



## The Internationalization of a Production Network and the Replication Dilemma: Building Supplier Networks in Mainland China

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**Abstract.** Replication can be a powerful strategy for firms, but the replication of organizational practices is not easy, and there exists a real tension between replication and adaptation. This paper looks at the sourcing strategies and supplier networks of three Taiwanese machine tool companies in mainland China to understand the conditions under which replication may be more or less likely to occur. In addition, by viewing the cases as examples of the production network internationalization and by considering the issue of convoy migration in such a context, this paper presents a new way of thinking about the internationalization of industrial networks.

**Keywords:** internationalization, production networks, replication, machine tools, China

### Introduction

In this paper, we look at the efforts of three Taiwanese manufacturers to establish operations in mainland China. With mainland China having become a workshop to the world, such an investigation is interesting in its own right. In addition, our research also has implications for two theoretical issues.

In developing this study, first, we consider internationalization from a network perspective (Johanson & Mattson, 1988). Second, by looking at how Taiwanese manufacturers have internationalized, we contribute to debates regarding adaptation and replication, both in terms of the replication of Asian company business practices abroad (e.g. Yoshino, 1976; Sorge & Streeck, 1988; Florida & Kenney, 1991) and the replication debate more generally (Nelson & Winter, 1982; Szulanski, 1996; Winter & Szulanski, 2001).

The qualitative data compiled for this study comes from interviews with managers overseeing the subsidiary operations of Taiwanese firms in mainland China. We also interviewed suppliers and parent company managers in Taiwan. As a result of this fieldwork and our analyses herein, we believe our research contributes valuable observations that can provide useful guidance for further research. In particular, by viewing the cases described here as examples of the internationalization of a production network and by directly considering the issue of convoy migration by manufacturers and their suppliers, our study extends the Johanson and Mattson (1988) framework for understanding the internationalization of industrial networks. Further, by looking at sourcing strategies and supplier networks, this study identifies

conditions under which the replication of organizational practices may be more or less likely to occur. We develop these contributions by first outlining some prior theoretical work. We then identify the context and focal issues for our study, which is in turn followed by a description of the case studies and a summary of our findings. We conclude with a discussion of those findings.

## Theory

### *A network approach to internationalization*

In international business, the dominant approach to understanding the international behavior of companies has been through a focus on the actions of individual firms operating internationally (Hymer, 1960; Buckley & Casson, 1976; Dunning, 1977; Hennart, 1982). Of course, business takes place in a network setting (Granovetter, 1985), and this is as much true when going abroad as when operating at home (Johanson & Mattson, 1988). Our understanding of the degree to which interfirm relations and interorganizational practices may change when a company goes abroad, however, remains incomplete.

Fortunately, some researchers have begun to adopt a network perspective to the study of firm internationalization (Johanson & Mattsson, 1988; Forsgren & Johanson, 1992). Johanson and Mattsson (1988:291, 294) see industrial systems as networks composed of "firms engaged in production, distribution and use of goods and services" and production nets (production networks) as containing "relationships between firms whose activities are linked to a specific product area." According to Johanson and Mattsson (1988), an example of a production net would be a 'heavy truck net' which would include all firms manufacturing, distributing, repairing and using heavy trucks, and a 'national production net' would be a production net in a specific country (e.g. the Swedish heavy truck net).

Forsgren and Johanson (1992) note that investing in foreign markets entails the creation of specific exchange relationships in other countries. Because building relationships can be difficult, internationalization tends to be cumulative and gradual. Market entry is therefore often a laborious process of acquiring a basic understanding of the character of the local network, engaging in different relationships, and responding to actions by others in the network (Hallen & Johanson, 1989).

According to Johanson and Mattson (1988), a production network can be more or less internationalized. A high degree of internationalization implies that there are many (strong) relationships between the different national sections. A low degree of internationalization means that the national networks have few relationships with each other. While Johanson and Mattsson's basic approach is good, as Chetty and Holm (2000) have noted, their model has certain weaknesses. In particular, their concept of production net internationalization may be a bit too broad, resulting in some real classification questions and a bias away from the consideration of certain issues. As a result, while it is true that some researchers have begun to adopt a network perspective to the study of firm internationalization, there are still aspects of the phenomenon that have yet to receive the attention they deserve. In the next section, we focus on one relatively unexplored issue (convoy migration) and work to

remedy some of the weaknesses of the Johanson and Mattsson framework by making a few modifications to their model of network internationalization.

*The timing of foreign direct investment and convoy migration*

This paper sees convoy migration as the coordinated investment of firms with pre-existing ties in a new location (e.g. the coordinated investment of a Japanese automaker and its Japanese part suppliers in the United States). While collective decision making and the timing of foreign direct investment have been discussed in several places, the two ideas have rarely been discussed together, and so the concept of convoy migration has languished in relative obscurity. Reason for this neglect on the foreign investment side seems to be that most discussions have treated the topic as a company level phenomenon, while on the group action side, discussions of coordinated action by a community of economic actors (e.g. Astley & Fombrun, 1983; Moore, 1993) have generally not considered international investment activities.

While there are a few cases where international business activities have been considered from a group context, some aspect of those investigations has typically led researchers away from a consideration of convoy migration. Knickerbocker (1973), for example, speaks about the timing of foreign investment, but it is in the context of a company's foreign investment activities relative to its *competitors*. While Johanson and Mattson (1988) provide a typology of firm internationalization relative to what they call the 'internationalization of the market', their labels and framework are somewhat challenging and generally obscure the importance of convoy migration as a theoretical category. Similarly, while Martin, Mitchell, and Swaminathan (1995) do, on the theoretical side, implicitly make space for leaders, laggards, and the simultaneous investment abroad of buyers and suppliers, by the time they get to their empirical investigation, they only look to see if a supplier has expanded before the buyer, and so the very possibility of convoy migration falls out of their analysis.

Viewed from the perspective of the internationalization of a production network, convoy migration is interesting as an example of an independent, theoretically distinct route for getting from a domestic system of production to what Johanson and Mattsson call 'International among Others' (a high degree of internationalization of both a firm and its network). To make this point more clearly, we present a modified version of Johanson and Mattson's basic framework (see figure 1).

The biggest changes include an attempt to draw a much clearer distinction between states and processes as well as an effort to focus specifically on the internationalization of a firm separate from the internationalization of its supplier network. Such changes require both the addition of material to the basic framework as well as a relabeling of certain terms.

While the changes may initially seem somewhat restrictive, given the many situations in which a buyer of one firm's products is, in fact, itself a supplier from the point of view of another company one step downstream, the framework is not an attempt to discount the importance of sales and distribution, but simply an effort to be consistent within a given context. Ultimately, given substantial differences in the strategic implications for a particular firm of the internationalization of its sales and distribution relative to the internationalization of competitors or suppliers, we think that, rather than lumping all such actors together when

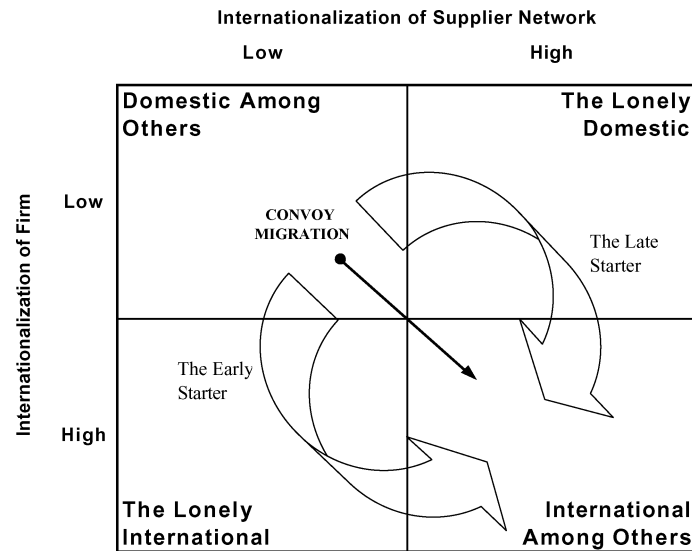


Figure 1. The Internationalization of a production network.

analyzing the internationalization of an industrial network, it is better to separate out the different categories.

Although established theory has little to say on the matter, a few empirical studies may be helpful in understanding the phenomenon of convoy migration. As far as Taiwan is concerned, Liu (1997) has pointed out that a specialized division of labor and articulated supplier networks are an integral part of the competitiveness of Taiwan's small and medium sized enterprises (something that makes it difficult for Taiwanese companies considering investing abroad to avoid thinking about their supply base). A good example of how Taiwanese companies have coordinated their internationalization efforts may be found in the work of Cheng (1997) and Chen (2000), which discuss the convoy migration of Taiwanese assemblers and their suppliers to mainland China, specifically considering the cases of China Motors (a Taiwanese automaker) and Guanyang Motors (a Taiwanese company best known for its motorcycles). Insofar as Taiwan's machine tool industry is similar to the island's vehicle assembly industry in terms of a specialized division of labor and mature supply base, one might expect companies in Taiwan's machine tool industry to act similarly when setting up operations abroad (though the question is ultimately an empirical one).

#### *Replication and adaptation*

While replication can be a powerful strategy for firms (Winter & Szulanski, 2001), the replication of organizational practices is not easy (Nelson & Winter, 1982; Szulanski, 1996;

O'Dell & Grayson, 1998), and international business research has recognized a real tension between replication and adaptation (Levitt, 1983; Bartlett & Ghoshal, 1988). Trying to manage the advantages of precision that come from successful replication relative to the benefits of learning and adaptation is what Winter and Szulanski (2001) have called the 'Replication Dilemma'.

While Winter and Szulanski (2001) have looked at large scale, intensive forms of replication (i.e. the creation and operation of a large number of similar outlets as per McDonald's) and Szulanski (1996) has looked at more narrow cases of the transfer of best practice within a firm, the creation of a new facility abroad is something of an intermediate case.

According to Szulanski (1996:28), the transfer of best practice connotes a firm's "replication of an internal practice that is performed in a superior way in some part of the organization and is deemed superior to internal alternate practices and known alternatives outside the company." From such a perspective, "transfers of best practice are thus seen as dyadic exchanges of organizational knowledge between a source and a recipient unit in which the identity of the recipient matters" and "the exchange of organizational knowledge consists of an exact or partial replication of a web of coordinating relationships connecting specific resources so that a different but similar set of resources is coordinated by a very similar web of relationships."

In contrast, a replication strategy creates value by discovering and refining a business model, by choosing the necessary components to replicate that model in suitable geographic locations, by developing capabilities to routinize knowledge transfer, and by maintaining the model in operation once it has been replicated. Growth by replicating requires the capability to recreate complex, imperfectly understood, and partly tacit productive processes in carefully selected sites with different human resources, while often facing resistance from proud, locally autonomous agents. Two characteristics in particular distinguish a replication strategy from related phenomenon: the broad scope of knowledge transferred and the importance attached to the accumulation of replication capabilities in the central organization (Winter & Szulanski, 2001).

As noted, the creation of a new facility in a foreign setting is something of an intermediate case. Similar to both a full-fledged replication strategy and the transfer of best practices, such activity requires the replication of effective routines. Like replication strategies, such activity requires the capability to recreate complex, imperfectly understood, and partly tacit productive processes in a carefully selected site with different human resources. Similarly, like the transfer of best practices, the activity consists of an exact or partial replication of a web of coordinating relationships connecting specific resources so that a different set of resources may be coordinated by a similar web of relationships.

Despite the similarities, the scope of knowledge transfer required to set up a new production facility is ultimately broader than what is required for the transfer of a single best practice (and so, in this sense, it is closer to what is needed to implement a replication strategy). However, since the transfer required is a relatively rare occurrence for the organization, the likelihood of developing and maintaining sophisticated replication capabilities is considerably lower. The establishment of a new facility abroad then may be one of the most challenging knowledge transfer assignments around, for while the scope of

knowledge transfer required is wide, a large investment in knowledge transfer capabilities is unlikely.

Extending Winter and Szulanski's analysis of replication to the establishment of operations overseas, this paper looks at a broad array of organizational practices in an effort to understand what is likely to be replicated and what is more likely to be modified. In the process, this paper explores some economic reasons for the transfers and keeps track of the potential templates available to the firms in question (Szulanski & Jensen, 2004).

### *The Japanese experience*

In thinking about Asian companies, some of the best documented cases of efforts to replicate organizational practices in foreign environments have come from Japan. Initial studies indicated a great deal of skepticism regarding the possibility of a successful transfer of Japanese organizational practices to foreign environments (e.g. Yoshino, 1976; Cool & Legnick-Hall, 1985; Sorge & Streeck, 1988). In studying Japan's automobile industry, however, Krafcik (1986), Florida and Kenney (1991), and MacDuffie and Helper (1997) have all found evidence of the successful replication of intraorganizational and interorganizational practices in the United States, and indications of a successful transfer of organizational practices from Japan to the United Kingdom have also been observed (Oliver & Wilkinson, 1989).

While much early skepticism regarding the transferability of Japanese practices abroad now seems somewhat overdone, a decade of economic stagnation in Japan has caused some to argue that the whole fascination with Japanese business may have been misplaced. Given the speedy rise of China's economy, it is tempting to substitute a fascination with Chinese business practices for earlier enthusiasm regarding Japanese business and simultaneously argue that Taiwan may represent the leading edge of what Chinese business may become.

We take a slightly different perspective. As far as Japanese business practices are concerned, we think a realistic appraisal of their merits and ease of replication leads one to recognize that not all Japanese business practices are superior, but neither are they all flawed. Moreover, while some practices may be very difficult to extract from their surroundings and replicate outside of Japan, other practices 'have legs' and are currently in use in many different parts of the world.

Focusing specifically on the establishment of new operations in mainland China by Taiwanese companies, we see such activities less as examples of a new worldwide best practice and more as a case of companies needing to create some sort of effective business system in a new environment given their own pre-existing traditions and ways of doing things. Given an intimate familiarity with their own companies' operations and the influence of what Bartlett and Ghoshal (1988) might call 'administrative heritage', it seems natural that managers will draw on what they know in an effort to create effective systems abroad. As a result, the replication of prior practices seems likely, though as the literature on international business makes clear, there always exists a tension between replication and adaptation, and local environmental factors can, at times, overwhelm company desires for standardization and the easy choice of doing 'the same old thing'.

*The replication of Taiwanese manufacturing practices abroad*

Overall, Taiwanese manufacturing seems to have several basic strengths, including effective industrial networks composed of specialized producers, widespread entrepreneurship, and the ability to adjust to changing conditions (Liu, 1997; Brookfield & Liu, 2001). Taiwan's machine tool industry seems typical in this regard. The industry has many specialized producers. A number of new machine tool companies were founded in the 1980s and 1990s, and with a large number of companies in the industry—each possessing its own skills—manufacturers have repeatedly been able to reconfigure themselves and their production networks in line with a changing environment.

Effective subcontracting networks have long been noted as critical to the success of industrial firms (Porter, 1980; Deming, 1982), and studies from the automotive industry have provided some good examples of such networks (Womack, Jones, & Roos, 1990; Nishiguchi, 1994; Dyer, 1996). Several articles have also analyzed interfirm networks in Taiwan and noted the importance of those networks to the competitive advantage of Taiwanese industry (Chen & Kao, 1991; Chen, 1994; Liu, 1994; Anderson, 1998), and as Amsden (1985:276) has pointed out, as the size of the market for Taiwanese machine tools has expanded, "a well articulated system of subcontracting and satellite shops has evolved similar to that in Japan."

Given the current environment facing Taiwanese manufacturing, how to transfer existing practices to a new setting has become an important operational challenge. Drawing on the experience of five Taiwanese companies, Yu (2000) tackles this question head on, and in so doing, is particularly sensitive to industry differences. Given the breadth of the analysis, however, isolating the effects of specific factors is difficult.

**Context***Taiwanese investment in mainland China*

Thanks to a rapid accumulation of capital, a strong manufacturing sector, domestic labor shortages, and the abolition of foreign exchange controls, FDI from Taiwan has expanded considerably since the 1980s. Moreover, despite the Asia crisis and puncturing of the Internet bubble, Taiwan's outward investment has remained strong (see Table 1).

Why do Taiwanese firms invest abroad? According to Lin (1995), Taiwanese businesses invest in Asia to sustain export competitiveness, while investing in developed countries to enhance market access. Similar to Sim and Pandian (2003), one important trend we have noticed has been the increasing importance of mainland China as both a market and location of production. According to Taiwanese figures, total authorized investment in mainland China has increased substantially since the early 1990s (see Table 2):

Actual investment is certainly much higher. Some have suggested Taiwanese companies may be a good model for other small and medium sized companies looking to invest in mainland China (Wang & Ralston, 2000). Given the large number of ventures formed, it seems likely that much could be learned from a study of such ventures.

Table 1. Outward investment from Taiwan.

	Total (USD \$ mn)	Growth rate (%)
1985	41	
1986	57	37.7
1987	103	80.5
1988	219	112.9
1989	931	325.6
1990	1,552	66.7
1991	1,656	6.7
1992	887	-46.4
1993	1,661	87.2
1994	1,617	-2.7
1995	1,357	-16.1
1996	2,165	59.6
1997	2,894	33.6
1998	3,296	13.9
1999	3,269	-0.8
2000	5,077	55.3
2001	4,392	-13.5

Source: Investment Committee, MOEA.

Table 2. Approved indirect Taiwanese investment in mainland China.

	(USD \$ mn) amount	Growth rate (%)
1991	174	
1992	247	41.8
1993	3,168	1182.8
1994	962	-69.6
1995	1,093	13.6
1996	1,229	12.5
1997	4,334	252.6
1998	2,035	-53.1
1999	1,253	-38.4
2000	2,607	108.1
2001	2,784	6.8

Source: Investment Commission, MOEA.



Table 3. Taiwanese machine tool operations in mainland China by location and type.

Location	Type of operation				
	Factory	Office	Branch	Sales office	Distribution ctr.
Guangdong area	4	8	3	1	0
Shanghai area	16	5	3	4	2
Fujian	1	0	0	1	0
Elsewhere	1	0	0	0	0

Source: Taiwan's Association of Machining Industry (TAMI).

As far as Taiwan's machine tool industry is concerned, the industry has invested most heavily in and around Shanghai and Guangdong (see Table 3):

According to Lin (1995), recently established ventures in mainland China appear to rely a great deal on their parent companies for production equipment, intermediate inputs, and managerial support with 85% of all machinery and 70% of all material and parts coming from parent firms in Taiwan. At the same time, as small rural and township enterprises have developed, Taiwanese companies appear to have begun to increase their interactions with local companies.

Martin, Mitchell, and Swaminathan (1995:590) refer to cases in which "traditional suppliers and assemblers establish manufacturing facilities in a new location and establish supply relationships" as 'recreating' buyer-supplier links. Critical to understanding whether buyer-supplier ties are likely to be replicated abroad is an appreciation of the possible alternatives to the recreation of such ties. One obvious alternative is the use of a local supplier. Other alternatives include the import of products from the existing factories of current suppliers, the import of products from other foreign suppliers, procurement from the local operations of other foreign companies, and possibly even bringing production of the part in-house. While Martin et al. (1995) recognize the importance of some of these alternatives, none ultimately appear in their empirical analysis. Though necessarily imprecise in its analysis of specific buyer-supplier ties due to the nature of the data available, this work has been written in an effort to complement past research by explicitly considering, not just the recreation of buyer-supplier ties, but also some of the alternatives available to firms in the internationalization of a production network.

### Focal questions

Based on previous experience, an analysis of the current state of Taiwan's machine tool industry, a comparison with other industries in Taiwan, and a desire to contribute to several current theoretical questions, this investigation was conducted with several issues in mind. In particular, this study has looked at seven different aspects of Taiwanese machine tool company activity in mainland China.

- (1) Convoy Migration: Do Taiwanese machine tool companies invest in mainland China along side and in concert with their Taiwanese suppliers?
- (2) Network Shape: Is there any evidence of concentration in the geographical distribution of suppliers to Taiwanese machine tool companies in mainland China?
- (3) Network Shape: Do the supplier networks associated with the manufacturing operations of Taiwanese machine tool companies in mainland China have a tiered shape?
- (4) Assembler Activities: To what degree are the manufacturing operations of Taiwanese machine tool companies in mainland China vertically integrated?
- (5) Assembler Activities: In setting up manufacturing operations in mainland China, do Taiwanese machine tool companies actively nurture and develop local suppliers?
- (6) Supplier Characteristics: Are the local suppliers of Taiwanese machine tool companies in mainland China privately owned companies?
- (7) Supplier Characteristics: Do those local suppliers serve a variety of different companies in the industry or only a single customer?

### **Cases**

Taiwan's machine tool industry is a success story. Though an island of only 22 million, it is the world's fifth largest exporter of machine tools and the sixth largest producer. In 1969, total machine tool production on the island was about US \$9 million. In 2000, machine tool production was about US \$1.8 billion. Taiwan's trade figures are similar with Taiwan's annual machine tool trade surplus having surpassed \$500 million (USD) in recent years.

Despite a long track record of growth and an integrated, comprehensive subcontracting structure for machine building in central Taiwan, companies have had difficulty expanding their factories, and some companies have begun to establish operations in mainland China. Factors behind such activity include high land and labor costs as well as an increase in the percentage of customers located in mainland China.

This paper focuses on the sourcing policies and supplier networks of three Taiwanese machine tool companies in mainland China. Data for the case studies come from interviews with managers overseeing subsidiary operations in mainland China, suppliers, and parent company managers in Taiwan.

### *Methods*

Generally speaking, the value of case study research lies in its ability to provide insights through rich details which generate ideas and hypotheses for further investigation. As an exploratory investigation, it is hoped that the cases here provide an opportunity to better understand the replication and adaptation of interorganizational practices in an international setting, the internationalization of a production network, and the nature of supplier networks in mainland China. Of course, the limits of case study research are well documented (Eisenhardt, 1989; Yin, 1994).

The material presented in this paper is based on the accumulated observations of the authors over the past ten years as well as interviews with each of the subsidiaries' parent

companies in Taiwan (which, on average, lasted about half a day each) and an intensive 45 day investigation of company subsidiaries and suppliers in mainland China from July 2, 2001, to August 15, 2001. Interviews were conducted with the general managers of Hangchow Liwu and Ningpo Chin Fong and the president of Hangchow Youjia. In addition, several managers involved in outsourcing for the three companies were interviewed, including three people at Hangchow Liwu, four people at Ningpo Chin Fong, and five at Hangchow Youjia. In total, each of the companies was interviewed 2-3 times during the investigation for half a day each time. Also, to better understand the companies' supplier networks, a total of 17 suppliers were interviewed 1-2 times each for about two hours per interview.

#### *Basic company information*

Each of the companies selected for study has operations engaged in volume production in mainland China and has a parent company that is a Top 10 producer of machine tools in Taiwan. In addition, all firms meet the selection criteria laid out by Yu (2000). Specifically, as machine tool producers, each is in an industry noted for production networks. Also, each is international—with operations in Taiwan and abroad—and acts as a core firm for its operations overseas.

One of the companies is an example of a DIY machine tool producer. Another produces metal presses, and the third builds metal cutting machine tools. Basic information for the companies in the sample (as of August, 2001) is as follows (see Table 4):

Table 4. Basic company information.

	Liwu Electric Co.	Chin Fong (China) Machinery Ind. Co.	Youjia Precision Machinery Co.
Parent company	Rexon Industrial Corp.	Chin Fong Machine Industrial Co.	Fair Friend Enterprises Co.
Location	Hangchow Xiaoshan	Ningpo City	Hangchow Xiaoshan
Year established	1993	1994	1993
Year volume production began	1996	1996	2000
Capital (in US\$ mn)	\$10	\$25	\$8
Sales (in US\$ mn)	\$12	\$14.5	\$23
Employees	260	270	114
Products	DIY Hand Tools	Metal Presses and Parts	NC Machine Tools Parking Equipment

Source: company interviews.

## **Liwu**

Liwu Electrical Machinery Company (or, more simply, Liwu) is located in Hangchow's Xiaoshan National Economic Technologies Development Park and is a wholly owned subsidiary of Taiwan's Rexon Industrial group. In 1993, under the guidance of Taiwan's Association of Machinery Industry (TAMI), Rexon Industrial, along with seven other machinery manufacturers like Kent, Ching Hung, and Fair Friend, established operations in the Park, thereby forming a kind of Taiwanese machine building enclave. After three years of negotiation, construction work, and trial production, Liwu's assembly line officially began operating in 1997. With \$1.2 million (USD) in capital, the company now produces over 58 different products, including drills, curve cutting machines, and slant cutting machines. In 2000, Liwu had about \$12 million (USD) in sales, employed 260 workers, and had a group of roughly six Taiwanese managers overseeing operations.

### *Liwu's supplier network*

When Liwu began production in 1997, by part count, approximately 70% of all parts were made locally. In 1998 this ratio grew to 80%. In 1999, it was 90%, and since 2000, the ratio has held steady at about 98%. As of 2001, except for machine spindles and gears (which were still imported from Taiwan), all other machine parts were produced locally.

In addition to Liwu's five assembly lines, its production operations also include a machinery department, responsible for precision parts processing and spray painting. In 2001, roughly 30% of all parts were produced in-house, a level which is substantially higher than the 15% found at Liwu's parent company operations in Taiwan. A collection of 146 different suppliers are responsible for producing those parts the company does not make itself. Of those, 10 are bought from purchasing agents. The rest have been outsourced to contract manufacturers. Of these 146 companies, all have local operations and while a few are Taiwanese, none came over with Rexon when it was developing its Liwu operations.

### *Liwu's suppliers*

According to the President of Liwu, the company first started looking for suppliers among mainland China's state owned enterprises, which tend to have good equipment and skilled employees. Coordination difficulties, however, caused Liwu instead to seek out business relationships with privately owned companies. In terms of a breakdown of suppliers by type (see Table 5), it is clear that nearly all of Liwu's suppliers are privately owned companies, and that, in fact, the company employs no state owned or township enterprises.

Privately owned enterprises, which account for 91% of Liwu's suppliers, come in two basic categories: (1) independent, individually owned and operated companies, and (2) township enterprises in which control has been transferred to the private sector. Of the eleven suppliers which are Taiwanese, all established relationships with Liwu only after it had already set up operations in mainland China. As far as foreign companies are concerned, Liwu

uses only two, accounting for a modest 1.5% of all suppliers. Overall, Liwu's production network exists at a relatively mature stage. In 2000, Liwu was able to produce 36 different products using roughly 140 suppliers, and at the time of the fieldwork for this project, Liwu manufactured 58 different products using 146 separate suppliers.

In terms of the geographical distribution of its suppliers, nearly 40% of Liwu's suppliers are located within the city, and roughly 70% of the company's castings are provided by suppliers located within 30 kilometers of Liwu's factory. Moreover, the distance between the company's factory and its suppliers has shrunk over time. This has been, in part, a conscious decision by the company, which has gradually sought to replace suppliers located a long distance away with others located nearer to the company. A clear example of this trend concerns the company's procurement of electric motors. Initially the company bought motors from a company in Shandong province (about 1300 km away), but more recently has switched to a company located in Zhejiang province's Wenling city (about 350 km away). Overall, ordinary parts appear to be sourced locally, while relatively high value added parts (like aluminum press castings, etc.) are more likely to be sourced from companies located some distance away.

#### *Liwu's relations with its suppliers*

During interviews, it was discovered that the shape of the material flow of Liwu's supplier network has been changing, moving towards a more rationalized tiered structure requiring less supplier management on Liwu's part. Not only have some companies originally responsible for simple parts processing been upgraded to the complete production of machine parts, companies initially only responsible for machine parts production have upgraded their operations to become subsystem suppliers.

As the following examples demonstrate, Liwu has rationalized and consolidated its supplier network over time. For example, Yong Kang Pillar originally only supplied basic castings. Starting in April, 2001, after an evaluation of its internal processing costs, Liwu began to use a comprehensive "one stop shopping" approach to sourcing. As a result, the company was able to extend the scope of its activities to precision processes like drilling and surface polishing. In addition, Hsing Yuan Motors, another Liwu supplier, has over time transformed itself from a simple parts supplier into a supplier of more elaborate subassemblies. Originally, the company only supplied motors to Liwu, but since July, 2001, the company has been providing a complete package of four major system parts including the motor, frame, electrical switches and wiring. In fact, Hsing Yuan Motors suggested this change to Liwu, pointing out that the cost of assembly and fitting work done by its workers was less than that of Liwu's own employees, and so in transferring the work to Hsing Yuan Motors, there was the possibility of creating a profitable win-win situation for both firms.

As part of this investigation of Liwu, seven different suppliers were visited. Of these seven suppliers, five said they had been recipients of Liwu's technical guidance. In terms of ownership, all seven were private. Five were individually owned and operated. Two were township enterprises in which control had been transferred into private hands. Six of the seven also supply parts and services to other companies in the same industry.

### **Chin Fong**

Chin Fong (China) Machinery Industrial Company Ltd. (Chin Fong) is located in Ningpo's Zhenhai Economic Technologies Development Area. The company was founded in October, 1994, as an independent, wholly owned subsidiary of Taiwan Chin Fong Machinery group. With registered capital of \$13.2 million (USD), Chin Fong has 266 workers and sales of roughly \$14.5 million (USD). Operations officially began towards the end of 1996 with the opening of an assembly line for C-style presses. Since then, the company has systematically obtained both permission for export production and international ISO 9002 quality certification. Currently, the company has a total of eight assembly lines and is able to manufacture a variety of presses and forging machinery.

#### *Chin Fong's supplier network*

In terms of the localization of Chin Fong's supplier network, the company's localization ratio was 40% in 1997 by part count. By 1998, it was 90%. In 1999, it increased to 95%, and in 2000, it reached 96%. In 2001, Chin Fong's part localization ratio was also 96%, with only spindles, large gears, and numerical controllers still needing to be imported.

In order to cope with the inability of local suppliers to produce certain parts, at the time of the fieldwork for this project, Chin Fong's manufacturing operations included a rather large machine processing department. To date, the company has purchased around \$10 million (USD) of equipment for the department, and the department's activities may be divided into two types. The first includes the cutting of steel plates, sand blasting, heat treatment, and welding. The second includes the manufacture of castings, slide rail preparation, and machine processing. As a result, Chin Fong's in-house production ratio is higher than that of its Taiwanese parent. Moreover, to make use of this capacity, it was discovered in the course of this research that Chin Fong has engaged in contract manufacturing for companies both within and outside the industry. Initially, the company received such orders only from other Taiwanese companies, but over time, orders from local companies and other foreign firms have appeared.

When Chin Fong officially began production in 1996, the company had already evaluated and selected 24 companies as qualified suppliers. None of them were Taiwanese transplants that had come over at the same time with Chin Fong. At first, due to local government pressure, Chin Fong worked to cooperate with local state owned companies and township enterprises. Over time, however, because of problems with part quality, delivery times, and inflexible attitudes on the part of state owned enterprises, Chin Fong has gradually reduced its business with state owned enterprises while seeking out relations with private companies. Initially, differences in technology and skill between Chin Fong and such private companies were quite large, and the company spent a great deal of time and effort to help develop such suppliers. Such assistance has included both help with manufacturing and process technologies as well as assistance in reforming basic business practices and mindsets, and it has only been with such effort that the current supplier system has come into being.

Table 5. Suppliers by type.

Suppliers	Liwu		Chin Fong		Youjia	
	Number	%	Number	%	Number	%
State owned enterprises	0	0	11	28	0	0
Township enterprises	0	0	0	0	0	0
Private companies	133	91	26	67	6	86
Taiwanese companies	11	7.5	2	5	1	14
Other foreign companies	2	1.5	0	0	0	0
Total	146	100	39	100	7	100

Source: company interviews.

### *Chin Fong's suppliers*

Including casting suppliers and forges, Chin Fong currently has a total of 39 suppliers. 11 are state owned enterprises. 26 are private companies, and 2 are Taiwanese (see Table 5). In the case of the Taiwanese companies, both are recent arrivals, having only been set up in 2001. As can be seen from the table, nearly 70% of all suppliers to Chin Fong are private companies, and they form the core of the company's supply base. While state owned enterprises account for roughly 30% of Chin Fong's suppliers, in nearly all cases, the amount of business the company does with them is small, the one exception being Guangzhou Chu Zhou.

In terms of the distribution of Chin Fong's suppliers, nearly 70% are located within 10 km of the company and 85% are located in Ningpo City (putting them within 30 km of the company)—clear evidence of geographical concentration. As far as suppliers of high value added parts like spindles and gears are concerned, however, several of such companies are located as far as a few hundred kilometers away from Chin Fong's Ningpo factory.

### *Chin Fong's relations with its suppliers*

In terms of the flow of materials within the company's supplier network, because most of the private companies that Chin Fong dealt with, especially early on, were individual proprietor type machine shops with insufficient assets, Chin Fong typically has played a key role in the procurement of basic materials. Because local suppliers have often been unable to buy the materials they need up front, Chin Fong has typically purchased the materials itself, and then delivered the materials to its suppliers for processing. Since the second half of 1997, however, this arrangement has gradually changed to one based on a notion of supplier self-sufficiency.

In 1999, Chin Fong began to implement a "one stop shopping" approach for casting procurement. Sending wooden molds to its suppliers, Chin Fong distanced itself from managing parts procurement by having its suppliers accept entire responsibility for casting

production including material preparation and processing, etc. For example, Yin County Chiang Li was initially only responsible for the rough and fine processing of castings. Basic molds were still supplied directly to Chin Fong by Tai Hsing Castings, after which Chin Fong itself would send them along to Yin County Chiang Li. Owing to the implementation of a comprehensive approach to delegating procurement activities, Yin County Chiang Li itself is now responsible for materials procurement and the provision of supplies to Chin Fong.

In interviews, it has also been revealed that, in order to ensure consistent product quality, Chin Fong has generally outsourced specific parts to individual suppliers. However, Chin Fong has repeatedly indicated that its suppliers should not become too dependent on it for orders. In fact, the company has sought to implement a “3-3 Control” structure, whereby Chin Fong looks to maintain three major suppliers for any given part, while expecting that Chin Fong’s orders should account for no more than 30% of the overall sales of those suppliers.

Over the course of the study, seven different suppliers were visited, including one Taiwanese firm. All interviews were conducted in the presence of Chin Fong’s purchasing manager. Of these seven, all seemed to have been receptive to Chin Fong’s technical guidance. Two had been township enterprises in which control had passed into private hands, three were private companies owned and operated by their founders, and one was a private company in which management had already passed to a second generation. In addition, except for the Taiwanese company, none of the suppliers interviewed were machine tool specialists.

### **Youjia**

Youjia Precision Machinery Company Ltd. (Youjia) is an independent, wholly owned subsidiary of the Taiwan Fair Friend Group. In 1993, under the planning and leadership of the Taiwan Association of Machinery Industry (TAMI), Taiwan’s Fair Friend group, along with seven other Taiwanese machinery producers (including Rexon), established a small Taiwanese machine building enclave in the Xiaoshan National Economic Technologies Development Area in mainland China. Currently, Youjia produces both numerically controlled (NC) machine tools and car parking equipment. Organizationally, the company has three divisions: a management group, a machine tool division, and a parking equipment division. The management group has 24 employees, the machine tool division has 58, and the parking equipment division has 36, for a total employee count of 118. Although the Fair Friend group had already purchased land in the Xiaoshan Development Area in 1993, it wasn’t until 1996 that factory construction began, and it wasn’t until 2000 that volume production and assembly of NC machine tools started. Currently, the company produces around 20-30 machine tool units a month.

#### *Youjia’s supplier network*

As far as the sourcing of machine parts is concerned, initially, parts came from CKD kits imported from Taiwan and assembled in mainland China. While the company has slowly



begun to reach out to local suppliers, as of 2001, Youjia's part localization percentage stood at about 15%, with most parts still coming from Taiwan. Generally speaking, the company has faced difficulties in sourcing parts locally. As Youjia's factory manager has said, "Although nearby state owned enterprises have quite good equipment, unfortunately, their desire to cooperate is often lacking, and where such interest does exist, there are often problems with pricing, part quality, or delivery times." In an attempt to cope with the difficulties of an, as yet, immature local supply base, in 2001 Youjia began to put together its own machining department. In addition to processing equipment transferred from Taiwan to its factory in Xiaoshan, the company has also invested millions of dollars (USD) in large scale Japanese processing equipment, which (at the time of the interview) was expected to be operational later in the year. Initially, Youjia estimates its machine tool operations in mainland China will have an in-house parts ratio of roughly 60%, which is substantially higher the 30% in-house parts ratio found in Taiwan Fairfriend's operations in Taiwan.

As things currently stand, none of Youjia's suppliers came over from Taiwan at the same time the group was setting up its operations in mainland China. However, owing to the poor economic environment surrounding Taiwan's machine tool industry in 2001, a number of companies in the industry have recently considered establishing production operations in mainland China. In so doing, several have come to Youjia to talk, and two are in the midst of serious negotiations concerning the construction of operations near Fair Friend's Hangchow factory.

#### *Youjia's suppliers*

Youjia's supplier network is still in the midst of development. Currently, it has seven local suppliers. Six are private local companies. One is Taiwanese (see Table 5). According to the company's factory manager, the machine tool department's most pressing recent need has been to bring its in-house parts processing equipment online. As a result, the company has not pushed too hard to develop a local supply base. Currently, the most important parts being supplied by local companies include sheet metal, fasteners, and castings. Having come to mainland China on its own, a Taiwanese supplier is responsible for castings. The other six are locally owned, small scale machine shops. In terms of geographical distribution, five of the companies are located relatively close to Youjia. Three are located within 10 km of the company, and all are located within 30 km of the company. Youjia's two other suppliers are roughly 200 km distant. As far as suppliers of sheet metal and fasteners are concerned, most seem to have begun by supplying parts for parking equipment before emerging as suppliers for Youjia's NC machine tool production.

#### *Youjia's relations with its suppliers*

In terms of the operation of Youjia's supplier network, the company has already implemented a tiered structure under a principle of supplier self-sufficiency. In taking the procurement of sheet metal as an example, Youjia has completely delegated design and production responsibilities to its supplier. During interviews with the Taiwanese supplier and two local suppliers, it was discovered that one of the local companies was an individual proprietorship,

while the other was a township enterprise in which control had passed into private hands. Of the three companies, two had accepted guidance in terms of product quality and manufacturing processes from Youjia. Neither of the two local suppliers investigated had any prior experience in supplying parts for the production of machine tools.

### Summary of findings

Based on information from the case studies, this paper has found evidence related to the focal questions as follows (see Table 6):

Four trends seem particularly strong. First, Taiwanese machine tool companies seem to have assisted local suppliers in a number of ways. Second, the machining departments of Taiwanese machine tool companies in mainland China appear to be relatively large. Third, most suppliers appear to be private enterprises and seem to have a number of different customers, although those customers are generally not machine tool producers and so do not directly compete with the companies examined here. Finally, as far as convoy migration is concerned, Taiwan's machine tool companies and their suppliers do not appear to have moved to mainland China *en masse*.

In addition, suppliers for the most part seem geographically concentrated, although Liwu's situation is somewhat equivocal. Also, while there is some evidence that supplier networks have taken on a tiered shape, information on the shape of supplier networks in mainland China is still somewhat thin.

While Taiwanese suppliers have not moved with machine tool companies to set up operations in mainland China, some Taiwanese part suppliers have gradually begun to establish operations there. Since establishing operations in mainland China appears to require a certain firm scale, it does not seem too surprising that the majority of companies that have established operations there are specialized suppliers of capital intensive parts or raw materials. The average small scale Taiwanese supplier has not found it easy to overcome the challenges of managing geographically separate operations and ensuring sufficient demand. Perhaps as a result, during the fieldwork for this study, no Taiwanese firm engaged in machining or simple processing was observed to have established operations in mainland China. Of course, such observations do give rise to an interesting empirical question—specifically, at what point may a firm set aside notions of replication and instead consider the possibility of complete relocation.

One obvious difference between Taiwanese subsidiaries in mainland China and those of their parent companies in Taiwan is in their machining departments. The degree to which Chin Fong and Youjia had invested in machining equipment was unexpected. Moreover, in setting up their large machining departments, the two companies have also sought orders for work from outside the firm—a situation vastly different from the independence typically seen in the activities of their parent companies in Taiwan. In mainland China, Chin Fong has received orders from Taiwanese, foreign, and local firms. Youjia has even done machining work for major Taiwanese competitors, something seen much less frequently in Taiwan itself.

While the internalization of production seen in the cases is consistent with a transaction costs point of view (Coase, 1937; Williamson, 1975, 1985, 1998), transaction cost

Table 6. Summary of case findings.

	Liwu	Chin Fong	Youjia
1. <i>Companies will, in concert with their suppliers, move production to mainland China</i> Did not move in concert with Taiwanese suppliers. Current Taiwanese suppliers all found locally. <sup>a</sup>	Did not move in concert with Taiwanese suppliers. Taiwanese suppliers moved to mainland China on their own initiative. <sup>a</sup>	Did not move in concert with Taiwanese suppliers. Taiwanese suppliers moved to mainland China on their own initiative. <sup>a</sup>	Did not move in concert with Taiwanese suppliers. Current Taiwanese suppliers in mainland China moved there independently. <sup>a</sup>
2. <i>Suppliers will be geographically concentrated</i> Nearly 40% are located in the city of Hangchow. Company is actively seeking to replace distant suppliers with those located nearby. Some firms providing high value added parts are located relatively far away. <sup>b</sup>	Nearly 85% are located in the city of Ningpo. Firm is actively seeking to replace distant suppliers with those located nearby. Some companies supplying high value added parts are located relatively far away. <sup>c</sup>	Nearly 85% are located in the city of Ningpo. Firm is actively seeking to replace distant suppliers with those located nearby. Some companies supplying high value added parts are located relatively far away. <sup>c</sup>	About 86% of all suppliers located in Hangchow. Company is actively localizing its procurement. <sup>c</sup>
3. <i>Material flow will tend toward a tiered shape</i> Trend is toward a comprehensive 'one stop' approach to sourcing. <sup>c</sup>	Most procurement occurs through a 'one stop' comprehensive approach to sourcing. <sup>d</sup>	Most procurement occurs through a 'one stop' comprehensive approach to sourcing. <sup>d</sup>	Most procurement occurs through a 'one stop' comprehensive approach to sourcing. <sup>d</sup>
4. <i>Machine tool companies will tend to vertically integrate</i> Operations include a machining department In-house processing % greater than operations in Taiwan <sup>c</sup>	Operations include a sizable machining dept. In-house processing % greater than operations in Taiwan. Machining dept. does work for other companies, including competitors. <sup>d</sup>	Operations include a sizable machining dept. In-house processing % greater than operations in Taiwan. Machining dept. does work for other companies, including competitors. <sup>d</sup>	Operations include a sizable machining dept. In-house processing % greater than operations in Taiwan. Machining dept. does work for other companies, including competitors. <sup>d</sup>
5. <i>Companies will assist and guide local suppliers</i> Actively provided technical guidance to local companies (5 out of 7 suppliers interviewed received assistance), especially product and process technologies at the start of cooperation <sup>d</sup>	Actively provided technical guidance to local companies (6 of 7 suppliers interviewed received help), especially product and process technologies at the start of cooperation. <sup>d</sup>	Actively provided technical guidance to local companies (6 of 7 suppliers interviewed received help), especially product and process technologies at the start of cooperation. <sup>d</sup>	All suppliers received technical assistance <sup>c</sup>

(Continued on next page.)

Table 6. (Continued).

	Liwu	Chin Fong	Youjia
6. <i>Most suppliers will be private enterprises</i>	No suppliers are state owned firms. Over 90% of suppliers are local private companies. 5 of 7 companies interviewed were founded as private firms. 2 were originally township enterprises but are now private. <sup>d</sup>	Some suppliers are state owned firms, but purchasing volume is typically low. Over 70% of suppliers are local private firms. 3 of 7 suppliers interviewed were founded as private firm. 2 were originally township enterprises but are now private. <sup>d</sup>	No suppliers are state owned firms. A majority are local private firms. About half were founded as private firms, half were originally township enterprises but are now private. <sup>d</sup>
7. <i>Suppliers will sell products to a number of competing firms in the same industry</i>	6 out of 7 suppliers interviewed sell to local competitors. <sup>d</sup>	Suppliers sell to companies outside the machine tool industry. In fact, excluding the company's Taiwanese suppliers, all local suppliers began by supplying firms outside the machine tool industry. <sup>a</sup>	Suppliers sell to companies outside the machine tool industry. In fact, excluding the company's Taiwanese suppliers, all local suppliers began by supplying firms outside the machine tool industry. <sup>a</sup>

a : not supported    b : unclear    c : supported    d : strongly supported    N: no data

economics seems a bit too passive to explain some of the activities undertaken by firms in the study. Firms are not only market takers. They also actively reach out to reshape market conditions by helping to nurture and develop local suppliers. In this, we concur with Lee and Chen (2003) regarding the importance of local subsidiary entrepreneurial activity and see a parallel between the behavior of Taiwanese firms in mainland China and some of the activities of Japanese firms in the United States (Florida & Kenney, 1991).

Three other notable trends were also observed. First, Taiwanese machine tool companies seem to be moving towards a relatively complete localization of parts. Second, they have begun to use locally produced mainland Chinese parts to supply operations located elsewhere. Third, as far as local suppliers are concerned, a vigorous entrepreneurial spirit and positive attitude towards learning were observed. Looking to improve the manufacturing capabilities of their own firms, suppliers took a keen interest in parts production, processing methods, and the production management practices of central factories. In so doing, the actions of today's suppliers in mainland China look very similar to those of Taiwan's small and medium sized firms twenty years ago.

### **Discussion and conclusion**

Convoy migration is an interesting phenomenon, yet it does not appear to have played an important role in the movement of Taiwanese machine tool companies to mainland China. This is so despite the industry sharing a number of similarities with Taiwan's automobile and motorcycle industries.

In thinking about industry differences between the automobile, textile, and machine tool industries, it would seem that at least two factors may be important: the bargaining power of assemblers and the minimum efficient scale of production for suppliers. Automakers seem to have substantially more influence on most of their suppliers than do machine tool companies or garment companies. In addition, the scale required for profitable supplier operations in the textile industry, for example, is much larger than what is required for assembly operations. Keeping these factors in mind, convoy migration would seem most likely in the auto industry and least likely in the textile industry with the machine tool industry being something of an intermediate case. Given the lack of convoy migration in Taiwan's machine tool industry, it would appear that the phenomenon may be strongly associated with assembler bargaining power. A full analysis, however, must await future research.

Based on the information available from the cases presented here, it would appear that there has been at least as much adaptation of sourcing practices to the mainland Chinese environment as replication of routines currently in use in other contexts. Moreover, to the degree replication may be said to have occurred, it is often of a historical kind, where the strongest parallel lies between current practices in mainland China and earlier practices in Taiwan (see Table 7).

As such, this does perhaps lend some support to the notion of Taiwan's economy being a harbinger of things to come for the economy in mainland China.

Table 7. Replication related findings.

Economic Rationale	Replication v. Adaptation	Template
(1) <i>Companies will, in concert with their suppliers, move production to mainland China</i> Yes. For an assembler, simultaneous migration helps ensure the availability of high quality inputs and companies can share methods for coping with the new environment.	No replication observed.	Template exists, but only outside of Taiwan's machine tool industry.
(2) <i>Suppliers will be geographically concentrated</i> Yes. Several advantages related to industrial agglomeration have been noted in the literature and observed, including the ease of machine tool production in Taichung, Taiwan.	Replication with some adaptation. Some clustering of suppliers is observed, but less than what is found in Taiwan, and distances tend to be larger than what is found in Taiwan.	A current template exists in the clustering of Taiwanese machine tool production in Taichung, Taiwan.
(3) <i>Material flow will tend toward a tiered shape</i> Yes. Distances are larger in mainland China and a tiered shape tends to be more effective in such conditions.	Partial replication. Some firms use a tiered structure in Taiwan. Others do not.	Template exists. For firms that currently use a tiered shape in Taiwan, it is directly accessible. For other firms, it must be inferred.
(4) <i>Machine tool companies will tend to vertically integrate</i> Yes. According to TCE literature, a high degree of environmental uncertainty may lead to internalization, and there is precedent for it in Taiwan's machine tool industry.	Adaptation, or perhaps historical replication, rather than a replication of existing practices.	No existing template, but memory of an earlier system retained by some managers.

<p>(5) <i>Companies will assist and guide local suppliers</i>                  Yes. Nurturing local suppliers improves the prospects of access to quality inputs.</p>	<p>Replication by analogy.</p>	<p>Template exists, but only outside of Taiwan's machine tool industry (e.g. the experience of Japanese companies in the U.S.).</p>
<p>(6) <i>Most suppliers will be private enterprises</i>                  Yes. Given the relatively small scale of machine tool companies and the lack of responsiveness typically displayed by state owned enterprises, this makes sense.</p>	<p>Replication of existing situation in Taiwan, but force of comparison is greatest in terms of the historical parallel.</p>	<p>Template exists and is reinforced by a consideration of the industry's history.</p>
<p>(7) <i>Suppliers will sell products to a number of competing firms in the same industry</i>                  ? Specialized suppliers are often more skilled, but suppliers without customer conflicts reduce the chance of proprietary information leaking out.</p>	<p>Adaptation. Suppliers are not industry specialists and do not serve other firms in the industry. May be a historical parallel, but information is insufficient.</p>	<p>May be a historical template, but situation is unclear.</p>

One aspect of replication that has received considerable attention is the notion of a template. Not only is its existence important, but equally critical is a firm's access to it. Looking across the sweep of examples provided by the cases in this paper, two tentative observations may be made. First, the existence of a template and good access to it are insufficient to see replication occur where economic logic seems to indicate a better path. Second, it may be that the existence of a historical template can, at times, provide some guidance for effective choices regarding organizational design. Of course, given the case study nature of this research, such observations must necessarily be considered preliminary.

From a theoretical perspective, one additional aspect of replication that deserves attention is its complexity as a concept. Inherent in the notion of replication is an idea of similarity, but what attributes should be considered primary? Taking the present study as an example, it is possible to imagine several different sourcing scenarios. To obtain a specific part for assembly operations in mainland China, a Taiwanese machine tool producer could: (1) import the part from the existing factories of a current Taiwanese supplier; (2) purchase the part from the local mainland Chinese operations of that Taiwanese supplier; or (3) use its traditional supplier practices to buy the part from a local mainland Chinese supplier. In the first case, an existing supplier tie is maintained as is the use of a particular factory, but the logistical process of obtaining the part changes dramatically. In the second, the supplier tie is maintained and the logistical process of obtaining the part remains similar, but the actual production site changes. In the third, the supplier tie is broken and the actual production site changes, but the logistical process of obtaining the part is conserved. Which of the above alternatives comes closest to replicating the machine tool company's former sourcing practices? Answering this question is by no means simple and would seem to depend on the specific issues being considered.

Overall, looking at the activities of Taiwanese machine tool companies in mainland China, it would appear that a number of the strengths of Taiwanese production have proven transferable to the new environment. At the same time, the characteristics of supplier networks serving Taiwanese machine tool companies in mainland China strongly reflect local context.

Taken as a whole, this paper has attempted to integrate strategic management discussions of replication and adaptation into international business discussions of internationalization and the establishment of manufacturing operations abroad. This paper has also attempted to bring together research related to networks and international business in a way that helps illuminate and demonstrate the theoretical significance of convoy migration—a mode of internationalization that, to date, seems to have been under appreciated.

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