THE ROLE OF HIGH-TECH PARKS IN CHINA'S REGIONAL ECONOMY: EMPIRICAL EVIDENCE FROM THE IC INDUSTRY IN THE ZHANGJIANG HIGH-TECH PARK, SHANGHAI

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With 7 figures and 1 table
Received 31. March 2010 · Accepted 14. October 2010

Summary: Numerous empirical investigations have been carried out which assess the roles of high-tech parks worldwide. Most of them focus on collaboration within the parks, innovation, and the formation of innovative local clusters, reflecting the perspective of industrialized countries. Chinese high-tech parks, however, are different in many ways. Besides the usual functions of stimulating collaboration and innovation, they are designed to attract foreign investment and to function as hubs for integrated regional economic development. This paper takes one of the country's leading high-tech parks, Zhangjiang High-tech Park in Shanghai (ZJ), and its most prominent industry, the IC industry (integrated circuits; microelectronics), as an example. Using survey data from 2008, it analyzes to what extent high-tech parks fulfill their different roles. It turns out that ZJ has successfully attracted FDI, today showing clear signs of technical dependence on foreign companies, at least in the field of advanced machinery. However, as ZJ remains focused on the design, manufacturing and testing of ICs that do not belong to the latest generation, the park has not succeeded in stimulating innovation, with the FDI-focused development policy thus not being successful in this respect. However, ZJ helps to raise the overall technological level in the Yangtze River Delta. The park succeeds in integrating the regional activities into global value chains and acts as an integrated economic hub that combines production factors from Shanghai and other parts of China.

Zusammenfassung: Die Rolle von Hightech Parks im Entwicklungsprozess ist Gegenstand zahlreicher empirischer Arbeiten. Im Einklang mit dem westlichen Theorieverständnis thematisieren viele von ihnen Kooperation, Innovation und Clusterbildung als wesentliche Leistungen der Parks. Chinesische Hightech-Parks entsprechen diesem Verständnis nur teilweise, denn sie haben zusätzlich die Aufgaben, ausländische Investitionen anzuziehen und als Motoren für regionsübergreifende Wirtschaftsentwicklung zu dienen. Das Zusammenspiel dieser verschiedenen Funktionen analysiert der vorliegende Artikel am Beispiel der IC-Industrie im Zhangjiang-Hightech-Park (Shanghai). Auf der Basis von Befragungsdaten aus dem Jahr 2008 lässt sich zeigen, dass der Park vor allem beim Anziehen von Auslandsinvestitionen Erfolg hat. Dies geht mit einer technologischen Abhängigkeit vom Ausland einher. Ebenso erfolgreich ist es gelungen, eine regionsübergreifende industrielle Vernetzung im Jangtse-Delta zu initiieren. Die IC-Industrie im Park beschränkt sich jedoch auf die weniger wertschöpfungsintensiven mittleren Schritte der Wertschöpfungskette. Somit hat der Park das Ziel verfehlt, Innovationen zu stimulieren.

Keywords: Global value chain, FDI, knowledge transfer, high-tech park, China

1 Introduction

Since scientific and political interest in high-tech parks increased during the 1980s, numerous studies have analyzed the functioning of different high-tech parks worldwide. However, the majority of studies examine the issue from a Western angle, stressing the importance of collaboration and knowledge-sharing within parks as a precondition for innovation and successful development of technology-intensive products. A recent example is Kulke's investigation of Berlin Adlershof, which studies the functioning of the park in terms of three dimensions: value added, technology and innovation, collaboration and networking (Kulke 2008).

The analysis of Chinese high-tech parks, however, calls for a different focus. Chinese high-tech parks are an important element of the national and the sub-national economic development and industrial policies. The parks are designed to serve both as comparably large and important industrial bases and as innovative zones. Although they share their Western peers' overall aim of raising the technological level of production, the path towards achieving technical progress is very different (Wang and Zeng 2008). Firstly, one main task is to attract large-scale

DOI: 10.3112/erdkunde.2011.01.04 ISSN 0014-0015 http://www.erdkunde.uni-bonn.de

foreign direct investment in manufacturing and to help integrate foreign firms' affiliates into the national economy. The foreign-invested enterprises (FIEs) bring with them a superior technology. This knowledge inflow is an important tool for facilitating technological progress, and the dissemination of this knowledge is an important goal of the parks (cp. Hayter and Han 1998). As part of the strategy of attracting FIEs, the parks provide a high-quality business infrastructure. The superior infrastructure, in turn, attracts investment from domestic Chinese firms, many of which favor the location in a high-tech park over alternative locations. This is especially true for ZJ, located in one of the economically most prosperous regions in China. Secondly, therefore, Chinese high-tech parks aim to provide a place where companies, workers and ideas from the local, national, and international economy co-locate. High-tech parks are supposed to help domestic firms integrate themselves into global value-added chains (Fasse et al. 2009, 3).

Hence, this paper intends to investigate whether ZJ has fulfilled the two functions that are specific for Chinese high-tech parks:

- To what extent has ZJ successfully attracted FDI, and to what extent is the park dominated by FIEs and international orientation?
- To what degree has ZJ developed into an integrated regional-economic hub and helped domestic firms join global value chains in the IC industry?

However, since FDI and integration into global value chains are to be seen as vehicles for achieving technological upgrading of the local industry and stimulating innovation, the analysis of both questions will often refer to aspects of technological upgrading, learning, and innovation. The questions will be answered based on 2008 survey data from the IC industry. The key factors analyzed are business activities, cooperation and collaboration along the value chain.

2 Global value chains, FDI and knowledge transfer

With respect to its economic structure, China is still a developing and transforming economy. This is the case even despite its sustained high growth rates, its strong export performance, its huge market size, decreasing poverty and the growing wealth of some regions and sectors. The Chinese economy is specialized in producing cheap and low-tech goods such as clothes, shoes and simple consumer electronics products, such as microwaves. Within the field of new and technology-intensive products, such as mobile phones or desktop PCs, Chinese producers specialize on labor-intensive steps of the value chain, while the truly knowledge-intensive components of high-tech products are imported (Lemoine and Ünal-Kesenci 2004). Trade statistics support this pattern, although some authors have begun to question China's continuing focus on the low-cost steps of the value chain (e. g. Ernst 2008).

The IC industry is an important capital and technology-intensive industry which shares a high degree of modularity, as the large scale and scope of operations creates comprehensive bundles, or modules, of generic value chain activities (Gereffi and Memedovic 2003, 4; Gereffi et al. 2005, 95). It is an example of a producer-driven value chain (Gereffi and Memedovic 2003, 5), which is mainly coordinated by large transnational companies and involves a huge amount of vertical FDI (Tung 2001; Arita and Fujita 2001). This kind of FDI is driven by efficiency or resource-seeking incentives, and aims to locate different stages of production in different countries (Smeets 2008, 129). Figure 1 shows a simplified version of the value chain of the IC industry. It is argued that Chinese producers occupy the mid-range steps, in particular packaging and testing. These steps are rather labor-intensive but yield low value added. The high value-adding early steps (e.g. chip design, miniaturization and design implementation) are mainly carried out by U.S., Japanese, Korean or Taiwanese firms, at least for high-performance ICs. The high value- added late steps of the value chain, for example service, are carried out by firms close to the customers. If Chinese enterprises want to upgrade - meaning innovation to increase value added - by entering higher unit value market niches or by undertaking new productive functions, more superior technologies need to be introduced or created (Giuliani et al. 2005, 552).

The specialization on low value-adding, low-cost, and low-technology activities is consistent with China's factor endowment: the country is relatively rich in unskilled cheap labor, and the resulting low wages are the foundation for the status of "factory of the world". China is relatively poor in human capital and knowledge (Dahlman and Aubert 2001, 106, 122; Cai et al 2009, 34), and little can thus be expected with respect to inventing products that are new to the world. This is true on the national scale and will only change slowly with China's vast and increasing investment in education and R&D (Dahlman and Aubert 2001, 73, 123; Fleisher et al. 2010, 216;

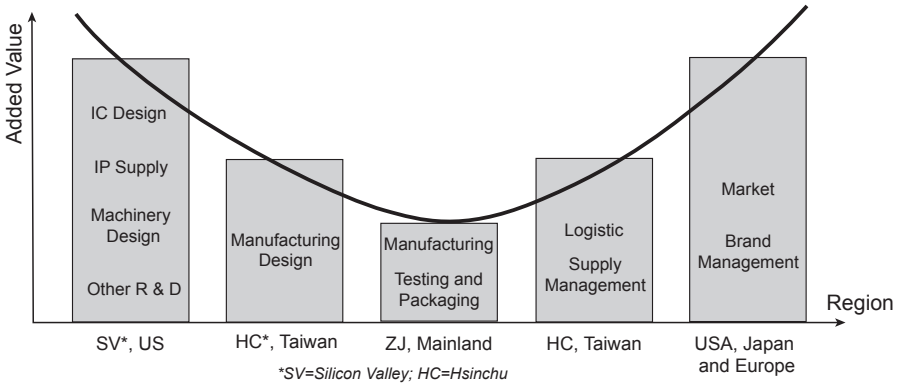

Fig. 1: The IC value chain: steps and major world regions. Source: based on Sher and Yang (2005) and Coe et al. (2007, 98), extended and modified by the authors

Heckmann 2003, 803). Regional economies within China vary with respect to factor endowments: some areas of inner China are typical low-cost locations, whereas parts of coastal China are building up competence in more technologically advanced activities. Examples include Beijing and the Bohai Rim regions, Shanghai and the Yangtze River Delta, and Shenzhen and the Pearl River Delta (Liefner 2009).

A major issue in changing the factor endowment of China, in particular with respect to knowledge and capital, is foreign direct investment (FDI). This is especially true for vertical FDI of the IC industry, which has been proved to have positive knowledge spillover effects (Protsenko 2003). The huge inflow of FDI into China is bringing new knowledge to the country, but it is not entirely clear what kind of knowledge this is, how much is coming in, and whether it is finding its way into the domestic economy. Although these questions go far beyond the scope of this paper, some limited evidence can be found in its empirical sections.

Transnational companies (TNCs) from developed economies which carry out FDI can be expected to transfer as much knowledge to their foreign affiliates as is necessary for running operations. Beyond this, no other knowledge will be supplied, as this would induce additional transfer costs and increase the risk of losing some knowledge to current or potential future competitors (Teece 1977; Tsang 1994). Spillover theories argue that some knowledge inevitably flows from the TNC affiliate to local firms, either as a by-product of cooperation with local suppliers or with employees who move between firms (Blomström and Kokko 2001; Fosfuria et al. 2001; Görg and Strobl 2005). Absorption theories stress active technology-seeking behavior on the part of domestic partners of foreign affiliates (e.g. Mathews 2002).

However, despite strong theoretical arguments, little comprehensive empirical evidence from China has been uncovered so far. This lack of proof can be attributed to methodological and measurement problems. The aggregate indicators, such as R&D input, patenting, or the introduction of new products (OECD and Eurostat 2005), are difficult to interpret when production is organized in production networks. Case studies (e.g. Marcotte and Niosi 2005) help to understand factors affecting the success of knowledge transfer, but their results cannot be generalized. It thus seems preferable to rely on company survey information. Empirical evidence, however, is still mixed. Some studies argue on the basis of collaboration frequencies and intensities, and find evidence of successful - though limited - knowledge transfer, at least in high-tech industries. They show that international knowledge transfer enhances the ability to meet certain quality standards, to introduce new products more quickly, and to raise productivity (Hong 2003; Chen 2006; Liefner 2006). Analyses that include less technology-intensive industries usually report very weak cooperation between FIEs and domestic firms; knowledge transfer must be assumed to be low (Sun 2002; Inkpen and Wang 2006). This situation is very disappointing from the Chinese point of view, as FDI has, from the beginning of the "Open Door Policy", been viewed as a means of incorporating new knowledge into the Chinese economy, thus helping to build up indigenous innovation capacities (TCPGPRC 2006).

The issues of FDI and knowledge transfer into China can also be analyzed based on different concepts such as network theory, or with a focus on re-migration. Some alternative approaches are discussed in other articles of this theme issue, for example the network analysis presented by Hennemann, and need not be discussed here.

3 The role of Chinese high-tech parks

The difficulties related to knowledge transfer from FIEs underline the importance of the country's high-tech parks. As designated areas for FDI in high-tech industries, they could help overcome barriers to knowledge sharing. Generally, high-tech parks are established based on four propositions. Firstly, proximity between potential business partners in a park allows for frequent contacts. Secondly, based on frequent contacts, functioning local business networks can evolve. Thirdly, cooperation in networks allows for knowledge exchange and learning. Finally, learning will, over time, evolve into innovation.

Each of these propositions has been studied numerous times in different settings, usually with examples outside China. Examples from developed economies show that high-tech parks may indeed work the way they are designed to. With respect to China, however, at least two propositions must be questioned.

The second proposition claims that frequent contacts stimulate networking and collaboration. In China, this cannot be assumed to happen automatically. On the one hand, networking and meaningful collaboration depend on trust between the partners. The Chinese business environment, however, is still not fully equipped to guarantee conditions necessary for building up trust. Issues such as copying, imitating, or reverse engineering may undermine trust and hamper trusting cooperation (Haas et al. 2008). Moreover, guanxi-based relations usually exist between groups of firms, for example those stemming from the same regions within China, and are difficult to extend beyond this group. A missing or unstable link between contact frequency and collaboration intensity, however, would significantly reduce a high-tech park's chance of succeeding (cp. Zhou 2005, 1128).

A second challenge is linking learning and innovation. Western high-tech parks function based on the principle that bringing together the different knowledge bodies of two partners allows for learning on both sides, but also for a joint development of new ideas. Such a process benefits from differences in the partners' backgrounds (Nooteboom et al. 2007), but requires a similar level of general technical understanding. The latter is often missing in China, where FIEs enjoy access to the parent company's superior knowledge base, and most domestic Chinese firms lag behind with respect to technical knowledge.

This situation may contribute to the separation of the business spheres of FIEs and Chinese firms in high-tech parks, as reported for the case of Beijing Zhonguancun (Wang and Wang 1998). However, given the sheer number of domestic companies, some leading firms have the potential to link up with FIEs and move towards learning and innovation (Zhou 2005; Liefner et al. 2006).

As a common feature, many Western and Chinese high-tech parks include some universities and public research organizations. They can function as alternative knowledge sources for companies, but can also be part of complex business networks and can supply graduates, provide applied research capacities, new ideas, etc. China's heavy investment in education and R&D is also reflected in the education zones of the country's high-tech parks. Again, empirical evidence concerning cooperation between companies and universities is at best ambiguous, sometimes contradictory. It varies to a large degree with the technical level of the firms surveyed (Lin and Wang 2008; Liefner and Zeng 2008).

4 Zhangjiang High-tech Park

Zhangjiang High-tech Park (ZJ), founded in 1992, is one of the main technology-oriented parks in Shanghai and China (Wang and Zeng 2008). It is located in Pudong New Area. In the related literature, it is usually regarded as a successful example of a Chinese high-tech park. ZJ has been designed to function as a science city that hosts innovative clusters. The park is thus structured with different zones for residential use, industrial use, education, and other functions. The zones for industrial use are again divided into areas for certain industries, for example the ICT and biopharmaceutical industries (Fig. 2).

Wang and Zeng (2008) show that ZJ has developed into a strong industrial zone for technology-intensive products, but indigenous technological capabilities remain weak. This is supported by the findings of Lai and Shyu (2005), who describe how Taiwanese investment has shaped the park's IC industry. ZJ has specialized in the low-cost steps of the value chains which are controlled by the Taiwanese investors.

ZJ's importance for the Chinese IC industry is remarkable. In the larger field of China's 'information and communication industry,' the national turnover in 2007 was 1,251 billion RMB, of which

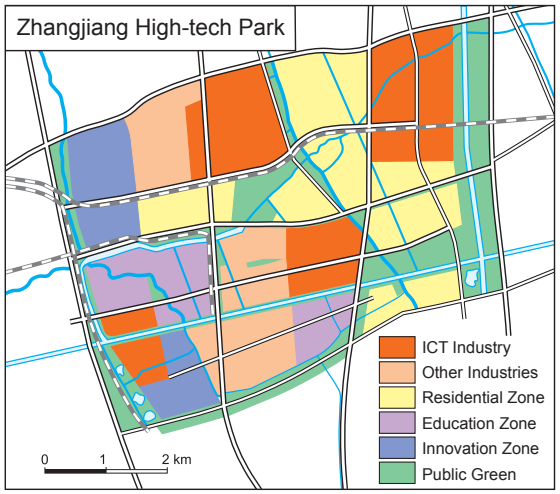

Fig. 2: Land use planning of the ZJ High-tech Park Source: Inst. of Geography, JLU Giessen

ZJ firms generated 230 billion. ZJ firms' turnover increased at a faster rate than the national average (SMCEI 2009). When it comes to certain steps of the IC value chain, however, ZJ's position is even stronger. In 2007, ZJ companies accounted for around 48% of China's output value in IC manufacturing, and for 39% in testing and packaging. ZJ's share of China's turnover is much smaller in other steps of the IC value chain, for example 11% for design and 2% for production machinery (Xu 2009). ZJ is thus heavily specialized in chip manufacturing, testing and packaging. This specialization has a strong impact on the spatial scope of business contacts, as shall be shown later. Figure 3 visualizes possible cooperation in ZJ's IC industry.

5 Methods and data

The IC industry survey which forms the basis for this article was carried out in ZJ by the Pudong Statistical Office and two of this article's authors between August and October 2008. 129 questionnaires were sent out to a sample of the IC company population in ZJ (N=172), of which 125 were returned completely filled out. Quality was checked by means of 16 in-depth company interviews. The questionnaire contained a total of 50 questions on company performance and economic and technical cooperation, as well as an assessment of the local business environment. The interviews also generated additional information on the quality of local business networks. Table 1 shows the distribution of firms over the steps of the value chain.

As figure 4 indicates, nearly two-thirds of the companies in the sample received overseas direct investment (including HK, TW and MC), which shows a high degree of foreign orientation. The owners of domestic companies are usually from Pudong, and only 15% of ZJ IC firms are subsidiaries of companies with headquarters in other parts of China.

Tab. 1: Sample distribution over the value chain

Activities	Amount	Proportion (%)
IC Design	57	45.6
Manufacturing	21	16.8
Packaging &Testing	8	6.4
Industrial Supporting	39	31.2
Total	125	100.0

Source: 2008 ZJ IC industry survey, own calculation

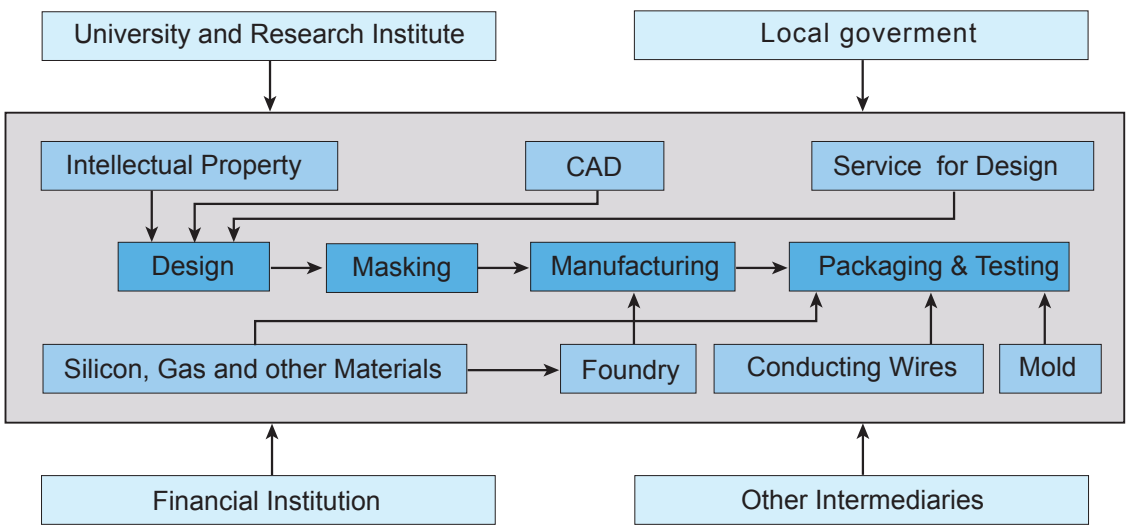

Fig. 3: Possible paths of interaction in the IC industry. Source: based on Sher and Yang (2005), modified by the authors

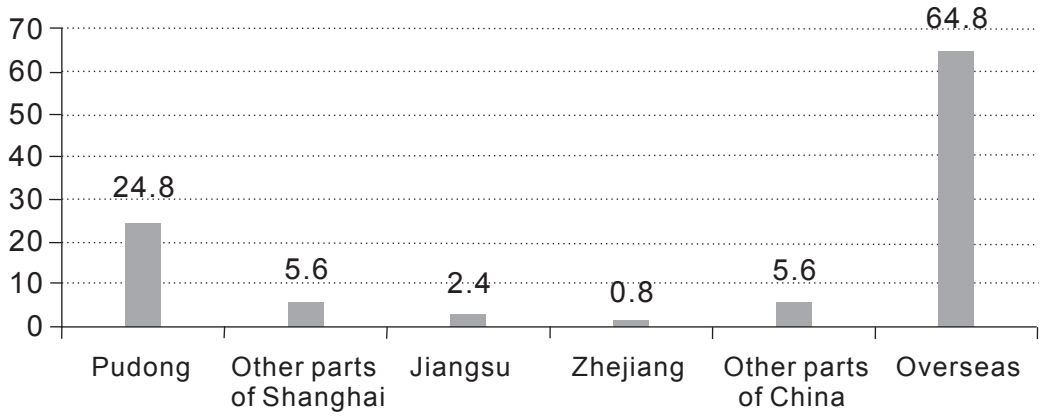

Fig. 4: Geographical distributions (Spatial Scope) of ZJ IC firms' shareholders (%). Source: 2008 ZJ IC industry survey

6 Firm-to-firm linkages: foreign dominance?

The claims, often heard, that the technology used in China's industry has been developed abroad and that value chains are controlled by firms from industrialized countries should also be reflected in the cooperation patterns of ZJ firms. However, examining the cooperation pattern of the total aggregate of firms may not be appropriate where the occurrence of typical linkages is concerned. Therefore, the following analyses focus on specific subsets of the company sample and on crucial business transactions. Figure 5 reveals the spatial scope of interactions for six selected types of business contacts.

The first case is the production materials supply of IC manufacturers. Nearly all of the ZJ IC manufacturers buy at least some production material abroad; sourcing from other parts of China and the nearby area is also common, but less pronounced. A similar pattern of dominance of foreign business partners is evident in cases 2 to 4. The ZJ testing and packaging companies buy their machinery mainly from abroad; in particular when it comes to primary machinery; local suppliers (Pudong, Shanghai, Yangtze River Delta) play a minor role. Procurement of production material and machinery is thus still a domain of foreign business partners. This underlines the claims made in figure 1.

The situation is slightly different when it comes to cooperation along the mid-range steps of the value chain. While most orders for ZJ IC companies still come from abroad, cases 5 and 6 underline the strengths of the local IC industry. Testing and packaging for ZJ firms is mainly carried out in Pudong. Jiangsu province, hosting large IC industry concentrations in the cities of Suzhou and Wuxi, is also strong in this activity. The situation is even clearer when it comes to the locations of manufacturing partners of ZJ IC design companies. These are located predominantly in Pudong, and to a lesser degree in Jiangsu and overseas. This finding underlines the specialization of ZJ on the mid-range steps of the IC value chain. Moreover, it shows that local firm-to-firm interaction along these mid-range steps has been established.

Whereas this finding supports figure 1, a glance at overall production orders shows that the domestic Chinese market has developed.

However, the ICs produced in ZJ are still not the latest generation on the market. As one manager of an IC design company interviewed illustrated, there are some IC design firms in ZJ that have the ability to design the newest and technologically most advanced products, but they can only search overseas for manufacturing and testing cooperation partners, as the technical level of these sectors in ZJ is comparatively low. This is also demonstrated in figure 4, which explains why the overseas proportions of cases 5 and 6 are still so high. It also hints that there may be technical back-flow from Chinese IC design companies to manufacturing and testing firms outside China. A closer look at the linkages of IC manufacturers alone gives additional insight (Fig. 6).

Part a) highlights the strong local interaction along the mid-range of the value chain, especially with respect to chip design and to testing and packaging. Part b) underlines the foreign dominance in the fields of production materials supply and machinery. It is interesting to note, however, that these patterns seem to have become even more accentuated during the three years prior to the survey. ZJ's specialization on a few steps of the value chain has intensified, as has the low profile in machinery supply. Overseas business contacts seem to be on the

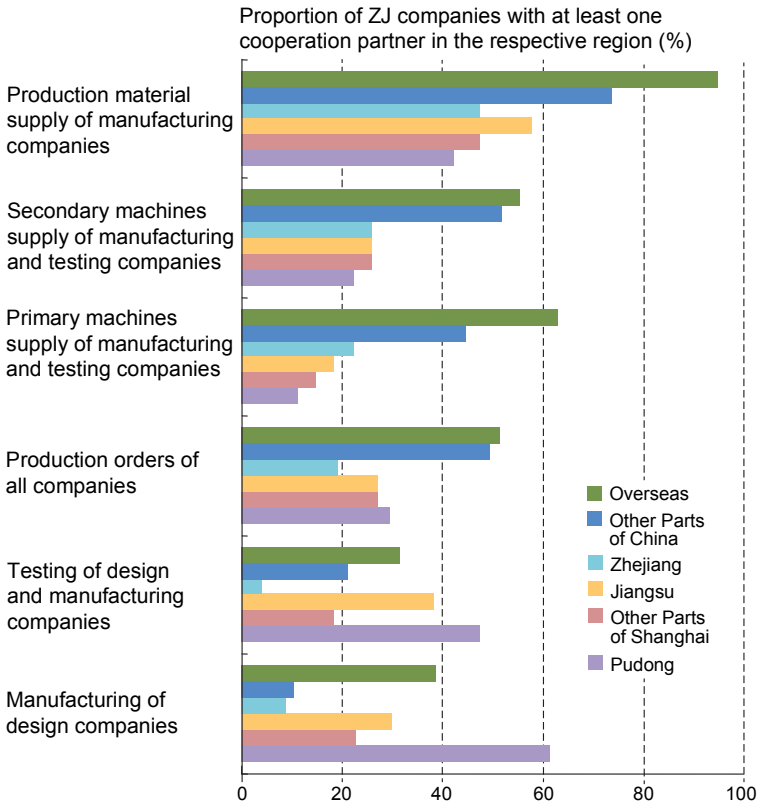

Fig. 5: Six typical cases of supplier-customer-linkages. Source: 2008 ZJ IC industry survey, own calculation

rise in general. As more and more ZJ IC manufacturers are getting involved with overseas contacts, diversity of knowledge access increases.

A technological dependence on foreign firms must be suspected at least for the supply of core machinery and production material. ZJ itself is strong in chip design, manufacturing, testing and packaging.

7 Cooperation in the Yangtze River Delta

The previous section of this paper showed that the predominantly foreign-invested IC firms in ZJ are indeed outward-oriented, but also intra-regionally connected. This section poses the question of whether the companies also cooperate intensively on a regional scale, i.e. within the Yangtze River Delta. Such a local economic integration would have two implications: firstly, it would prove that ZJ functions as a hub for regional-economic integration. Secondly, this would suggest that a trickling-down effect from FDI in Shanghai to neighboring provinces is likely.

One indicator of regional-economic integration is the movement of employees. 60% of companies in the sample report hiring personnel from other firms in Pudong, nearly 80% from other parts of Shanghai, and more than 80% from other parts of China, i.e. there is considerable fluctuation, both intra-regional as well as inter-regional. Around half of the firms report hiring people from the neighboring provinces in the Yangtze River Delta. In contrast to this, only very few firms report that their employees had left to work in Jiangsu (10%) or Zhejiang (8%). Employees who leave ZJ IC companies usually find new jobs in other firms in Pudong (38%) or other parts of Shanghai (40%). This side of labor fluctuation is thus mainly a local phenomenon which can contribute to knowledge sharing and clustering.

Another indicator for regional-economic integration is firm-to-firm linkages. Figure 7 displays the proportion of ZJ IC manufacturing firms that cooperate with industrial partners in the neighboring provinces of Jiangsu and Zhejiang, and in other parts of China.

Interestingly, cooperation with the neighboring provinces is not significantly less frequent than cooperation with partners in the rest of China, which includes large industrial agglomerations such as the

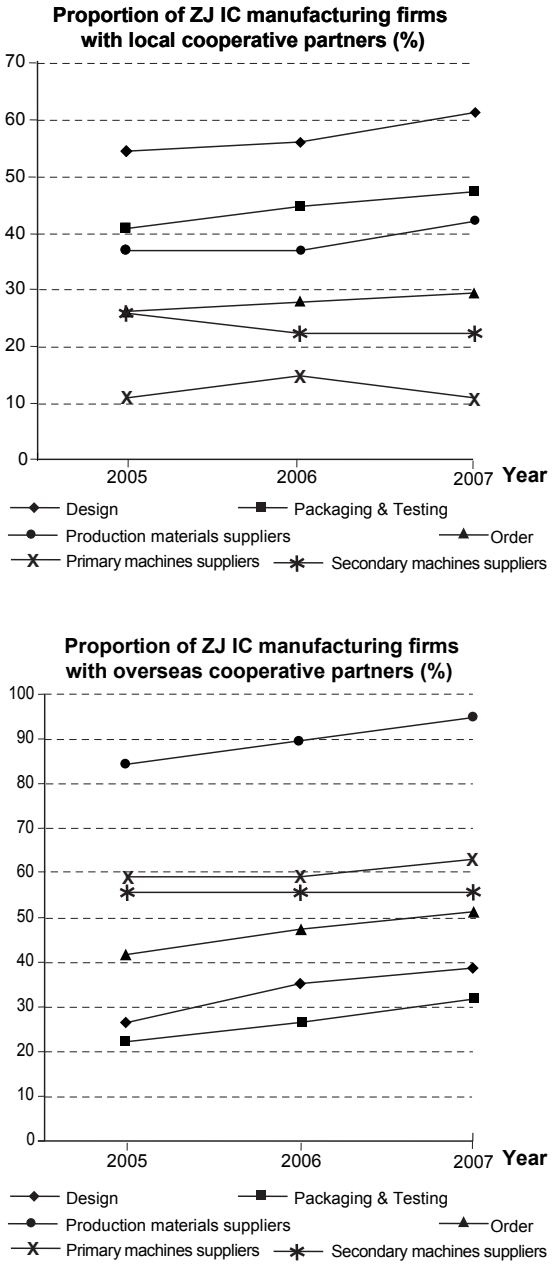

Fig. 6: Local and overseas cooperation of ZJ IC manufacturers. Source: 2008 ZJ IC industry survey

Pearl River Delta. Another general feature is the importance of cooperation in the field of production materials, showing that this activity is simply missing in ZJ, partly because it involves the large-scale manufacturing of bulk material. The more interesting findings relate to the characteristics of Jiangsu and Zhejiang. Jiangsu province hosts many partners of ZJ firms. This is even true for activities such as design or testing and packaging, in which ZJ companies are particularly strong. This pattern underlines that a) Jiangsu's IC industry is growing strongly, b) its specialization is similar to that of ZJ, and c) cooperation is becoming more frequent. Zhejiang's relative strength lies more in the field of machinery. However, contacts with ZJ firms are not becoming more frequent. A similar stagnation, although on a higher level, can be observed for the rest of China.

Regional-economic integration in the field of IC in the Yangtze River Delta is thus mainly a matter of the two growing IC industries in Jiangsu (Suzhou and Wuxi) and Shanghai. They are creating an interlinked IC corridor along the lower reaches of the Yangtze River. Meanwhile, there is also intensive competition between them, as could be observed in the course of the interviews. If ZJ cannot improve its innovation ability or its economic and social contexts, such as venture capital, private investment or incubator conditions, it may possibly lose the first-mover advantage in the Yangtze River Delta in the future.

8 Discussion and conclusion

The first question focused on in this paper was that of FDI attraction and foreign dominance in the IC industry. Given the share of foreign-invested firms and the international trade relations in the field of materials supply and machinery, foreign influence is an important characteristic of ZJ's IC industry. Indeed, ZJ works well in attracting FDI, thus fulfilling one of its core functions. But in terms of the technology transfer alongside the FDI, it turns out not to be as successful as the Chinese government had hoped. After twenty years of development, the chip industry in ZJ specializes on the mid-range steps of the value chain, in particular manufacturing and the testing and packaging of ICs that are not of the world's latest standard. Therefore, ZJ's IC industry is not innovative in a strict sense, but specialized in carrying out low-cost steps of the value chain of high-tech products. This specialization is consistent with China's factor endowment and development stage. The role of ZJ, however, is not one of producing innovations, but at best one of raising the technological level of China's IC industry.

This finding is of particular importance when it comes to judging the success of China's FDI-focused development policy. FDI, at least vertical FDI within the producer-driven value chain, has helped to promote the technical level in high-tech

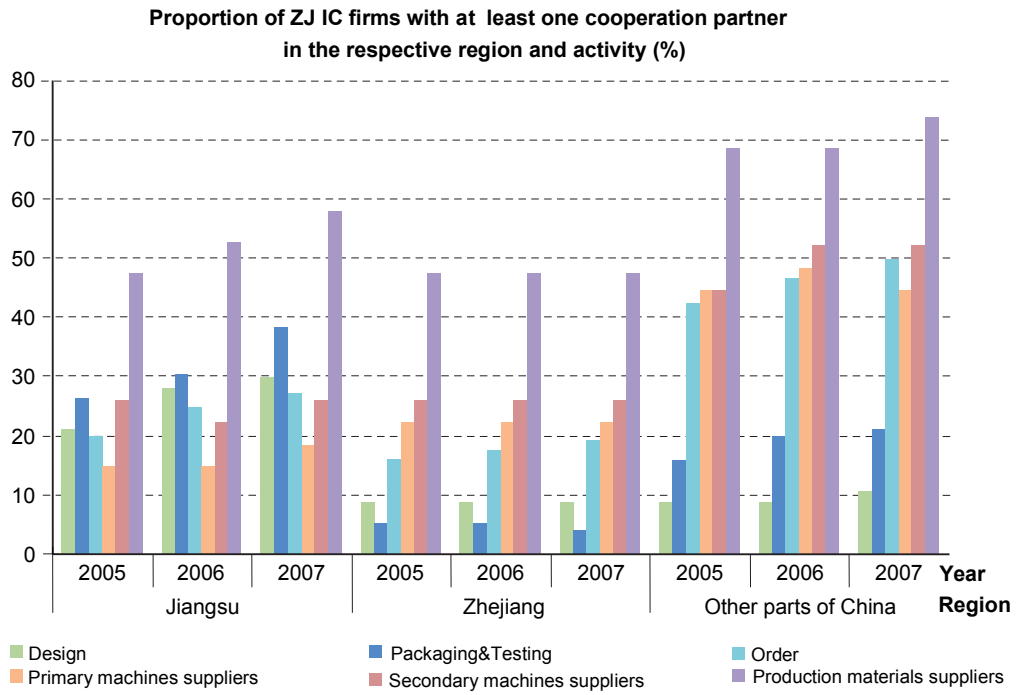

Fig. 7: Domestic cooperation. Source: 2008 ZJ IC industry survey, own calculation

parks, but it is very difficult for them to take the most advanced or latest technology to China. That means that in the next step, China should pay more attention to fostering the national indigenous innovation ability, as well as providing a better legal and financial environment for domestic high tech industries and companies.

Secondly, the paper focused on the role of ZJ in integrating regional-economic activities, in particular within the Yangtze River Delta, into the global value chain. The survey data shows that firm-to-firm linkages within the delta are becoming more frequent along the lines of specialization on the mid-range steps of the IC value chain. These linkages indicate that a truly China-based production network is beginning to emerge, however, it is one that only covers part of the IC value chain.

The two findings together help to judge the success of China's development approach focused on high-tech parks. It seems that even sectors dominated by FIEs are starting to cooperate in a China-based company network, at least in some selected business activities. This is a strong indicator of burgeoning regional embeddedness, and may be a starting point for the development of a high-tech industry that, at least in part, depends not only on the size of the domestic market and low labor costs, but also on localized industry networks. This inevitably goes hand-in-hand with some degree of technology spillover and learning – for example how to meet quality standards and master the technology of certain steps of the IC value chain. This process will be accelerated as employees – often assumed to be the most effective carriers of new knowledge – move between ZJ and other parts of the Yangtze River Delta and beyond. Hence, one clear difference to the notion dominating the literature on cooperation in China emerges from this article: the claim that firm-to-firm linkages in China are generally weak can be rejected. Along the steps of the value chain that China's IC industry has specialized on, cooperation is becoming more and more frequent on local, national, and international scales.

Acknowledgements

The research reported in this paper was funded with a grant from NSFC. Work on the article was funded with a TransCoop grant from the Alexander von Humboldt Foundation. The authors would like to thank participants of the 2009 workshop on Transnational Corporations, Innovation and Regional Economic Development at ECNU Shanghai for comments on a previous version of this paper. The authors thank two anonymous reviewers for their helpful comments.

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