M US$	10M to 100 M US$	More than 500M US$	10M to 100M US$
Marketing Channel	OEM/ODM 80%~90% Wholesales 10%~20%	OEM/ODM 30~40% Wholesales 60~70%	OEM/ODM 80%~90% Wholesales 10%~20%	Wholesales 70~80% OEM/ODM 20~30%

Note: OEM--Original Equipment Manufacturing
ODM--Original Design Manufacturing

In analyzing the networks of small and medium-sized "family" firms in the garments industry, insufficient information has been supplemented by second hand data, collected by various Taiwanese scholars, such as Chen's investigation on traditional ways of networking (1994, 1995), studies by Chao（1995）and Chen (1997) on garments firm networks in the Homei area, Ka's long-term observation of Wufenpu's garments industry (1993), Shieh's book "Boss Island" (1992), and Hamilton and Gao's (1990) theory about Taiwanese "family" firms. In the following, we will summarize our analyses of quantitative data in Table II, so as to present the changes in Taiwanese productive networks.

III. Network of "Family" Firms in the Garments industry

The garments industry has various types of networks. Large garments firms tend to integrate business processes vertically into hierarchies or conglomerates, which are very different from small and medium-sized "family" firms, which depend mainly on subcontracting networks. Among small and medium-sized "family" firms, networks also show variation. In analyzing firms in the Wufenpu and Homei areas, we have tried to identify their similarities, and make to compare them with PC firms.

Relationship initiation is also the focus of most research into Taiwanese networks (Hamilton and Gao 1990; Shieh 1992; Chen 1994). In these studies, family members, extended family ties, and close friends are often viewed as sources of

strong ties (Chen 1998), whereas geographical relations (Ka 1993), acquaintances and indirect friends constitute the majority of weak ties in joint economic action. How exactly are small and medium-sized "family" firms formed in the garments industry, specifically those not utilizing modern large-scale assembly lines? Sociologist Chieh-Hsuan Chen (1994) found that commercial networks in Taiwan are closely connected with social structure, with social relations deciding what networks are to be created. Subcontractors are often relatives or acquaintances but not necessarily close ones. Ka in his study of Wufenpu case also finds that close subcontractors often come form hometown folks who worked for the center firm for several years before they start up new businesses.

About the role of subcontractors in a transaction, Ka (1993) finds that a small firm, in order to maintain its flexible specialization (Piore and Sabel 1984), usually needs to build a three-tier mobilization structures. The first tier is a group of exclusive subcontractors, most of them having personal relationship with the center. The center needs to keep providing them jobs, in exchange for their loyalty and trust, even in the lean time. Besides depending on exclusive subcontractors, the center will usually also reserve some jobs for non-exclusive subcontractors, in order to keep its contact with them. The relationship between non-exclusive subcontractors and center is long-term, but not necessarily indefinite. Lastly, when the market becomes extremely busy, the center may need to utilize temporary subcontractors, who do not have any previously existing relationship with the center. Transactions of this sort are purely a reflection of market behavior. By mobilizing these three tiers of subcontractors, a center firm maintains its flexibility in a fluctuant market. In Wufenpu practice, a small firm may take a big order, then horizontally subcontract out part of the order. It is a contractor and subcontractor at the same time (Ka 1993).

Chen terms the role of exclusive subcontractors as 'simulated extended family member' (1994: 189-218). Once a strong relationship is built, a simulated family group is created, in which members are bound together by ties of business accompanied with emotional support. The term 'simulated extended family groups' clearly describes the nature of this type of business networking. Exclusive subcontractors are considered to be part of the center, since their interests and fate are directly linked.

From the viewpoint of control mechanism, the maintenance of the relationship is contingent upon a non-economic social structure, and deeply influenced by social interactions. Chen proposes four principles in the control of small-firm networks, i.e. interest principle, emotion principle, power principle, and the fourth--how to balance these three principles to maintain the relationship (1994: 219-220). Unless product

quality becomes intolerable poor, the consideration of social connections is always put before trouble shooting. Necessary actions, if any, are taken in a way that won't hurt feelings. In other words, social control is the main mechanism of control.

In the process of negotiation if there were changes of cooperation plan, trust needs to be emphasized while business interests have not been seriously jeopardized (Powell 1996). With regards to this trust-based forms of governance in the garments industry, Chen has provided a theoretical basis with his model of a 'weighted balance of social relations and business interests' (1994: 219-247). We find this model as well in Ka's study of Wufenpu. In subcontracting garments production work, one important source of personal trust is the tie between these who come from the same town or county. When an employer and worker build a strong relationship, once the worker leaves to start his own firm, their social relationship will be strengthened in proportion to the growth in their cooperative business profits. Cooperation networks of small and medium-sized "family" firms in the garments industry have a stratified structure. Relationships extend outwards from family members to relatives and hometown folks. The strength of interpersonal relations decides the level of personal trust, as well as the nature and duration of commercial alliances (Chen 1994).

Small and medium-sized "family" firms in the garments industry tend to complicate relationships with personal feelings. It is difficult to restore a relationship once it breaks down. Because of the obligations imposed by social connections, a business relationship will not be easily given up unless there is no other way out. Indeed, if the business partnership is jeopardized, the social relationship will also be endangered. Those engaging in cooperative economic endeavors within an interpersonal network must seek balance between one's own personal interests and face—the social demands imposed by relationships.

Lastly, about network structure, small and medium-sized "family" firms in the garments industry adopt various types of network structure. Some garments firms in the Homei area studies done by Chao (1995) and Chen (1997) had organized their own dependent center-satellite subcontracting systems to fill big orders. Most subcontractors observed by Chao were dependent on a center, so boundaries among different networks could be easily defined. A center generally is an international trader or a factory that can take orders from abroad. There are only a few subcontractors in each network, and they tend to concentrate in one area--Homei. The garments firms industry in Wufenpu studied by Ka exhibit a typical small-firm network, where firms subcontract jobs to parallel partners, and no fixed center can be clearly identified. Network size is small and geographically concentrated in Wufenpu.

Table II. Analysis of Questionnaire Survey Data—A Comparison of Production Networks between Notebook PC and Monitor Firms

		Large Note Book Firms	Medium Note Book Firms	Large Monitor Firms	Medium Monitor Firms
		Taking LCD Firms as Examples		Taking OCT Firms as Examples	
Governance Structure					
Relationship Initiation		100% searches in market	83% searches in market 17% uses "family ties" (two are missing in this item)	28 % purchases in conglomerate. 58% searches in market, 14% uses "family ties"	63% Searches in markets 25% uses retailer's reference 12% uses customer's reference (one is missing in this item)
Role of Subcontractor	Duration	7 to 8 years, Mean: 7.5 years	2 to7 years, Mean: 3 years	3 to 20 years, Mean:9 years	1 to 15 years, Mean: 7 years
	Multiple Relations	No overlapping Relations	83% no overlapping Relations, 17% has joint marketing (two are missing in this item)	16% has joint R&D, 67% has mutual investment, 67% has joint marketing, 16% has technology transferring (one is missing in this item)	55% has technology transferring, 11%has mutual investment, 44%has joint marketing, 11% has joint R&D, 33% has joint training (two are missing in this item)
Nature of Adjustment (Bargaining Power)		firms' purchase from the largest source 50%, in average about 50%	firms' purchase from the largest sources 40% to 90%, in average about 55%	firms' purchase from the largest sources 30% to 95%, in average about 60%	firms' purchase from the largest sources 20% to 80%, in average more than 50%

Means of Enforcement (Control Mechanism)		Multiple outsourcing. Keep stable relations. Purchase lower than 50% from one subcontractor.	Multiple outsourcing. Shift orders according to services.	Multiple outsourcing. Establish stable and multiple relations. The three firms in conglomerates utilize hierarchical governance structure.	
Relationship Termination		The general practice: If a subcontractor failed to fill an order or proved unsatisfactory, centers would reduce the quantity of orders to that firm, then cease doing business with that firm but would keep the relationship on hold in case another opportunity for cooperation come a long.			
		100% reduces orders 50% may stop cooperation 50% asks better trade terms (one is missing in this item)	100% reduces orders	100% reduces orders 100% may stop cooperation 16% asks better terms (one is missing in this item)	100% reduces orders 44% may stop cooperation 11% asks better terms (two are missing in this item)
Network Structure					
Network Structure		Non-dependent Center-Satellite System		Non-dependent CSS, 2 in Conglomerates	
Net-work Size	Geographic Distribution	For an average firm: 45% from Taiwan, 30% from Asia, and 25% from North America	For an average firm:75% from Northern Taiwan, 6% from Southern Taiwan, 16% from Asia	For an average firm: 54% from Northern Taiwan, 2% from Southern Taiwan, 26% from Asia and 5% from North America	For an average firm: 70% from Northern Taiwan, 5% from Southern Taiwan, 12% from Asia and 1% from North America

Note: LCD--Liquid Crystal Display, OCT--Object Code Translator

IV. A Picture of Taiwan's PC Industry Networks

Our survey uses three big notebook PC firms, as well as eight medium-sized firms for major parts of analyses, supplemented by seven large and 11 medium-sized monitor firms, to determine some of common features of the PC industry. Analysis of quantitative data is displayed in Table II, and open questions will be summarized as follows.

We found that in the PC industry, the networks of medium-sized firms differ from those of big firms, and networks for different products also display differences. We will point out these differences by the analysis of quantitative data, but our primary aim is to identify similarities. The first step is classification of big firms and medium-sized firms, based essentially on their sales. Big firms have sales more than US$300 million and medium-sized firms less than US$100 million. As indicated in Table I and shown by the points, big firms usually become established earlier than medium-sized firms, and derive their profits primarily from OEM/ODM, while medium-sized firms, on the other hand, rely heavily on distribution to wholesalers. Since all these PC firms have a standard business process of subcontracting, mostly following ISO 9000 regulations, their governance structure in our open-question survey demonstrates similarities. In the following, we first state their similar business processes, and then show their difference by analysis of quantitative data.

A. Relationship Initiation

A center usually searches for potential vendors through several sources, including the name list collected by related industrial associations, brochures received through vendor representatives, word-of-mouth recommendations, circulated information in the community, etc.. Since quality standards are the first priority in choosing potential partners, R&D (Research and Development) and QC (Quality Control) departments are usually first involved in the process of evaluating quality. After a simple development agreement is reached, a sample of the supply in question will be delivered and carefully examined in order to let the center issue a document of quality-proof. Then, R&D, QC and the procurement departments jointly continue their research into the factory of the potential vendor, whose production line, quality control, R&D ability, and financial health can thus be investigated. In this evaluation process, all review items are recorded in a quantitative manner so that production quality can be measured precisely according to global standards.

All PC firms use this practice to search partners in open markets by various ways, except one medium-sized notebook firm employs its "family members", two large monitor firms buy components in their own conglomerates, and one large monitor firm uses its "family ties" (see Table II).

B. Role of Subcontractor

Subcontractors in the PC industry demonstrate networking behaviors—long term transaction relationship accompanied with a cooperative plan. When the potential vendor is selected as a partner, a plan of cooperation should be signed before a formal alliance can be formed. In the very beginning, a comparatively small quantity of supplies is delivered. As this alliance grows over time, the center firm may increase orders according to the development of their relationship. In this agreement of cooperative plan, quality requirements, price range, the principle of periodical price-down, predicted demand for the next year, and delivery methods should be regulated. In Taiwan's PC industry, industrial community norms generally offer fairly standard terms along the lines of this type of plan.

The average duration of relationship is more than two product lifecycles (for example, CD-ROM's cycle period is around three to six months, while for monitor's it is about one year). Big notebook PC firms usually keep their subcontractors for up to 7.5 years, as in the case of the LCD industry. Medium-sized firms reduce this period to roughly three years, reflecting weaker relationships. Monitor firms usually maintain relationships for 3 to 20 years, which is longer than notebook PC firms. Monitor firms tend to keep longer and stronger relation with subcontractors than notebook PC firms (see Table II). Several monitor producers also produce TVs, and belong to conglomerates. The monitor industry is similar to the home electronics industry, in that its product life cycles are fairly long. That is why monitor firms usually employ the strategy of building strong and durable relationships, and some even try to develop joint ventures with subcontractors so as to include them in one business group.

In the notebook PC industry, most centers and subcontractors don't have multiple relations[1], except one medium-sized firm has joint marketing activities, but monitor firms generally develop technical, marketing and even investment connections in addition to production networks. This doesn't indicate exclusive subordination. The subcontractors still maintain their independence because the center does not rely entirely on their supply. Two monitor firms are exceptions when the centers and

[1] Some notebook firms have joint R&D activities with their primary subcontractors, but not in the relations with LCD firms which were investigated by our survey.

subcontractors are both subsidiaries of conglomerates, in which case there is mutual funding as well as overlapping of control. Monitor firms show a greater tendency to maintain multiple ties with their subcontractors than do notebook PC firms.

C. Monitoring Procedures and Means of Enforcement

After receiving supplies, the storage department checks the quantity of the order and issues a proof of delivery. Then, the QC department comes into the picture. Standard practice of the QC department is to randomly sample a certain percentage of supplies and use a commonly agreed standard to measure samples. A whole order of supplies will be turned back if it fails to pass QC, in which case the QC department of the vendor will be called in to figure out where the problem has occurred.

Control mechanism is a mean of enforcement making subcontractors cooperative. The PC industry has an array of institutionalized control mechanisms. A center usually procures components from more than two subcontractors, and controls the relationship through allocation of orders. More orders are placed with subcontractors offering good service and stable quality, and fewer orders with those whose service and quality are poor. A center firm keeps ties with a cluster of subcontractors for the purchase of certain components. It may buy from two or three firms at any given time, while still preserving its ties with other subcontractors. This control mechanism encourages competition both in service and quality, while at the same time distributing risk. Centers select their partners according to the services they offer, for example, Leo frequently cooperates with 100-150 subcontractors, while maintaining ties with another 200-250 firms for the sake of price comparison. Taking monitor suppliers as an example, Leo requests price quotations from five to six firms, but purchases from only two to three firms.

Medium-sized notebook PC firms source their supplies from non-dependent subcontractors, supplemented with procurement on the market. Firms offering the best services (usually the biggest subcontractor) take priority in mobilization. Other subcontractors function as back-ups. Direct procurement on the market is the last resort to fill emergency orders. For example, A medium-sized firm Twinhead recently purchased 90% of its CD-ROMs from two non-dependent subcontractors. They control the relationship through allocation of orders. Only 10% of supplies were procured on the market. We found that large notebook PC firms maintain a stable relationship with their subcontractors, and seldom resort to market purchase to fill emergent orders, because they have the bargaining power to ask subcontractors to supply them first. Medium-sized do not enjoy this advantage. Monitor firms in

general don’t need to purchase on the market either, since their networks are durable and stable.

D. Nature of Adjustment

Before an agreement of partnership is reached, vendors should offer an analysis of their production costs, as price is set generally based on that cost plus a certain percentage for profit. By industrial community norms, 20% is a reasonable profit. Quality and price of potential vendors are the most important criterion in making the final selection of appropriate partners. Price bargaining continues on along the entire lifecycle of a component. In terms of community norms in Taiwan’s PC industry, price should be lowered almost every quarter. In a bargaining process, the social relation between sales and procurement managers is not so much relevant, since managers of both sides are employees without policy-making power. The most determinant factor is relative bargaining power of the two companies.

Big firms have slightly greater bargaining power than medium-sized firms, whether in the monitor or the notebook PC industries. For example, most LCD operators are very big firms with little dependence on single notebook PC firm. On the other hand, big notebook PC firms are able to keep their purchases from any single LCD firm below 50%, while medium-sized firms are weaker power, in that their dependence on one firm is sometimes over 60% (see Table II). However, medium-sized firms generally choose to cooperate with small firms in order to increase their bargaining power in the relationships. A center tries to increase a partner’s dependency while decreasing its own in order to gain more leverage and obtain better services. In a recent procurement, for example, the main subcontractor supplied 70% of its monitors to Leo, while the center purchased only 50% of its total need from the subcontractor. According to one of the Leo staff, their No.1 partner in the monitor deal is much smaller than the No.2. Good service and bargaining power account for this selection.

In the notebook PC industry, centers have the power of control and distribution of orders. Since most subcontractors are non-exclusive, they don’t depend only on one certain center. Large and medium-sized suppliers are basically equal power in their relationship with the center. But in the case of small-sized subcontractors, some may rely on one single center and therefore lose their bargaining power. Interestingly, though, if a subcontractor possesses a technical advantage in the manufacture of a certain product particularly if it is a design-in component, then they gain a stronger competitive edge, and sometimes may even be more powerful than the center. From

the above discussion, we see that the PC industry is technology-intensive. PC firms must constantly improve their products and maintain their flexibility in order to survive. Thus, building multiple ties helps to insure that a competitive firm will not be dragged down if one of its partners is unable to keep up. It also means that the center won't have 100% dependence on subcontractors of vice versa. No one party is in a position of absolute power.

E. Incentive and Relationship Termination

The evaluation of a vendor's performance is executed periodically. The main concerns include quality, on-time delivery, price, R&D ability, flexibility, and the vendors' motivation to cooperate. If a vendor fails to pass the evaluation, the buyer will inform the vendor first, and ask the latter improve its performance within a limited time. In our analysis of quantitative data, 100% of centers switch orders to other vendors in the case that satisfactory improvements have not been made. A certain percentage of them may suspend partnership temporarily due to irresolvable differences. Only a small number of centers may ask better trade terms (see Table II).

Large firms have stable subcontracting relations, holding on to partners for a long period of time without replacement. The relationship of monitor firms with their subcontractors is even more stable than with the big notebook PC firms. The subcontracting system of medium-sized notebook PC firms, on the other hand, is more of an unstable network. For example, when a medium-sized firm Leo purchased CD-ROMs, it once ceased purchasing from what today is its biggest subcontractor. If a subcontractor failed to fill an order or proved unsatisfactory, Leo would cease doing business with that firm. Although cooperation may only be intermittent, purchase is never a one-time deal.

The general rewards for good service are more orders and stable relations. Joint R&D is definitely a sign of good subcontracting relationship. Only those vendors with special know-how and the ability to make long-term commitments can receive technological investments from the buyer. In the general practice of joint molding design, the center needs to guarantee several months of monopolized production with generous profit to the vendor. Certainly, stable relationship adds credibility to a guarantee of this sort.

F. Network Structure

In accordance with the above-mentioned classification of network structures, the

Taiwanese PC industry can be termed a non-dependent center-satellite subcontracting system. Two monitor firms are found in the category of conglomerate. Indeed both large and medium-sized firms in the industry are characterized by a primary center with linkages to many subcontractors, most of which are small and medium-sized firms, but some a few of which are big names listed on the stock market. Usually the major subcontractors have many centers also. Second-tier subcontractors may also sell to several buyers, and the third-tier firms operate in the same way. This structure of cooperation has a dominant core, but its component parts are more or less independent, as analyzed in the section on bargaining power.

In the network structure of the PC industry, a center can always easily be identified, which is usually a large or medium-sized final-product assembler. A center has access to buyers from around the world. It is different from small-firm networks, where every firm has the opportunity to fill orders but there is no stable core. Centers tend to procure their components mostly from subcontractors or in the market, avoiding self-production as much as possible, except for the two monitor firms that belong to conglomerates, which can obtain components from factories operated by the conglomerate. The components they purchase all have standard specifications, so that subcontracting is more efficient and less risky. The non-dependent subcontracting system combines competition and cooperation, by distributing risk among small subcontractors. Such a structure is more flexible than vertical integration, and more able to withstand outside pressure as well. The center still has other backups if it loses a subcontractor, and the system is immune to abrupt breakdown.

Another issue to be considered is network size. Large notebook PC firms vary from medium-sized firms in this regard. Large firms have subcontractors located mainly in Taiwan and Asia with supplements in the United States. Medium-sized firms, on the other hand, have subcontractors all located in Taiwan, chiefly to the north of Hsinchu Science-based Industrial Park. This difference, then, is primarily a reflection of a firm's ability to adopt a strategy of global logistics. Medium-sized firms are more relied on local networks than large firms (see Table II).

V Conclusions—From Family Business to Business Family

We observed that networks differ due to different products and firm size. After comparing large and medium-sized notebook PC firms, we found that the former have more durable and stable sub-contracting relationships than the latter. In bargaining power, the formers are slightly more powerful. With reference to network size, the former has globally distributed network while the latter has only local ones. Monitor

firms don't exhibit a high degree of variation within the industry, except those large firms have greater leverage and bigger networks size than do medium-sized firms. However, the discrepancies between the two industries are also significant. In general monitor firm's networks are typified by overlapping relations while notebook PC firms are not. They also have longer and more stable relations with their subcontractors, in comparing with notebook PC firms, but their network size is smaller in geographical distribution.

The networks of small and medium-sized "family" firms in Homei and Wufenpu also likewise display some differences. Unlike the small-firm networks found in Wufenpu, the network in Homei is a center-satellite subcontracting system with a highly unequal balance of power between the centers and subcontractors.

Although differences can be found between different-sized firms in the same industry, there are still some common features among networks within both the PC and garments industries. From the variation in network and governance structures between the two industries, we can detect possible changes in the status of "family firms" in Taiwan. In the PC industry, centers emerge out of networks, and are generally the large assemblers of final products. Many of these centers are huge, listed on the stock market, and are strong exporters. The PC industry in Taiwan has a high level of concentration—i.e. the ten largest firms control over 90% of the market share. This is very different from small-firm networks, where none of the member "family" firms enjoy such a dominant status, even though they are centers of networks.

In relationship initiation, all PC firms, except one notebook PC firm and three large monitor producers, often search subcontractors in open market. As the vice president of the notebook PC firm MITAC has pointed out: "priority will go to social relations in case of equal qualifications, but such cases are rare."

Control mechanisms in hi-tech network are very different from those in a "family" business, which mix social control and personal connections with daily management. In the PC industry, control mechanisms are more institutionalized, using systematic methods to evaluate both relationships and product quality. Good quality and service guarantee longer cooperation. Multiple outsourcing and shifting orders among firms are often used to encourage competition among subcontractors, and thus improve component quality.

Within nature of adjustment, balance of power and social relations are the principles for both PC and garments industries. However, power plays a more important role in the PC industry, since the social connection of middle-level sales and procurement managers is not a crucial factor. Finally, PC firms suspend rather than terminate partner relationship, and personal friendships among relevant managers

may not cease at the same time.

However, the role of subcontractors in Taiwanese PC industry cannot be characterized as a market one, since its cooperation plan is long lasting. All large firms in the PC industry do their best to build long and stable subcontracting systems by searching for qualified suppliers. But networks of this type cannot be called “family” networks, since the centers are often own by public stockholders, and ties with subcontractors are seldom “family” ties (in its broad sense). Because of the long and stable relations, which bind a center and its subcontractors together in close-knit relation, we can call such networks a “business family”. Thus, the governance structures of Taiwanese networks show evidence of significant change in the comparison between PC and garments industries. This change can be summed up as moving from “family business” to “business family”.

Upon an initial investigation, our survey is not comprehensive. To draw a general picture of PC networks, we present our observations in abstraction. The changes of network and governance structures from small garments firms to large or medium-sized PC firms cannot also be generalized to a general trend of transformation in Taiwan. However, the comparison of network structures between Taiwanese industries shows some evidence of change from "family business" to "business family" in the process of technological upgrading. We look forward to further studies of these changes by more social scientists in order to describe more comprehensively the networks found in Taiwan’s PC industry.

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從家族企業到企業家族--臺灣高科技業與製衣業外包網絡之比較

過去社會學者對臺灣經濟發展模式的研究經常歸功於中小型「家族企業」以及它們組成的企業網絡對經濟的貢獻，然而隨著臺灣經濟的轉型，高科技產業的興起，此一企業型態與網絡已發生了本質上的變化。本文透過對二十九家高科技公司之訪談，並整理過去學者對製衣產業網絡的分析，藉以比較高科技業與製衣業統制結構與網絡結構之異同。本文雖然以描述性統計說明了高科技業內因公司規模與產業性質之不同，其統制結構與網絡結構亦會有所不同，但其共同之處卻顯示高科技業皆從市場上而非社會關係中尋找合作伙伴，對外包網絡的控制也有較制度化的方式。然而，這種交易雖然少了社會關係為其前題，但又絕非市場交易，因為公司間仍然建立了堅實的信任，並有長遠的合作計劃。故我們稱此一網絡為「企業家族」。

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