Geoforum 42 (2011) 484–495

Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

Network configurations and R&D activities of the ICT industry in Suzhou municipality, China

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ARTICLE INFO

Article history:
Received 21 November 2008
Received in revised form 8 March 2011
Available online 25 June 2011

Keywords:
Globalization
ICT industry
Innovation
Regional development
China

ABSTRACT

This paper analyzes the network structure and R&D activities of the information and communication technology (ICT) industry in Suzhou municipality, known previously for its local state-directed Sunan model of development. Suzhou, however, has been undergoing dramatic restructuring to remake itself into a globalizing production center. We highlight the significance of the Chinese state and local/regional assets in shaping the trajectories of globalization and regional development, and the increasing importance of domestic markets and regional clusters/agglomeration for foreign ventures. We have found that Suzhou's development path, heavily dependent on external forces, has made Suzhou a TNC (transnational corporation) satellite district. We also find that the ICT industry in Suzhou has a dual-structure, segmented between foreign-invested enterprises (FIEs) and domestic firms. TNCs tend to network among themselves and their interfirm networks are increasingly domestic and regionally embedded in the Yangtze River Delta, while the linkages between TNCs and local firms are weak. We argue that there is a series of technological, structural, spatial, and institutional "mismatches" that limits the establishment of "global pipelines" of knowledge exchange. We hold that the nature of global–local networks is contingent upon regional endogenous capacities and the specific ways in which global capital interacts with local institutions. Therefore, perspectives on TNCs' local embeddedness must be positioned in their regional/external networks. We also analyze the constraints placed on Suzhou's development into an innovative city and promote the integration of global and local/regional assets through development of indigenous capacities.

1. Introduction

Through its mass production of low value added products such as toys, shoes, and clothes, China has come to be known as the global manufacturing floor or the world's factory. Despite the fact that China is often blamed for job losses, trade deficits and currency manipulation, "Made in China" does not actually challenge the structure of global value chains because developed countries remain the innovators and commanders of the world economy (Froebel et al., 1980). However, China is not satisfied with "Made in China" and has intensified its effort towards "Innovated in China" (Rowen et al., 2008). China has quickly become both one of the world's largest and most rapidly growing producers and consumers in the information and communication technology (ICT) sector. China's effort in knowledge production echoes the drive of East Asia towards the knowledge economy, which is considered the second round of East Asian development (Yusuf and Evenett, 2002). China's pathways to globalization, innovation and development also have strong theoretical implications for global–local linkages, technological progress, and regional development (e.g., Dicken, 2003; Coe et al., 2004; Wei, 2007).

However, China's achievement towards "Innovated in China" might be exaggerated since the existing knowledge is largely based on Beijing's Zhongguangcun Science Park, referred to as China's "Silicon Valley", and to a lesser extent Shanghai, the core of the Yangtze River Delta (YRD). The YRD is a major center for the ICT industry in China and has empowered the rise of Shanghai. Suzhou, a secondary city in the YRD, is an ancient city of China and known for its Sunan model of development centered on township and village enterprises (TVEs). With the failure of TVEs, the Suzhou government has implemented a series of policies to transform Suzhou into a major destination of FDI, and a rapidly growing manufacturing center. Suzhou's significance in global production has been coined "the Suzhou Price" (Ross, 2006).

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doi:10.1016/j.geoforum.2011.03.005

This paper analyzes the development and structure of the ICT industry in China through a study of Suzhou Municipality, one of China's leaders in ICT industrial development, with an emphasis on the global–local networks in production and R&D activities. Specifically, we investigate Suzhou's pathway to regional development, the structure of foreign direct investment (FDI) and the ICT industry, and the nature of global–local networks. We ask: (1) What are the structural characteristics of ICT industrial development and innovative activities in Suzhou? (2) What is the nature of global–local linkages and how embedded are transnational corporations (TNCs) in local economies? (3) How structurally different are foreign and domestic firms in R&D activities and what are the effects of TNCs on local R&D activities? (4) What are the constraints on local innovation, and what are the implications of Suzhou's experiences for the trajectories of technological progress and regional development? We also discuss the constraints placed on embedding TNCs and developing Suzhou into an innovative city. We study the ICT sector because it is one of the most globalized, innovative and dynamic industries (Yusuf and Evenett, 2002) and one of the fastest growing industries in China. We examine the ways in which forces of global capital intersect with China's local institutions and places at the sub-national scale.

We argue that Suzhou's development path, heavily dependent on external forces, has made Suzhou a TNC satellite district; that the ICT industry in Suzhou has a dual-structure, segmented between foreign ventures and domestic firms; and that TNCs tend to network among themselves and that the linkages between TNCs and local firms remain weak. We also argue that there is a series of technological, structural, spatial, and institutional "mismatches" which limit the establishment of knowledge exchange between Suzhou and global hot spots. We maintain that the nature of global–local networks is contingent upon the specific ways that global capital interacts with local institutions. Our data come from national and regional statistics, a survey of the ICT industry, and interviews of firms and public officials in Suzhou.

2. Global–local networks, technological progress and regional development

The New Regionalism literature has presented serious challenges to the hyper-globalization thesis. Imprints of New Regionalism are well manifested in the new economic geography scholarship, which emphasizes the importance of regional institutions, local networks and clusters, and local assets and knowledge bases in innovation and development, with various notions such as Marshallian industrial districts, untraded interdependency, innovative milieu, regional systems of innovation, and learning regions (e.g., Storper, 1997; Cooke and Morgan, 1998; Scott, 1998; Porter, 2000). Indeed, for many geographers, distance is alive, path dependence matters, agglomeration is logical, the world is uneven, and divergence is the norm.

However, geography is not equivalent to the local, and not all geographers subscribe to New Regionalism. New Regionalism literature has recently been criticized (Hadjimichalis, 2006; Wei et al., 2007) for its narrow focus on endogenous assets and local networks. There is a long tradition in geography of analyzing regional development through the lens of spatial interaction, interregional dependency, world systems, and global networks. The so-called Manchester School of global production networks (GPNs) places external agents/networks at the heart of technological change and regional development, calling for "globalizing" regional development (Coe et al., 2004). The perspectives of global commodity chains (GCCs), global value chains (GVCs), and GPNs (Gereffi and Korzeniewicz, 1994; Dicken et al., 2001) have emerged as a powerful alternative. However, the GCC/GVC/GPN perspectives tend to over-emphasize global processes in shaping the trajectories and dynamics of technological change and regional development (Wei, 2010).

Issues central to the debate, and particularly relevant to this research, are the nature of TNCs-local networks, sources of innovation, and their effects on technological and regional development. Based on the perspectives on TNCs, regions and development, below we will analyze in greater detail the specific notions of global–local networks, innovation systems and institutions, and firm decision making, to guide our analyses based on company-level data.

First, the literature in geography and development studies tends to view the TNC-local relationship as dependent, as echoed by the dependency school, world systems perspectives, and GVC/GCC approaches. It is argued that in developing countries, it is often the external agents, either TNCs or external markets, which dominate technological change and regional development. This is the case when TNCs are export-driven and domestic capacities are weak, as evidenced by the Cathedrals-in the-Desert phenomenon or the satellite industrial platform in Central and Eastern Europe (e.g., Grabher, 1994; Hardy, 1998), the weak integration of local firms with TNCs' production networks existing widely in Latin America (e.g., Lowe and Kenney, 1999), and the dominance of quiescent or branch plant-like subsidiaries in the Asia Pacific region (Poon and Thompson, 2003; Vind, 2008). The satellite district platform hosts foreign branch plants with limited relations to the domestic economy; key decisions are made externally and the state is often subordinated to global TNCs (Markusen, 1996). The notions of industrial districts have also been applied to the research on China, and scholars have questioned whether Suzhou is an innovative neo-Marshallian district with global–local synergies (Wei et al., 2009).

It has also been found that TNCs tend to network among themselves, forming global–local networks of TNCs, rather than networking with local indigenous firms (Jensen, 2004). Taiwanese firms in Suzhou are well integrated with Taiwanese production networks and their global production networks (Wang and Lee, 2007; Yang and Hsia, 2007; Yang and Liao, 2010). In these situations, GVCs or GPNs are rarely integrated with local firms (Wei, 2010), and the effects of TNCs on local economies are limited, mostly taking the form of job creation, and to a lesser extent, capital formation and tax contribution.

These perspectives prompt us to ask whether Suzhou exhibits features of a TNC satellite district and whether TNCs' subsidiaries tend to network among themselves. We analyze the transformation of Suzhou and the structure of the ICT industry and argue that Suzhou's development path, which is heavily dependent on external forces, has made Suzhou a TNC satellite district where TNCs tend to network among themselves.

Second, studies also reveal that TNCs are not reliable sources for technological transfer and export orientation does not necessarily lead to increasing technological capacities. One of the core competitive advantages of TNCs is their R&D and innovation capacity. To remain competitive TNCs must keep their technological edge through R&D investment and protection of intellectual property (IP) rights. It is well known that the innovative activities of TNCs remain mostly in their home countries and that TNCs have little incentive to transfer core technology to developing countries (Gertler, 2003). In addition, the transfer may include "know-how" (production engineering), but not "know-why" (basic design, R&D) (Lall, 1984). Moreover, an export orientation may not transfer the technology to other sectors of the economy (Parthasarathi and Joseph, 2002). TNCs often only reinforce the dependence of the receiving countries on technological progress in developed countries.

TNCs usually enjoy a superior knowledge base and their decisions on cooperation and knowledge transfer are based on

long-term economic considerations (Teece, 1977). On the one hand, a TNC cooperates and provides as much knowledge as necessary for ensuring the success of the affiliate's business operations: The affiliate itself and – possibly – key suppliers are provided with knowledge concerning products, processes, quality, and organization. However, knowledge transfer to local firms does not exceed the minimum that is necessary for successful production for two reasons: knowledge transfer is always a cost factor, and in an environment of low IP protection, knowledge may be lost to future competitors.

This paper investigates the forward and backward linkages of TNCs and the status of TNC-local knowledge transfer and cooperation. We ask whether TNCs and local firms cooperate in R&D and innovation activities and whether TNCs transfer key knowledge to Suzhou. We argue that the ICT industry in Suzhou has a dualistic structure, segmented between foreign investment enterprises (FIEs) and domestic firms; there is little incentive for TNCs to transfer knowledge to endogenous firms. We also argue that perspectives on TNCs' local embeddedness must be positioned in their regional/external networks.

Third, scholars have also emphasized openness to global capital and markets as a key to technological dynamism and regional development (Castells, 1996; Pack, 2000; Patibandla and Petersen, 2002). Links to outside the regional network are most crucial for a local innovation system and should be established and maintained (Malecki, 2002; Bathelt et al., 2004).

This allows for combining the local knowledge base with ideas from the outside. Thus, firms should engage in cooperation with local firms and actors as well as in global networks. Improvement in local economies and institutions provides conditions for TNCs to actively seek localization and embed themselves in local economies. TNCs can benefit from cost reduction with the improvement of local labor markets, regional innovation systems, and local supplier networks. Localization could also be driven by the need for market penetration of the rising middle class and the huge market potential in developing countries (Hsu, 2006). To adapt to local institutions and gain the support of nation states, TNCs may also seek localization, through production outsourcing and hiring local people for marketing and management positions.

Export strategies, either through original equipment manufacturing (OEM) as practiced in Taiwan, or by encouraging subsidiaries of TNCs as practiced in Malaysia, are seen as generating superior results in promoting technology transfer when compared with, for example, import substitution practiced by Brazil (Hobday, 2000). Fromhold-Eisebith (2002) found that the active participation of TNCs in Bangalore, India, enhanced the regional cycle of learning compared to Bandung, Indonesia, where technological development is based on domestic actors and markets. In the Chinese context, Zhou (2008) also emphasizes the interdependent nature of TNCs and local firms and argues that the reliance on external technology does not necessarily diminish the importance of local networks and institutions in promoting technological change. The effects of TNCs on technological progress and regional development may be quite positive when local firms have strong abilities to drive the global–local networks, as in the case of Qingdao, with a powerful electronics cluster led by China's own producers such as Haier (Kim and Zhang, 2008).

This line of thinking makes us wonder whether Suzhou's globalization strategy has improved the innovation activities of local firms and whether an effective "pipeline" of knowledge exchange has been developed between Suzhou and Taiwan, the key player of the ICT industry. Our overall assessment of Suzhou's strategy for remaking the Sunan model is positive, but we argue that a series of technological, structural, spatial, and institutional "mismatches" has limited the establishment of "global pipelines;" and that the notion of "local buzz" and "global pipelines" is too general to guide technological and regional development and has to be operationalized.

Last, despite the critique, an overwhelming majority of the literature in geography emphasizes the role of local institutions and absorptive capacities in the innovation process. The concept of regional innovation systems (RIS) highlights the systemic nature of interactive innovation processes and stresses the importance of cooperation (Kline and Rosenberg, 1986). Close interaction allows companies to acquire knowledge from partners and to utilize it in the innovation process (Leydesdorff and Meyer, 2003). Important actors in RIS are universities and public research organizations, banks, business service companies and governments. Moreover, cooperation, knowledge sharing, and innovation in regional networks depend on more than just the local availability of suitable actors. Central characteristics of innovative regions are the highly developed inter-organizational linkages and the local institutions and social values that facilitate the proliferation of such linkages. Asheim and Vang (2006) point out that the leading urban agglomerations of developing countries may offer conditions for innovation and learning similar to those in industrialized countries. Their universities and research institutes are usually among their countries' top institutions. The most technologically advanced domestic companies and TNCs that seek cheap but skilled personnel locate in these city regions. These conditions not only allow for learning but might also result in innovation.

However, companies in poorer countries incorporate knowledge developed in industrialized countries into their own knowledge base and then copy, imitate or generate products that are technologically similar to existing ones (Mathews, 2001). The process does not necessarily require close cooperation with any other actor. The only requirement is a knowledge inflow from technologically advanced parts of the world, either through direct cooperation with TNC affiliates or through the use of advanced products or production equipment. For firms that seek cooperation with TNCs, an important precondition for successful knowledge acquisition is the absorptive capacity (Cohen and Levinthal, 1989), the ability to acquire new information, assess its relevance for the company and to process it. Absorptive capacity depends mainly on the company's R&D activities and human capital, which enable firms to understand technology used by cooperating firms. Cooperation, learning, and interactive innovation are also influenced by the local institutional setting (Griffith et al., 2003). There is a strong reciprocal dependency between a firm's innovation capacity and the supporting environment that, in turn, enables firms to increase their absorptive capacities (Audretsch et al., 2002). Scott (2003) shows that absorptive capacity is a precondition for successful cooperation and is itself affected by external contacts.

In the context of China's strive for innovation, one notices that national or regional institutional settings can either promote innovation or hamper it. With rising production costs, China is undergoing a shift towards higher qualification standards, with a greater emphasis on education and technology, at least in the more developed regions. The well-known tax incentives for technology-intensive companies in the nation's high-tech zones are an element in the institutional setting for innovation. On the other hand, weak IP protection, distrust among business partners, and unnecessary bureaucracy reflect institutional deficiencies that hamper cooperation, learning, and innovation. For innovation in China, the institutional environment of Beijing and Shanghai is superior to that of other large cities (Kroll and Liefner, 2008). Beijing's local governance structure, which is highly supportive of high-tech enterprises, is considered essential to the rise of the high-tech industry in the city (Segal, 2003). The competitive edge of each city, i.e. its strong institutional capacity, is fuelled by a high level of education, skilled bureaucrats and government employees, strong research organizations, and a diverse population of

companies. Other regions generally lag with respect to their institutional development.

3. Data and methodology

We deployed a combination of qualitative and quantitative methods, including quantitative analysis of questionnaire surveys and interviews at the firm level. We conducted a survey of the ICT industry in Suzhou Municipality in spring 2007 (hereafter the ICT survey or the surveyed ICT firms), including both domestic and foreign firms, after testing the survey questions in 2006 (Zhou et al., 2011). Our sample size was pre-determined with the target of representing 5% of the sample frame based on the China Bureau of Statistics' relatively complete list of the ICT firms in Suzhou. The survey was conducted through cold calling and onsite visits, which usually took 1–1.5 h to complete. The survey has generated 160 hardware firms, with an estimated effective response rate of 12%. Such a return rate is comparable to most other similar surveys in China and other developing countries in Asia. The dataset for analysis includes 108 FIEs and 49 domestic Chinese firms (hereafter non-FIEs), excluding three firms with 2005 data.

The survey was followed by interviews of more than a dozen firms in 2007–2008, chosen from among the surveyed firms that expressed willingness for further interviews or were identified through our local contacts. We also interviewed about thirty municipal, district, development zone, and township officials and managers over the last several years to better understand regional development, public policy, and state-firm relations. These data provide valuable information for our study of the ICT industry in Suzhou.

4. Suzhou: institutional reform and development trajectories

Located northwest of Shanghai (about 100 km) (Fig. 1), Suzhou was once the center of the YRD and the second largest city in China. Its economic status in the YRD and China has been superseded by Shanghai's since the Opium Wars, and the city struggled during Mao's era, although some TVEs were established in the countryside. TVEs blossomed in Sunan in the 1980s, creating a successful pathway of development known as the Sunan Model. In the mid-1980s, TVEs produced half of the industrial output in Suzhou Municipality. However, with globalization and privatization in the early 1990s, TVEs' problems of fuzzy property rights and the lack of economies of scale resulted in industrial decline and TVEs were restructured into private and joint ownership firms, which signaled the end of the historical role of TVEs and the orthodox Sunan model of development (Wei, 2004). Almost all of the state operated enterprises (SOEs) have also been either privatized or shut down.

The opening up of the YRD in the early 1990s created new opportunities for Suzhou, and globalizing Suzhou has since become the new pathway for industrialization and regional development (Wei et al., 2009). The Suzhou government has implemented a series of policies to transform Suzhou into a globalizing, competitive place, and attracting FDI has been the central element of Suzhou's globalization initiatives. The municipality has established a number of development zones and industrial parks providing favorable policies for foreign investment. The city hosts five national-level development zones, including the China–Singapore Suzhou Industrial Park (CSSIP) and the Suzhou High-Tech Zone. CSSIP was established in 1994 as a "software transfer" program jointly run by government-led Chinese and Singaporean consortiums (Pereira, 2003). Suzhou has also created a higher education district for establishing local branches of national universities and research institutions. Moreover, the municipality has created many incentives for the high-tech industry, including technological development funds, venture capital, entrepreneurial funds, and funds for human resources, as well as services for innovation and new firm formation such as financing, management consultancy, human resources, and information services. Last, Suzhou understands that the development of the ICT sector relies on local institutions and urban environments and has been committed to institutional reforms and creating a more livable city.

FDI in Suzhou City has risen dramatically since the early 1990s, reaching US$2.8 billion in 2006 (SSB, 2007). By 2006, Suzhou City realized a cumulative total of US$16.3 billion FDI. FIEs had exports and imports of US$88.8 billion in 2006, accounting for 94.7% of Suzhou's total exports and imports and indicating the external orientation of development. Suzhou has quickly emerged as a major FDI destination and manufacturing center in China (Dolven, 2001), especially as a hub of ICT industries such as notebook

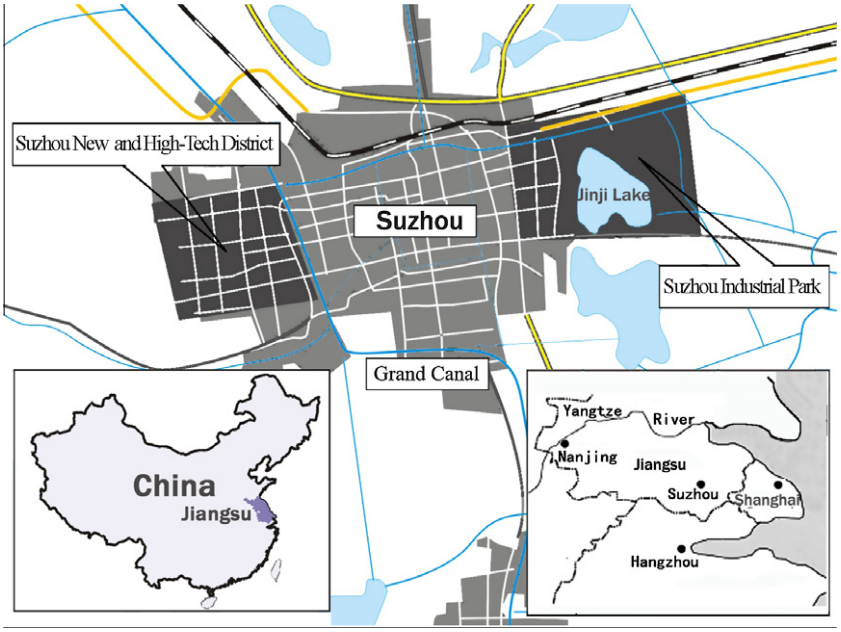

Fig. 1. Location of Suzhou.

computers and semiconductor manufacturing. Its GDP per capita in 2006 was 78,252 yuan, the highest among the sixteen municipalities in the YRD and even higher than Shanghai's (75,778 yuan). Business Week (2001) even profiled Suzhou as one of the top 10 emerging 'tech cities'.

5. The ICT industry and structural patterns

Given its economic base, proximity to Shanghai, and active local states, Suzhou has quickly emerged as a major destination of FDI in China and a major manufacturing center. The ICT sector is the most important sector in Suzhou, accounting for 33.2% of its total industrial output in 2005. The output value of ICT manufacturing was 328.7 billion yuan in 2005, and Suzhou's ICT manufacturing was ranked first in Jiangsu and second in the YRD (slightly behind Shanghai's). Per capita ICT output in Suzhou was even twice as large as Shanghai's. The role of TNCs is particularly important in the ICT sector, where FDI is concentrated. The ICT sector is also Suzhou's new action center for climbing the value chains through the development of R&D and innovative capacities.

Most of the surveyed ICT firms were established after 2000 (67.5%), corresponding with China's move towards the high-tech sector and the recent wave of Taiwanese investment from the Pearl River Delta to the YRD (Table 1). With regard to sector composition, the surveyed firms were primarily in electronic components and parts (51%), followed by computer/communication equipment manufacturing (29.9%), and semiconductor manufacturing (19.1%). Such an ICT structure indicates the relatively complete production chains established in Suzhou, where electronic components/parts and semiconductors serve computer/communication equipment manufacturers. The software sector in Suzhou is relatively small and largely concentrated in Suzhou City and is also less important than in Beijing, Shanghai, and Shenzhen.

Table 1
Profile of the surveyed ICT firms. *Source*: The ICT survey.

Attribute	Category	Number of cases	Percent
Year established	Before 1992	3	1.9
	1992–1995	17	10.8
	1996–2000	31	19.7
	After 2000	106	67.5
Sectors	Computer equipment manufacturing (404)	33	21.0
	Communication equipment manufacturing (401)	14	8.9
	Electronic parts and components (405, 406)	80	51.0
	Semiconductor wafer (4052)	11	7.0
	IC manufacturing (4053)	19	12.1
Type	Sino-Foreign Joint Ventures	6	3.8
	WFOEs	102	65.0
	SOEs	2	1.3
	Private Enterprises	46	29.3
	Other (collective)	1	0.6
Headquarter	Taiwan	70	44.6
	Japan	13	8.3
	Suzhou city	36	22.9
	Suzhou counties	13	8.3
	Others	25	15.9
Asset (million $)	Less than 1 million	38	24.2
	1–5 million	64	40.8
	5–10 million	18	11.5
	10–25 million	10	6.4
	Over 25 million	27	17.2
Employee	Less than 100 persons	43	27.4
	100–199 persons	24	15.3
	200–499 persons	37	23.6
	500–1000 persons	31	19.7
	Over 1000 persons	22	14.0
Profit 2006	>10%	34	21.7
	5–10%	67	42.7
	1–5%	52	33.1
	⩽0	4	2.5
Profit 2004	>10%	15	9.6
	5–10%	32	20.5
	1–5%	99	63.5
	⩽0	10	6.4

With respect to ownership structure, 65% of the surveyed firms were wholly foreign owned enterprises (WFOEs), followed by private enterprises (29.3%); only two were state-owned or controlled enterprises and one was a collective enterprise (Table 1). TVEs and SOEs, which traditionally dominated the economy of Suzhou municipality, have now been totally replaced by foreign and private enterprises, again indicating the end of the orthodox Sunan model. Taiwan is the largest source of investment, where 44.6% of the surveyed firms were headquartered, followed by Suzhou City (22.9%) and Japan. None of the FIEs had their headquarters in Suzhou, where only domestic firms are headquartered, indicating the branch plant nature of FIEs in Suzhou.

In terms of firm size, a substantial proportion of the firms had investments of less than US$5 million (65%), and domestic firms were considerably smaller than FIEs (Table 1). Regarding private firms, all except for two firms had investments below US$5 million (95.9%), which indicates that domestic ICT enterprises in Suzhou are overwhelmingly small. A large proportion of the firms had employment of less than 500 (66.2%). Most of the domestic firms had employment below 500 (89.8%), and none of them had employment over 1000, in comparison with 23 FIEs (20.7% of FIEs). Our survey, therefore, reveals that for the ICT industry in Suzhou, most firms are WFOEs headquartered in Taiwan, with mixed investment size and labor intensity. We did find that the number of domestic firms has been increasing over recent years, but they tend to be small in size and locally based.

The profits of the surveyed ICT firms show an ascending trend from 2004 to 2006, while the proportion of loss-making FIEs decreased from 6.5% to 2.6%, and that of FIEs with profits higher than 10% increased from 9.6% to 21.7%. FIEs in general enjoyed more competitive production and profitability. These indicators reveal the ICT sector in Suzhou was generally healthy, and its performance had been improving over time.

6. Production networks and global–local linkages

Suzhou has increasingly become a node of the global economy and the global urban network. Our survey finds that most of the surveyed FIEs serve as the regional or global manufacturing nodes within their corporate networks. Serving as a production facility for the Chinese market is the leading function of FIEs in Suzhou (39.4%), followed by the functions of product and process development facilities for the Chinese market (15% and 11.9% respectively). Taken together, serving the Chinese market accounted for 75.6% of the total functions. Almost all of the domestic firms serve the Chinese market due to their local nature and small size. In comparison to our survey of FIEs in Suzhou conducted in 2003, when FIEs served primarily as manufacturing firms for the world market, we found that serving the Chinese market has become more important over the years, reflecting the rise of China and its domestic market.

With respect to purchasing linkages, the foreign parents of the surveyed FIEs often dominate purchasing decisions due to specific considerations of quality and speed. The surveyed FIEs' supply bases are localized within the YRD. Among domestic purchasing (44.4% and 72.15% of total purchases for FIEs and non-FIEs

Table 2
Production networks of FIEs vs. non-FIEs. *Source*: The ICT survey.

	All samples	FIEs	Non-FIEs
Domestic purchase as % of total purchase*	53.1	44.4	72.1
% Purchase of domestic firms*	45.7	37.7	63.6
% Local purchase (within 2 h driving distance)*	52.0	49.0	58.7
% Yangtze River Delta purchase	61.7	60.2	66.2
Key components purchase: % from FIEs*	42.7	51.6	21.4
Equipment purchase in recent three years: % Domestic*	35.1	30.5	45.3
Subcontracting relations			
% of firms with subcontracting relations (from)	44.0	45.4	40.8
% Subcontracting from FIEs*	43.5	50.6	26.0
% Subcontracting from the local (within 2 h driving distance)	53.0	54.3	50
% Subcontracting from the YRD	65.7	67	62.6
% from FIEs*	41.9	48.1	26.8
% of firms with subcontracting relations (to)*	37.6	43.5	24.5
% Subcontracting to FIEs*	36.4	41.8	15.1
% Subcontracting to the local (within 2 h driving distance)	58.4	60.1	51.7
% Subcontracting to the YRD*	72.6	76.9	55.8
% to FIEs*	33.6	39	12.3

* Significant at 5% level.

respectively), the surveyed FIEs purchased their core materials or components mainly from other FIEs (62.3%), while non-FIEs tend to purchase from domestic firms (63.6%) and are even more localized (Table 2). More specifically, the surveyed FIEs and non-FIEs had on average purchased 60.2% of their materials and 66.2% of their components from the YRD, indicating the clustering of the ICT industry in the region. FIEs also tend to purchase more from FIEs than non-FIEs do in terms of key components purchasing (51.6% vs. 21.4%) and are more likely to import equipment. FIEs are clearly externally oriented and maintain closer interactions with their parent firms and other FIEs, while non-FIEs are domestically oriented.

In terms of subcontracting linkages, we found that both FIEs and non-FIEs have heavy concentrations of subcontracting relationships with the YRD (Table 2). FIEs are even more localized in the YRD than non-FIEs, again indicating the localized nature of external production linkages of the surveyed firms. However, the linkages between FIEs and non-FIEs in Suzhou are very thin. Only 12.3% and 26.8% of non-FIEs have had subcontracting relationships with FIEs in the YRD. We also find that linkages tend to form among FIEs from the same country or region, indicating the home country effect argued for by other geographers (e.g., Dicken, 2003). Non-FIEs in Suzhou are structurally less embedded in the existing purchasing networks of FIEs. We have tested important indicators for the difference between FIEs and non-FIEs, and most of them are significantly different (at the 5% level) (Table 2).

Our survey shows that most of the surveyed firms (63.1%) are involved in export activities, and FIEs have maintained a significant proportion of products for export (43.5%), much higher than non-FIEs (16.6%) (Table 3). Among surveyed FIES, 40.7% have export rates higher than 50%, although 25% of them have export rates lower than 10%, while 71.4% of non-FIEs have export rates lower than 10%. Foreign parent enterprises and partners played an important role in export businesses, which accounted for 49.4% and 8.4% of the surveyed FIEs, while a high percentage (38.6%) were decided by the surveyed firms themselves. A high percentage of the surveyed FIEs (74.1%) direct the sales for the Chinese market. This indicates substantial parental control over FIEs' export businesses and the decentralization of power over FIEs' businesses in China. FIEs tend to sell more to other FIEs and less to non-FIEs (47.4% vs. 26.3%), reflecting the production networks among FIEs. While the markets are somewhat diversified, the role of the YRD is significant, since it accounted for 56.2% of the sales; the sales of non-FIEs are even more concentrated in the YRD (70.4%), a fact also reflecting the extent of local clustering. These observations are supported by *t*-tests (Table 3). Our finding also confirms other observations about the FIE networks existing in Suzhou and the YRD (e.g., Yang and Hsia, 2007).

While we find the thin linkages between foreign and domestic firms, we ask whether we can identify a trend of localization given the significance of embedding FIEs in Suzhou for the local government. Our survey shows that most of the FIEs did not experience significant changes in domesticating and localizing production during 2003–2006, indicating that the nature of a satellite district persists. Most noticeable is that 83.3% of the surveyed firms changed little in terms of domestic key components purchased from FIEs, and 13.9% of the FIEs even experienced a significant increase. Our interviews find signs of increasing domestic purchases of FIEs, although with other FIEs in China, and therefore FIEs in China are replacing the functions of firms in their home countries, which should have contributed to job losses and trade deficits in their home countries. The survey reveals an increasing number of firms with significant increases of subcontracting to local areas (within a 2 h driving distance) and within the YRD, which indicates the increasing spatial clustering for the ICT industry in the region. However, most of such linkages are with other FIEs, and the subcontracting relations with other FIEs are the most stable (91.5%), further evidence of the clustering and networking of FIEs in the YRD.

The survey has also found that for domestic firms, the change in production and marketing behaviors in 2003–2006 was even smaller than that of FIEs, with slightly more firms experiencing an increase in imports and a decline in domestic purchasing. It is surprising that all of the surveyed non-FIEs reported their subcontracting relationships with FIEs have had few changes. The most significant increase was in purchasing and subcontracting from FIEs, reflecting the rising importance of FIEs in Suzhou Municipality. Overall, during 2003–2006, the network linkages of domestic firms with FIEs changed very little, which indicates that the weak linkages between FIEs and local domestic firms did not change much in Suzhou, another sign of the weak global–local linkages and the nature of a satellite district.

Table 3
Marketing activities. *Source*: The ICT survey.

	All samples	FIEs	Non-FIEs
% Firms involved in export	63.1	76.9	32.7
% Exported	35.1	43.5	16.6
% Export directed by foreign parents	41.4	49.4	0
% Export directed by foreign partners	11.1	8.4	0
% Domestic sales directed by the surveyed firms	82.2	74.1	100
% Domestic sales: among which			
% Consumers*	20	16.1	28.7
% Domestic firms*	29.6	26.3	36.9
% FIEs*	40.1	47.4	23.9
% Governments/Institutions	2	1.9	2.3
% Yangtze Delta *	56.2	49.8	70.4

* Significant at 5% level.

7. R&D activities and innovation behaviors

Given the dynamic nature of the ICT industry and the drive for innovation in China, it is important to study specifically the R&D and innovation activities. During Mao's era, Suzhou, like other cit-

ies of China, emphasized production, paying little attention to R&D and industrial upgrading. Suzhou, therefore, has had a weak base in R&D infrastructure. The drive towards R&D and innovation has become more intense in the last few years. Local statistics show increasing local funding for R&D and a rising number of scientists and engineers engaging in R&D activities and the high-tech industry, a fact also emphasized by government officials we interviewed. Suzhou and the YRD have come a long way from a technologically backward region in the 1970s to their current levels in technology and development.

The surveyed firms generally recognize the significance of R&D in productivity and competition. We find that slightly over half (55.6%) of the surveyed FIEs have R&D facilities, although most of them are within engineering or facility departments and only one is at the national level (Table 4). Fewer domestic firms have R&D facilities (42.9%) and all of them are at the local level, another sign of their lagging status. The need to adapt to the increasingly sophisticated industrial and consumer markets in China is the major reason for undertaking such activities. However, our survey finds that basic R&D facilities for world markets accounted for only 3.3% of the functions. The most important functions of FIEs' R&D facilities are for product and process development for the Chinese market. This shows that Suzhou is a manufacturing base of TNCs for the Chinese and world markets or a satellite production center of TNCs. Our interviews confirm that TNCs tend to place their more significant R&D functions in their home countries, and their major R&D facilities in China tend to be placed in leading globalizing cities such as Shanghai and Shenzhen.

In terms of human capital, the survey found that 2.8% of the employment is at least partly engaged in R&D, which is considerably lower than in the leading cities of Beijing, Shanghai, and Shenzhen (Table 4). As expected, the percentage of employees with a bachelor's degree or higher is greater in FIEs than domestic firms, both in terms of total employment (9.5% vs. 5.9%) and R&D employment (82.6% vs. 67.3%). FIEs also tend to have more R&D personnel recruited abroad (2.8%), but no domestic firm has such employees. We have learned through our interviews with local government officials that Suzhou City has been more aggressively recruiting from abroad, but mainly for FIEs and administrative commissions in Suzhou Industrial Park, and to a lesser extent, Suzhou New District. Most of the counties have not been able to recruit abroad, mainly due to costs and lack of information.

R&D spending is generally higher in the surveyed firms than the industry as a whole in Suzhou, reflecting the dynamic and capital-intensive nature of the ICT industry. The average R&D spending in FIEs is considerably higher than in non-FIEs (US$2.9 million vs. US$0.08 million), which, once again, indicates the technological gaps between FIEs and non-FIEs (Table 4), although the average share of R&D spending over total costs is similar. When asked about change in R&D funding, while most of the surveyed firms

Table 4
Profiles of R&D activities: FIEs vs. non-FIEs, 2006. *Source*: The ICT Survey.

	All samples		FIEs		Non-FIEs	
	#	Percent	#	Percent	#	Percent
Having R&D facility	81	51.6	60	55.6	21	42.9
Belongs to						
National R&D	1	1.2	1	1.7	0	0.0
Provincial R&D	5	6.2	5	8.3	0	0.0
Local R&D	13	16	8	13.3	5	23.8
Firm self	62	76.5	46	76.7	16	76.2
	# of Employees	Percent	# of Employees	Percent	# of Employees	Percent
Employment structure						
R&D employee*	6008	2.8	5656	2.8	352	4.5
Bachelor or higher degree*	19,998	9.4	19,532	9.5	466	5.9
R&D employee structure						
Bachelor or higher degree*	4908	81.7	4671	82.6	237	67.3
Recruited abroad	158	2.6	158	2.8	0	0.0
	US$ millions	Percent of total cost	US$ millions	Percent of total cost	US$ millions	Percent of total cost
R&D expenditure	2.02 (317.5*)	6.9 (7.9^)	2.9 (313.7*)	6.9 (7.9^)	0.08 (3.76*)	6.8 (6.3^)
	#	Percent	#	Percent	#	Percent
R&D change (2004–2006)						
Increase significantly	32	20.4	23	21.3	9	18.4
Decrease significantly	6	3.8	5	4.6	1	2.0
Little change	119	75.8	80	74.1	39	79.6

* Total R&D expenditure; Significant at 5% level.
^ Total R&D expenditure/total cost.

Table 5
Sources of core technology: FIEs vs. non-FIEs. *Source*: The ICT Survey.

Source of core technology	All samples		FIEs		Non-FIEs	
	Score	Percent	Score	Percent	Score	Percent
Total # of firms	157	100	108	100.0	49	100.0
Internal development	63.1	40.2	42.4	39.3	20.7	42.2
Companies in China	34.6	22	16.2	15.0	18.3	37.3
Imported abroad	38.7	24.6	32.8	30.4	6	12.2
Abroad and internal	17.4	11.2	15.2	14.0	2.2	4.5
Domestic Univ./Institution	2.2	1.4	0.4	0.4	1.8	3.7
Other	1	1	1	0.9	0	0.0

Table 6
Patents and new product/process development, 2006. *Source*: The ICT Survey.

	All Samples		FIEs		Non-FIEs	
	#	Percent	#	Percent	#	Percent
Firms with patents	39	24.8	31	28.7	8	16.3
Firms with domestic patents, 2004–2006	33	21.0%	25	23.1	8	16.3
Firms with foreign patents, 2004–2006	16	10.2	16	14.8	0	0.0
	US$ million	Percent	US$ million	Percent	US$ million	Percent
Firms with new products (2005–2006)	77	49	54	50	23	46.9
Sales income of new products (as of total sales)	17.7(2772.1[a])	17.2(14.4[b])	25.4(2748.5[a])	18.6(14.5[b])	0.5(23.6[a])	14.3(9.5[b])
	#	Percent	#	Percent	#	Percent
Firms with new processes (2005–2006)	76	48.4	55	50.9	21	42.9

[a] Total.
[b] Total sales income of new products/total sales income.

(75.8%) reported little change, 20.4% of them reported a significant increase. We also notice that substantial proportions of both FIEs (21.3%) and non-FIEs (18.4%) had significant increases.

Regarding sources of core technology, our survey finds the most important to be internal development, followed by imports and companies in China. FIEs have relied on both internal development (39.3%) and foreign sources (30.4%) (Table 5). Together, including those using both resources, they accounted for 83.7% of the sources for FIEs. Only 15% of the FIEs used domestic companies. While both FIEs and domestic firms rely mostly on internal development, FIEs consider their channels abroad more important, while domestic firms pay more attention to other domestic firms (37.3%). The surveyed firms rely more heavily on foreign sources in terms of the most advanced core technology, while self/internal development and domestic firms are playing more significant roles in application and process development. Surprisingly, only one firm partially used domestic universities and institutes as a source. While domestic firms use domestic universities and institutes more frequently, the rate remains low. The finding that both FIEs and domestic firms rarely use Chinese universities and research institutions indicates the general status of research institutions in China; they have low knowledge transfer and few of them are world class, which contrasts sharply with the United States, where universities and research institutions play a significant role in R&D and industrial upgrading (Mowery and Rosenberg, 1993). Moreover, Suzhou's universities rank far below the level of the leading universities and research organizations in Beijing and Shanghai. Those leading universities maintain more horizontal linkages with companies (Liefner et al., 2006).

Patents and new product/process development are also important indicators of R&D and innovation activities. We found that 24.8% of the surveyed firms had patents, with a significantly higher percentage for FIEs (28.7%) than non-FIEs (16.3%) (Table 6). While a larger percentage of FIEs have both foreign and domestic patents, non-FIEs have had no foreign patents. FIEs have also had substantially higher numbers of new products than non-FIEs (on average, 56 vs. 11). The gap between FIEs and non-FIEs in terms of sales income of new products is even larger (US$25.4 million vs. US$0.5 million). The survey also shows similar differences in terms of sources of new product development. While non-FIEs are based almost entirely on internal development, FIEs rely more heavily on foreign sources and other FIEs.

Of the most important drivers of technological change, the survey finds the most significant to be customers, with 41.4% reported domestic customers and 24.8% reported foreign customers, followed by competitors (12.1%) and technological change itself (10.2%) (Table 7). Differences between FIEs and domestic firms are also as expected. FIEs are influenced more by foreign customers and suppliers (40.7%), while domestic firms are more heavily influenced by domestic customers and suppliers (71.4%). For FIEs, the next most important reason for technological change is competition, followed by technological change itself, while a slightly different order exists for non-FIEs. Only 6.1% of non-FIEs reported foreign customers as the most important driver. Both foreign and domestic partners have little impact on technological change.

Important information sources for technological innovation and upgrading are customers, suppliers, cooperators and colleagues (Table 8). Exhibition, media, and government also play certain roles. The least important are personal friends, universities and research institutions, and business associations. Firms rely more on formal channels than local, informal channels such as personal friends and business associations, indicating weak information ex-

Table 7
Drivers of technological change: FIEs vs. non-FIEs. *Source*: The ICT Survey.

Drivers of technological change	All samples		FIEs		# of non-FIEs	
Most important reasons	#	Percent	#	Percent	#	Percent
Foreign customers	39	24.8	36	33.3	3	6.1
Domestic customers	65	41.4	33	30.6	32	65.3
Foreign suppliers	8	5.1	8	7.4	0	0.0
Domestic suppliers	8	5.1	5	4.6	3	6.1
Foreign partners	1	0.6	1	0.9	0	0.0
Domestic partners	1	0.6	1	0.9	0	0.0
Competitors	19	12.1	14	13.0	5	10.2
Technology	16	10.2	10	9.3	6	12.3

Table 8
Importance of information sources for technological innovation and upgrading. *Source*: The ICT Survey.

Information sources	All samples	FIEs	Non-FIEs	Importance of FIEs vs. Non-FIEs (%)			
				FIEs		Non-FIEs	
				FIEs	Non-FIEs	FIEs	Non-FIEs
Customers	2.5	2.4	2.5	72.8	27.2	29.2	70.8
Suppliers	1.9	1.9	2	67.6	32.4	33.3	66.7
Cooperators	1.5	1.5	1.6	60	40	34.6	65.4
Colleagues	1.4	1.4	1.6	68.6	31.4	26.9	73.1
Personal friends	0.6	0.6	0.5				
Univ. and research institutions	0.8	0.8	1				
Business associations	0.9	0.9	1				
Media	1.1	1.1	1.2				
Exhibition	1.1	1.2	1.1				
Government	1	0.9	1				

The answers of unimportant, average importance, relatively more important, very important are coded with scores of 0, 1, 2 and 3.

Table 9
Cooperation of FIEs with domestic firms FIEs in R&D. *Source*: The ICT Survey.

Cooperation in R&D	Surveyed non-FIEs: with FIEs		Surveyed FIEs: with non-FIEs	
	# of Non-FIEs	Percentage	#of FIEs	Percentage
Firms with collaboration in R&D	12	24.50	42	38.90
Importance of alliance	49	100	108	100
Not important	47	95.90	92	85.20
Average	1	2.00	9	8.30
Important	1	2.00	7	6.50
Importance of cooperative R&D	49	100	108	100
Not important	40	81.60	88	81.50
Average	3	6.10	10	9.30
Important	6	12.20	10	9.30
Importance of technology transfer	49	100	108	100
Not important	46	93.90	92	85.10
Average	1	2.00	14	13.00
Important	2	4.10	2	1.90
Importance of technology advice	49	100	108	100
Not important	42	85.80	82	76.00
Average	5	10.20	22	20.40
Important	2	4.10	4	3.70
Importance of personal exchange	49	100	108	100
Not important	41	83.70	75	69.40
Average	6	12.20	25	23.10
Important	2	4.10	8	7.40
Importance of information exchange	49	100	108	100
Not important	39	79.60	76	70.40
Average	7	14.30	18	16.70
Important	3	6.10	14	13.00

change among firms in Suzhou. A further investigation of FIEs and non-FIEs found that for FIEs, important information sources are other FIEs, and vice versa, which is further evidence of networking among FIEs, rather than between FIEs and non-FIEs in Suzhou.

The lack of cooperation between FIEs and domestic firms in R&D is also evident from our survey (Table 9). The linkages exist only in personal and information exchange and technology advice. The weakest exchanges are in strategic alliance and cooperative R&D, which are the highest levels of exchange and most critical to business development and technological innovation. FIEs in Suzhou tend to maintain closer contacts with their parent firms in terms of R&D and have little interaction with other firms in Suzhou, whether foreign or domestic. This is another sign of Suzhou as a TNC satellite production center.

9. Discussion: global–local networks, embeddedness, and regional development

Suzhou hosts thousands of factories and plants of TNCs, with their headquarters located outside the municipality. We have found that these factories are mainly manufacturing assemblers, and as local branches of TNCs, they have less control over the making of key decisions with the global market but more control over the Chinese market. We have also found that FIEs and non-FIEs in Suzhou have weak production linkages, and FIEs are less embedded with local economies. FIEs are more highly clustered among themselves in terms of supply relations, mostly among FIEs with the same country sources. Even fewer linkages exist between FIEs and non-FIEs in R&D and innovative activities. The weak embeddedness of FIEs in Suzhou well reflects the external control of production and the dependence of Suzhou on TNCs and external markets. The dominance of TNCs in Suzhou City overshadows endogenous firms, which tend to be small in size.

A number of mismatches – technological, structural, spatial and institutional – explain the satellite nature of the city and weak embeddedness of FIEs. Technological mismatch is a key reason since the ICT sector requires higher levels of technological competence, while local enterprises are low-tech oriented. Most of the FIEs in the ICT sector in Suzhou are coming from Taiwan, whose investment is characterized by network-based cross-border production (Yang and Liao, 2010). For Taiwanese component suppliers, following the decisions of system manufacturers is the most significant reason they gave for transplanting to the Suzhou region (Yang and Hsia, 2007). Wang and Lee (2007) argue that Suzhou is a globally embedded but locally delinked economic region, whose competitiveness lies in providing firms with institutions that can fulfill their needs for low costs, speed, and flexibility, rather than in the localities' own specific assets.

National-level development zones in China are often developed in rural suburban areas, which tend to have weak industrial bases and few local firms to cooperate. Suzhou Industrial Park and Suzhou New District are located far apart from each other—one at the east end and the other at the west end. Both are mainly production centers and compete with each other, although they are attempting to build their own CBDs, since the city lacks a CBD for the organization of urban spaces and the development of advanced business services. The fragmentation of city districts and the preservation of the old city district at the center of the city further handicap the sharing of resources for innovation and the city's efforts to make itself into a center of innovation. Spatial segmentation within Suzhou and within the YRD, intensified by regional competition, reflects the imprint of spatial and administrative segmentation in China, rooted in its historical legacy of regionalism and socialist legacy of a cadre promotion system.

The weak embeddedness also has other institutional dimensions. The dependence on TNCs and the weak localization and R&D capacities are also a result of local policies and bargaining power. Our study of local policies convinced us that the city had overly favored FDI in manufacturing, deemphasizing services and endogenous firms. The emphasis of local governments on FDI limits the resources and support committed to the development of private enterprises and the service sector. This is especially the case in those counties and zones where FIEs concentrate. Kunshan, for example, is an exemplary case, with powerful FIEs and weak local firms; its county-level local state and intensified regional competition also weakens the city's bargaining power with FIEs. Taiwanese firms we interviewed explained to us that the networking among themselves has cultural and credit reasons and attempts to protect intellectual property rights. Our interviews found that their interest in patents has much to do with using patents as a tool for IP protection.

However, firms, after all, are capitalistic economic entities, and many firms we visited tend to weigh the economic factors heavily. When economically sensible and politically necessary, they do network with domestic firms. First, both our survey and interviews have led us to conclude that Suzhou is increasingly a node of the production network of the YRD, where FIEs, while rarely networking with local firms, have established some production networks with more established domestic firms in Shanghai and Zhejiang Province; linkages also exist between FIEs in Suzhou and domestic firms in the Pearl River Delta. In this sense, FIEs are embedding, to a certain extent, within production networks in China, primarily with other FIEs, but also with domestic firms outside Suzhou, and to a lesser extent, within Suzhou as well.

Second, with the continuous rise of the Chinese market, foreign firms also have to use Chinese firms for marketing activities. With years of rapid growth and capital accumulation,

Chinese firms are using the resources they control and the huge domestic Chinese market to produce more efficiency, build up brands, and become more competitive. They have also undertaken technological upgrading and climbed the global value chains. Taiwanese firms we visited are producing computer components for Lenovo and computer storage devices for Aigo; these two Chinese firms have established brand names and market power in China, while the Taiwanese firms are mainly OEMs with limited functions in R&D and marketing. Such production and market linkages indicate that FIEs are not confined to Suzhou, but rather have broad networks and action spaces. Also, the corporate service functions of FIEs are not located in Suzhou, and many companies in Suzhou generally rely on other Chinese domestic firms and cities, especially Shanghai and Beijing, for services. Embeddedness is not simply within Suzhou, but has to be analyzed in terms of the regional context of the YRD and the broader context of China.

There are also local and FIE-specific factors which contribute to local embeddedness. First, not all foreign firms are large in size or in the high-tech sector; small, low-tech, service-oriented foreign firms tend to network more with domestic firms. Second, our fieldwork finds that for firms located in towns and villages where there is no Taiwanese cluster, there are tendencies to network with local firms for economic reasons, as well as political and social reasons. Third, those at the bottom of the supply chains tend to use raw materials and parts from China, such as the Taiwanese power cord factory we visited that obtain most of their supplies (e.g., copper, plastic, rubber, and steel) from China. Last, there are also cases where foreign firms deliberately hire local officials and establish production and marketing relations with local firms, often for political purposes. The nature of global–local networks is therefore multi-faceted and more complicated than the literature has suggested. These mechanisms of local embeddedness are not specific to Suzhou, but also appear in other regions of China as well, such as Dongguan, as demonstrated by our interviews of FIEs there in June 2008.

We must also point out that given the marked regional differentials in China, the nature of global–local linkages also varies within regions. Within the YRD, our fieldwork indicates that the linkages between foreign and domestic firms tend to be stronger in cities like Hangzhou where domestic economies are better developed. Stronger global–local linkages and more positive effects have been reported in the automobile industry in Shanghai and are evidenced by the local content requirement and embeddedness (Depner and Bathelt, 2005) and the strong ability of local firms to drive the global–local networks in Qingdao (Kim and Zhang, 2008).

FIEs' direct contributions to indigenous R&D activities are very limited, and their contributions are more likely to come indirectly through job creation, flows of workers and economic growth, thereby providing more available capital and better trained professionals for R&D and innovative activities. Such a process of learning and development is slow (Miao et al., 2007). To reduce the dependence of the city on manufacturing FIEs, Suzhou has intensified the development of the high-tech industry, business services, and endogenous capacities, as indicated by local government officials and revealed through our analysis of local policies. The city has established a number of "creative platforms" for R&D and education, such as the International Science Park, the Software Park, the Intellectual Property Protection Centre, the IC Design Centre, the Software Testing Centre, the Doctorate Work Station, and the High-Educational Zones. The city provides many incentives for R&D and the high-tech industry, including technological development funds, venture capital, entrepreneurial funds, and funds for overseas students, as well as services for innovation and firm formation such as financing, management consultancy, human resources and information services.

We have to point out that Suzhou's efforts towards localization and innovation have strong institutional barriers, which are difficult to overcome. Unlike Shanghai, Beijing and even Nanjing, which have massive state investment, cities like Suzhou have less financial support and decision-making powers from the central and provincial governments. One of the most important institutional factors is Suzhou's lack of top-ranked domestic universities and research institutions, which hinders its efforts to develop its own R&D capacities. The city has to rely on TNCs and external research institutions for R&D, which further contributes to the nature of a satellite district and technological gaps between foreign and domestic firms. Most of the local branches of national universities in China provide programs mainly in management and training to capitalize on the demand for workers and are weak in basic research. Moreover, Suzhou is not alone in the race for R&D and human capital; it is accompanied by Beijing, Shanghai, and Shenzhen.

10. Conclusion

This paper analyzes the network structure and R&D activities of the ICT industry in Suzhou municipality. We highlight the significance of the Chinese state and local/regional assets in shaping the trajectories of globalization and regional development. Suzhou has been transformed from a region known for the Sunan model of development dominated by TVEs and SOEs into an externally driven production center dominated by FIEs. Despite the end of the orthodox Sunan model, active local states are still in operation, and Suzhou has made a series of efforts to globalize the city. While foreign ventures are known for their mobility, we have found the increasing importance of regional clusters/agglomeration for location and network decisions of foreign ventures, indicating the significance of the pervasive force of local/regional agglomeration in industrial location and regional development.

We have found that Suzhou's development path, heavily dependent on external forces, has made Suzhou a TNC satellite production district dominated by TNCs and external organizations, where its indigenous firms are small, low-tech, and locally oriented. The satellite nature means that the city functions largely as a TNC manufacturing floor for the global and Chinese markets. The ICT industry in Suzhou has a dual-structure, segmented between FIEs and domestic firms. FIEs tend to network among themselves, and their interfirm networks are increasingly domestic and regionally embedded in the Yangtze River Delta. TNCs are weakly embedded with local economies, and there is little cooperation between foreign and domestic firms in R&D and innovative activities. The weak local embeddedness has technological, structural, spatial and institutional foundations (mismatches), which limit the establishment of knowledge 'pipelines' with global innovation centers. Our study suggests that the nature of global–local networks is contingent upon regional endogenous capacities and the specific ways in which global capital interacts with local institutions, not merely on firms' absorption capacities.

The Suzhou case also suggests that globalizing regional development has the danger of promoting satellite districts, and that localizing the global is another aspect of the globalization process to which localities must pay particular attention. While our overall assessment of the Suzhou pathway to industrialization and regional development is positive, and we recognize that the city has had to use foreign capital to move beyond its stagnating economy once dominated by uncompetitive SOEs and TVEs, Suzhou might be better off if it had given more weight to business services and

private enterprises and been more cautious with industrial land use and urban spatial organization. On the other hand, the networks of FIEs extend to the YRD, which suggests that we must evaluate the nature of global–local networks in a broader context rather than at the local level only. More generally, in opening up to the outside world, developing countries have to pay more attention to using external resources for the development of endogenous firms and innovation capacities, which does not prevent them from breaking economic impasses and narrowing their economic gaps with the developed world.

Suzhou is increasingly aware of the importance of FDI embeddedness and local innovative capacities and has heightened its efforts to strengthen local innovative capacities. However, the future development of Suzhou faces a series of limitations and challenges. The city focuses primarily on manufacturing, and international experiences suggest that given its weak R&D and advanced service functions, Suzhou's efforts to improve innovative activities will take a long time and require the commitment of huge resources. Since R&D has become the backbone for the development of high-tech industries, the most serious challenge to Suzhou's development is the lack of top-ranked research institutions, resulting largely from Suzhou's status as a prefectural-level city. The city is also trying to find a balance between serving and bargaining with TNCs to avoid driving them away from Suzhou, a paradox challenging all places in the increasingly globalizing world.

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