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State-Firm Strategic Coordination and Technological Innovation in the Software Industry in China: A Comparative Study of Shanghai and Shenzhen*

CASSANDRA C. WANG, GEORGE C. S. LIN, FIONA F. YANG, AND ANJIAO OUYANG

Recent theoretical attempts to understand the dynamics of technological innovation have been based predominantly on the theory of localized knowledge spillover which sees technological innovation as the

CASSANDRA C. WANG (王琛) is an assistant professor in the Department of Earth Sciences, Zhejiang University, Hangzhou, China. She can be reached at <chencwang@zju .edu.cn>.

GEORGE C. S. LIN (林初昇) is chair professor in the Department of Geography and associate dean of the Faculty of Social Sciences, the University of Hong Kong. He can be reached at <gcslin@hku.hk>.

FIONA F. YANG (楊帆) is research assistant professor of the Department of Urban Planning and Design, the University of Hong Kong. She can be reached at <fionayf@hku.hk>.

ANJIAO OUYANG (歐陽安蛟, corresponding author) is an associate professor at the Department of Earth Sciences, Zhejiang University, Hangzhou, China. He can be reached at <ouy219@mail.hz.zj.cn>.

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result of inter-firm interactions in the process of industrial clustering. This study introduces a new analytical framework that goes beyond inter-firm knowledge exchange and highlights the significance of the strategies and selectivity of both the state and firms to understand the dynamics of technological innovation in a transitional economy such as China. A comparative study on the strategies and selectivity of central government, local government, and individual firms in both Shanghai and Shenzhen, the two key city-regions in China, has found that difference in the degree of state-firm strategic coordination—or the dynamic process in which firms' innovation-related strategies are coordinated with the "strategic selectivity" of the central and/or local governments—is a significant factor explaining the regional variation in technological innovation. The Chinese experience demonstrates that the uneven growth of technological innovation has been contingent upon how the state builds a favorable institutional structure and market environment to stimulate, encourage, and support firms' innovative activities and how firms actively respond to the institutional environment created by the state.

KEYWORDS: information technology; technological innovation; strategic coordination; Shanghai; Shenzhen.

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In recent decades, much scholarly attention has been paid to the role of geographical proximity and inter-firm linkages in the process of technological innovation.[1] Among many other things, the acquisition of knowledge and technology has been highlighted in the knowledge-based economies and therefore great emphasis has been laid on the mechanism of localized knowledge spillover. Although the concept of knowledge spillover has contributed to a better understanding of the dynamism of technological innovation, recent studies have started to cast doubt on its application to cases in the developing countries.[2] In particular,

[1]Cassandra C. Wang, George C. S. Lin, and Guicai Li, "Industrial Clustering and Technological Innovation in China: New Evidence from the ICT Industry in Shenzhen," *Environment and Planning A* 42, no. 8 (2010): 1987-2010.

[2]Cassandra C. Wang and George C. S. Lin, "The Growth and Spatial Distribution of China's ICT Industry: New Geography of Clustering and Innovation," *Issues & Studies* 44, no. 2 (June 2008): 145-92; George C. S. Lin et al., "Placing Technological Innovation in Globalizing China: Production Linkage, Knowledge Exchange, and Innovative Performance of the ICT Industry in a Developing Economy," *Urban Studies* 48, no. 14 (2011): 2999-3018.

by placing too much emphasis on technology and knowledge, this framework has undervalued other significant factors that influence innovation, such as firms' internal ability to mobilize capital as well as the market and institutional environment.

The growth and location of technological innovation in China in recent decades provide an interesting case to advance theoretical enquiries into the dynamics of innovation. For years, Chinese industrial development was described as being "stuck at the lowest level of the high-tech value chain."[3] More recently, a growing number of studies have documented the rise and transformation of China's high-tech industry.[4] Al though the growth of China's high-tech industry has attracted much scholarly attention, the detailed mechanism of technological innovation and its regional variations have remained an important subject for further study. Shanghai and Shenzhen, two of the most influential city-regions in China, have played a distinct strategic role in the growth of the national economy and technological innovation. This study investigates the dynamics of regional variation in technological innovation through a comparison of Shanghai and Shenzhen.

The paper is organized in four parts. It begins with a brief evaluation of the existing theory of knowledge spillover and an introduction to a conceptual alternative that can be used to explain the regional variations in technological innovation in the Chinese context. This is followed by a clarification of data and methodological issues. The third part consists of an examination of the strategic role played by Shanghai and Shenzhen in

[3]Magnus Breidne, "Information and Communications Technology in China: A General Overview of the Current Chinese Initiatives and Trends in the Area of ICT," in *VINNOVA Report* (Stockholm: VINNOVA, 2005), 11.

[4]See for example, Yifei Sun, "Sources of Innovation in China's Manufacturing Sector: Imported or Developed In-House?" *Environment and Planning A* 34, no. 6 (2002): 1059-72; Susan M. Walcott, "Chinese Industrial and Science Parks: Bridging the Gap," *Professional Geographer* 54, no. 3 (2002): 349-64; Dennis Yehhua Wei, Wangming Li, and Chubin Wang, "Restructuring Industrial Districts, Scaling Up Regional Development: A Study of the Wenzhou Model, China," *Economic Geography* 83, no. 4 (October 2007): 421-44; Henry Wai-chung Yeung and Weidong Liu, "Globalizing China: The Rise of Mainland Firms in the Global Economy," *Eurasian Geography and Economics* 49, no. 1 (January-February 2008): 57-86; Yu Zhou, *The Inside Story of China's High-Tech Industry: Making Silicon Valley in Beijing* (Lanham: Rowman & Littlefield, 2008).

the country as a whole in an effort to understand the strategic considerations of the central government as well as the developmental trajectory of these two city-regions. This is followed by a comparison of the strategies adopted by local government to improve local technological innovation as well as the degree of state-firm strategic coordination in Shanghai and Shenzhen, which will help us understand how these differences have affected the innovative performance of the two city-regions. The final part consists of a summary of the important research findings and a discussion of the theoretical implications and limitations of this study.

Dynamics of Technological Innovation in a Transitional Economy: Beyond Localized Knowledge Spillover?

Recent studies of innovation have been primarily concerned with the concept of the industrial cluster and, especially, localized knowledge spillover.[5] It is generally believed that innovation depends to a large extent on the process of knowledge acquisition and accumulation.[6] Yet the knowledge base of individual firms is limited and external heterogenous knowledge is an important complementarity for a firm wishing to achieve technological innovation. Fagerberg, for instance, argues that "the growing complexity of knowledge bases necessary for innovation means that even large firms increasingly depend on external sources in their innovative activity."[7]

[5]David B. Audretsch and Maryann P. Feldman, "R&D Spillovers and the Geography of Innovation and Production," *American Economic Review* 86, no. 3 (June 1996): 630-40; Thomas Doring and Jan Schnellenbach, "What Do We Know about Geographical Knowledge Spillovers and Regional Growth? A Survey of the Literature," *Regional Studies* 40, no. 3 (2006): 375-95; Effie Kesidou and Henny Romijn, "Do Local Knowledge Spillovers Matter for Development? An Empirical Study of Uruguay's Software Cluster," *World Development* 36, no. 10 (October 2008): 2004-28; Roderik Ponds, Frank Oort, and Koen Frenken, "Innovation, Spillovers and University-Industry Collaboration: An Extended Knowledge Production Function Approach," *Journal of Economic Geography* 10, no. 2 (March 2009): 231-55.

[6]Manfred M. Fischer, ed., *Innovation, Networks, and Knowledge Spillovers* (Berlin: Springer, 2006).

[7]Jan Fagerberg, "Innovation: A Guide to the Literature," in *The Oxford Handbook of Inno-*

Therefore, the ability of firms to obtain external knowledge free of charge becomes crucial in the process of innovation.[8] The importance of knowledge externalities in the process of growth and technological innovation has been empirically demonstrated with econometric techniques.[9]

Although the concept of localized knowledge spillover has enhanced our understanding of the dynamics of innovation, it is questionable whether it can be applied to cases in China, which has gone through a transition from a planned to a market economy. In an immature market environment in such a context, many research and development (R&D) investors tend to suffer losses while imitators or competitors are generally able to obtain greater economic returns.[10] As such, a satisfactory profit can be made without any investment in innovation and firms' incentive to innovate is depressed. The institutional environment that is regulated and shaped by both central and local governments therefore becomes highly significant in the formulation of firms' strategies on innovation. Sternberg and Arndt identify three groups of factors that affect firms' innovative behavior, namely, location-specific factors, the extra-region general environment, and innovation and technology policies.[11] They argue that the regional environment, particularly an environment that is favorable to R&D, can help firms exploit their innovation potential. Gerstenfeld and Brainard argue that if firms can achieve a high rate of return without innovation, they will reduce their investment in innovation or not invest in it at all.[12]

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vation, ed. Jan Fagerberg, David C. Mowery, and Richard R. Nelson (New York: Oxford University Press, 2005), 1-26, 11.

[8]George C. S. Lin and Cassandra Wang, "Technological Innovation in China's High-Tech Sector: Insights from a 2008 Survey of the Integrated Circuit Design Industry in Shanghai," *Eurasian Geography and Economics* 50, no. 4 (July-August 2009): 402-24.

[9]Henri L. F. de Groot, Peter Nijkamp, and Zoltan J. Acs, "Knowledge Spill-overs, Innovation and Regional Development," *Papers in Regional Science* 80, no. 3 (July 2001): 249-53.

[10]David J. Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *Research Policy* 15, no. 6 (December 1986): 285-305.

[11]Rolf Sternberg and Olaf Arndt, "The Firm or the Region: What Determines the Innovation Behavior of European Firms?" *Economic Geography* 77, no. 4 (October 2001): 364-82.

[12]Arthur Gerstenfeld and Robert Brainard, eds., *Technological Innovation: Government/ Industry Cooperation* (New York: John Wiley & Sons, 1979), 1.

They suggest that this situation can be ameliorated by the government.

In recent years, the important role played by central and local government in shaping the institutional environment and technological development, and particularly the way this has influenced the strategies and behavior of firms in developing countries, has been studied by many of scholars.[13] According to Block, "although economic efficiency is dependent on markets, markets are state-constrained and state-regulated and thereby incapable of operating in a *laissez-faire* environment."[14] Lu maintains that the state can stimulate firms to invest in innovation and shape their resource structure by taxation, local schemes, and other administrative tools.[15] Although there is a growing body of literature on the role played by the state in the process of innovation, scholars tend to focus on the general policies that the state enacts but overlook the strategic selectivity of the state. The concept of strategic selectivity was originally adopted by Jessop to emphasize "the ways in which the state serves as a specific political form which offers structural privileges to some but not all kinds of political strategy."[16] He contends that "particular forms of state privilege some strategies over others, privilege the access of some forces over others, some interests over others, some time horizons over others, some coalition possibilities over others."[17] Here, instead of treating the strategic selectivity of the state as a system, we employ this concept from an agent's action perspective to highlight the ability of the state as a political entity to privi-

[13]Fred Block, "The Roles of the State in the Economy," in *The Handbook of Economic Sociology*, ed. Neil J. Smelser and Richard Swedberg (Princeton, N.J.: Princeton University Press, 1994), 691-710; Peter Evans, *Embedded Autonomy: States and Industrial Transformation* (Princeton, N.J.: Princeton University Press, 1995); Phillip M. O'Neill, "Bringing the Qualitative State into Economic Geography" in *Geographies of Economics*, ed. Roger Lee and Jane Wills (London: Arnold, 1997); Adam Segal, *Digital Dragon: High-Technology Enterprises in China* (Ithaca and London: Cornell University Press, 2003).

[14]Block, "The Roles of the State in the Economy," 691.

[15]Qiwen Lu, *China's Leap into the Information Age: Innovation and Organization in the Computer Industry* (Oxford: Oxford University Press, 2000), 183.

[16]Neil Brenner, *New State Spaces: Urban Governance and the Rescaling of Statehood* (Oxford: Oxford University Press, 2004), 88.

[17]Bob Jessop, *State Theory: Putting the Capitalist State in Its Place* (University Park, Penn.: Pennsylvania State University Press, 1990), 10.

lege some actors over others. The concept of "strategic selectivity" is significant because "the state *is endowed with selectivity*—that is, with a tendency to privilege particular social forces, interests, and actors over others" (emphasis added).[18] On this point, we first of all argue that the tendency of the state to select certain economic agents over others is spatially and temporally contingent upon the actions and strategies of participating agents. Secondly, the state is oriented toward a range of social and economic goals and tries to bring coherence to diverse activities through the creation of a series of strategies.[19] Finally, the present structure and behavior of the state is inherited from and affected by past strategies.[20] We use the term "strategic selectivity" rather than "strategic selection" because the former highlights the power and tendency of the state to privilege some strategies over others. Furthermore, the concept of "selection" works in a static form and fails to indicate the dynamic characteristics of the process of selecting.

In this study, we propose an analytical framework that moves beyond localized knowledge spillover and takes seriously the strategic selectivity of both state and firms as well as state-firm strategic coordination in order to understand the various degrees of innovative performance in different regions. The concept of state-firm strategic coordination refers to a dynamic process in which firms' innovation-related strategies are coordinated with the "strategic selectivity" of central and/or local government. Because of their role as important actors in economic development and technological innovation, certain firms are selected by the local or central state to develop its technological capability. Meanwhile, selected firms are not totally passive in their interaction with the state because they have their own interests and strategic considerations. State-firm strategic coordination is therefore a mutually selective process rather than a process unilaterally induced by the state. With the state's selectivity and firms' re-

[18]Brenner, *New State Spaces*, 87.

[19]Gordon Macleod and Mark Goodwin, "Space, Scale and State Strategy: Rethinking Urban and Regional Governance," *Progress in Human Geography* 23, no. 4 (December 1999): 503-27.

[20]Jessop, *State Theory*, 259-60.

activity and selectivity, the state and certain firms manage to achieve a strategic coordination which has the potential to encourage firms to carry out innovation, enlarge their internal resource base, and enhance their capability.

This state-firm strategic coordination can be analyzed on three levels. First, each region occupies a strategic position in the national economy coordinated by the central government, resulting in certain firms in some regions receiving more support from the central government or enjoying more preferential policies than other firms elsewhere. This is the result of the strategic selectivity of the central government. Secondly, some local governments invest more than others in supporting innovation among their firms and create a better institutional environment for innovation than others. This is the strategic selectivity of local governments. Finally, the strategic decisions about innovation made by firms are affected by their internal capabilities and external institutional environment. The internal capabilities include their ability to attract high-tech talent, to mobilize necessary capital for innovation, to capture useful technology and market information, and so on. Firm size may also influence corporate strategies since smaller firms may not be able to mobilize as much capital as larger ones. One recent study reveals that the innovative activities of small high-tech firms in the United Kingdom were severely hampered by financial factors.[21] The innovation-related strategies and activities of ICT firms in China have been significantly affected by their ownership and their ability to mobilize capital.[22] It is noted that innovation is a tool rather than a terminal goal for firms whose ultimate interest is the maximization of profits. They respond to the selectivity of governments and the external institutional and market environment when they decide whether or not to invest in innovative activities and how to make full use of these resources to achieve better innovative performance.

[21]Allessandra Canepa and Paul Stoneman,"Financial Constraints to Innovation in the UK: Evidence from CIS2 and CIS3," *Oxford Economic Papers* 60, no. 4 (October 2008): 711-30.

[22]Lin et al., "Placing Technological Innovation in Globalizing China," 2999-3018.

This framework is neither totally new nor isolated from others, however. The concept of state-firm strategic coordination is an important element of the regional innovation system.[23] While the regional innovation system (RIS) model draws our attention to an interacting knowledge generation subsystem that consists of many agencies, such as research institutes, universities, technology transfer agencies, and investors, our framework particularly highlights the importance of the coordination of state and firms in the process of innovation by firms. State-firm strategic coordination does not put major emphasis on the relationship between the state and the firm. Instead, it highlights the importance of the motivations, interests, and strategies of the active agents and actors that are the key to understanding the formation of any kind of economic and social relationship among actors, the evolution of these relations, and the innovation-related behavior and performance of the firms. This study will emphasize how the governments shape the regional environment which is crucial to stimulating innovation among firms and boosting their innovative performance, and how firms with different resources and capabilities respond to the regional milieu and coordinate with the strategic selection of the state. It is noted that state-firm strategic coordination is particularly important in the transition from a state-dominated to a market-oriented economy. With the evolution of the market and the institutional environment, the importance of state-firm strategic coordination may decline.

Methodology

This study investigates state-firm strategic coordination and the uneven distribution of technological innovation in China with special focus

[23]Bjørn Asheim, and Meric S. Gertler, "The Geography of Innovation: Regional Innovation Systems," in *The Oxford Handbook of Innovation*, ed. Richard Nelson. David C. Mowery, and Jan Fagerberg (New York: Oxford University Press, 2005), 291-317; Philip Cooke, "Regional Innovation Systems, Clusters, and the Knowledge Economy," *Industrial and Corporate Change* 10, no. 4 (2001): 945-74; Philip Cooke, Martin Heidenreich, and Hans-Joachim Braczyk, eds., *Regional Innovation Systems: The Role of Governance in a Globalized World* (London and New York: Routledge, 2004).

on a comparative study of Shanghai and Shenzhen. The issue to be addressed essentially concerns how the different levels of innovative performance in different regions are related to the strategies and selectivity of the central and municipal governments as well as the different degrees of state-firm strategic coordination. We maintain that firms may be able to make profits without investing in innovation in the short term, but innovation is the only way for them to be sustainable and successful in the long run. In this sense, innovation is significant and merits further investigation.

Three types of state-firm strategic coordination that are specific to China's ongoing market transition can be identified, namely, product-based, funds-based, and information-based coordination. Product-based strategic coordination is measured by the share of government procurement in firms' total sales revenue. Funds-based coordination is measured in terms of the absolute amount of innovation funds provided by local governments and the ratio of innovation funds to local governments' total financial expenditure. Information-based strategic coordination refers to the exchange of innovation-related information between local governments and firms. In the process of innovation, firms have to obtain as much information as possible to make the right decisions to meet market demands that in transitional economies are sometimes dependent on state strategies and to take advantage of state policies. Meanwhile, the governments need to adjust their strategies and selectivity in response to feedback from firms in order to better support innovation-related activities in a region. Innovation performance in this study is measured by the output value of new products and the number of invention patents granted to the firm.

Before we move on to the empirical analysis, we need to justify our selection of the software industry. First, it is widely recognized that the software industry is one of the most important industries in the world not only because of its high-tech and security-related characteristics but also because of its penetration of the entire economy and society. Second, in China, the software industry is recognized as being more creative and innovative than the hardware industry. Since the main purpose of this paper is to explore the dynamics of technological innovation, we chose an industry with a higher technology potential. Finally, the software industry

has been selected by Chinese governments for promotion as a strategic industrial sector. Both central and local government have been committed to the development of the software industry since the beginning of the economic reforms and this commitment has been incorporated into China's Eleventh Five-Year Plan. As a result, the industry has expanded dramatically since 2000. For these reasons, since our research focuses on state selectivity and state-firm strategic coordination, our purpose will be best served by an analysis of the software industry.

Meanwhile, the selection of Shanghai and Shenzhen for a comparative study requires some explanation. First of all, Shanghai and Shenzhen followed divergent historical trajectories that have significantly influenced the different strategic tasks they have been assigned by the central government in its overall plans for the national economy. This assignment of tasks has, in turn, strengthened and reshaped their growth paths. Shanghai has historically played a significant and irreplaceable role in the national economy, whereas Shenzhen was only a small border town which could be chosen with impunity as the site of an experiment with reform and opening-up. The different strategic positions and historical trajectories of these two city-regions interacted in a way that exerted a significant effect on their urban growth and the formation of their values, identities, cultures, and institutions. Secondly, the Shanghai and Shenzhen municipal governments have adopted different attitudes to and ways of involvement in their respective economies and industries. It is intriguing to see how these differences between Shanghai and Shenzhen have produced different degrees of state-firm strategic coordination. Finally, Shanghai and Shenzhen are the core city-regions for the software industry in China and their software firms exhibit significant regional differences in terms of technological innovation. For these reasons, they provide a good case for us to verify our new conceptual framework.

This research analyzes three sets of data. The first set is obtained from statistical reports such as the *China Statistical Yearbook on Science and Technology*, the *Shanghai Statistical Yearbook*, the *Shenzhen Statistical Yearbook*, the *Shanghai Economic Census Yearbook*, the *Shenzhen Economic Census Yearbook*, the *Shanghai Statistical Yearbook on Science*

and Technology, and the *Guangdong Statistical Yearbook on Science and Technology*. This set of data is used to evaluate the efforts made by the central and local governments to improve the regional environment for science and technology and support the innovative activities of firms. The second set of data is gathered from a large-scale questionnaire survey conducted in 2006-2007 on China's information and communication technologies (ICT) industry (including both hardware and software) in Beijing, Shanghai, Shenzhen, Suzhou, and Dongguan. The firms in the sample were chosen from the database developed and maintained by the China State Statistical Bureau from the first national economic census conducted in 2004 with a sample rate of 5 percent. Altogether, 1,023 valid responses were received, including responses from 633 hardware companies and 390 software companies. This study only uses the survey results from the software companies in Shanghai and Shenzhen. This set of data is used to examine the innovative performance of the software firms and the degree of state-firm strategic coordination in Shanghai and Shenzhen. Finally, insights into the motivations and strategic considerations of firms are obtained from in-depth face-to-face interviews conducted in Shanghai and Shenzhen in 2008. This survey covers forty-nine informants, including senior managers and CEOs, senior engineers, secretaries of industrial associations, and directors of non-profit service organizations. This information is used to understand the innovation-related responses of the software firms to the external environment in which they operate as well as the different degrees of coordination they have with government.

Technological Innovation and State-Firm Strategic Coordination in Shanghai and Shenzhen

Different Levels of Performance in the Software Sector

Since it is extremely difficult to obtain data on innovation performance in China's service sectors, we used survey results to compare the innovative performance of software firms in Shanghai and Shenzhen. A significant regional difference was revealed in innovative performance

Table 1
T-test Results for Innovative Performance of Software Firms in Shanghai and Shenzhen, 2006

Indicators	Mean		T-value	P-value
	Shanghai	Shenzhen		
Number of granted invention patents (unit)	0.90	0.14	3.118**	.002
Share of new products in total sales revenue (%)	41	25	2.255*	.026

Note: * the mean difference is at the 0.05 significance level; ** the mean difference is at the 0.01 significance level.

Source: Authors' questionnaire survey.

measured by both granted patents and new products. As shown in table 1, software firms in Shanghai held on average 0.9 granted invention patents, compared to the 0.1 achieved by Shenzhen's software firms. More than 21 percent of software firms in Shanghai had been granted at least one invention patent while under 6 percent of Shenzhen's software firms achieved the same level. Furthermore, the most innovative firm in Shenzhen had been granted only five invention patents, in sharp contrast to the fifteen held by the most innovative firm in Shanghai. As such, new products produced by Shanghai's software firms contributed 41 percent of the sales revenue of the software sector, a significantly higher proportion than they did in Shenzhen (25 percent).

Meanwhile, economic performance in Shanghai is revealed to be much better than it is in Shenzhen. As shown in table 2, Shanghai's labor productivity was 0.37 million yuan at the end of 2004, compared to 0.24 million yuan in Shenzhen. The capital profitability of Shanghai's software firms was in excess of 7 percent, three times higher than that of software firms in Shenzhen. As for profits, the average profit of Shenzhen's firms was 0.36 million yuan, in sharp contrast to the 0.62 million *yuan* of Shanghai's firms. It is interesting to see that software firms in Shanghai used a larger proportion of highly qualified personnel in production and innovation. In Shanghai, 13 percent of employees held master's degrees

Table 2
Major Economic Indicators of the Software Sector in Shanghai and Shenzhen, 2004

	Shanghai	Shenzhen
Establishment	2863	1248
Employment (persons)	62607	28974
Ratio of employees with master's degree and above to total (%)	13.30	6.86
Labor productivity (million *yuan*/person)*	0.37	0.24
Capital profitability (%)#	7.02	3.10
Average profits per firm achieved (10,000 *yuan*)	36.33	62.06

Note: * Labor productivity is defined as the output value generated per worker, # Capital profitability is calculated as total profit generated per yuan of capital investment.

Source: Shanghai Statistic Bureau (SSB), *Shanghai jingji pucha nianjian 2004* (Shanghai Economic Census 2004) (Beijing: China Statistics Press, 2005); Shenzhen Statistic Bureau (SSB), *Shenzhen jingji pucha nianjian 2004* (Shenzhen Economic Census 2004) (Beijing: China Statistic Press, 2005).

or higher, compared to only 7 percent in Shenzhen.

The Strategic Selectivity of the State:
National Industrial Center vs.Experimental Zone

Shanghai, the largest metropolis in China, has played a strategic role in new China. It was one of the most significant industrial centers of China in the Maoist era and made a great contribution to state revenues during the period of reform. According to one authority, Shanghai is where China's first 10,000-ton hydraulic compressor, first 10,000-ton ship, first man-made satellite, first roll of cable, and even first bag of laundry detergent were manufactured.[24] Shanghai accounted for 20 percent of China's gross industrial output value in 1953 and this ratio remained over 15 percent during the entire period 1952-69.[25] Although the ratio started to fall in

[24]M. Chen, "Preface: Read about Shanghai from the 'One Sixth'," in *Old Industries in Shanghai*, ed. Wu Chen and Chen Haiwen (Shanghai: Shanghai Culture Publishing House, 2007), 5.

[25]China State Statistical Bureau (CSSB), *Xin Zhongguo wushinian lai tongji ziliao huibian*

1970, it remained above 12 percent prior to 1978.[26] Chinese consumers generally believe that "made in Shanghai" is a sign of good quality and good taste. Shanghai was also dubbed the "golden milk-cow" in the era of the planned economy since around one-sixth of state revenues was derived from the city.[27]

Shenzhen can in no way compete with Shanghai in terms of its glorious history. Yet Shenzhen has achieved an economic miracle in the past three decades. It was a border town without any industry or much of a history before the 1978 economic reform. A close neighbor of Hong Kong, Shenzhen was designated a special economic zone (SEZ) to act as a link between China and the outside world. Shenzhen was dubbed the "window of the open-door policy" in the 1980s and it became an experimental base for testing the feasibility and efficiency of the reform and open-door policies. When it was selecting cities for SEZ status, the Chinese government avoided choosing places that had played a significant role in the national economy, such as Shanghai.[28] As an official of the Shanghai municipal government has commented, "Shanghai is so important to the national economy that the central government was less likely to allow experimentation that might threaten its revenues. Failure in Shanghai would affect the entire country."[29]

At the beginning of the reforms in 1978, Shenzhen embarked on a path of rapid economic growth and urban expansion. "Shenzhen speed" was the term used to describe the amazing economic efficiency and rapid urban growth that Shenzhen achieved in a short space of time. At the start

(Comprehensive Statistical Data and Materials on 50 Years of New China) (Beijing: China Statistics Press, 1999), 36, 353.

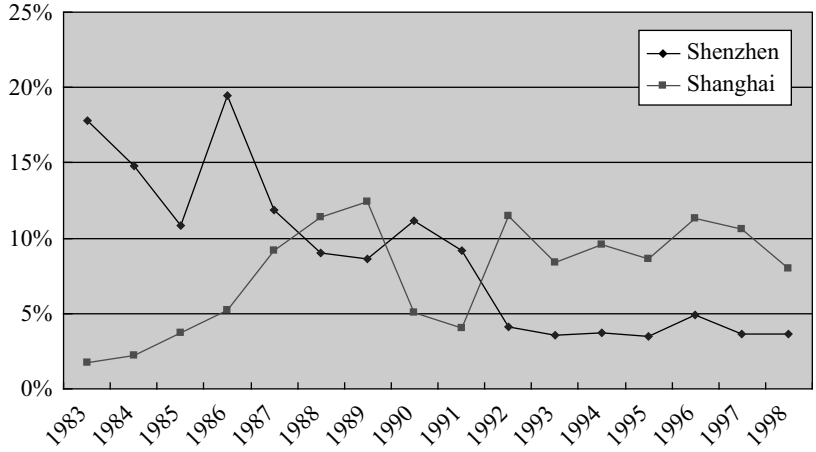
[26]Ibid.

[27]See Chen, "Preface"; Y. M. Yeung, "Introduction," in *Shanghai: Transformation and Modernization under China's Open Policy*, ed. Y. M. Yeung and Sung Yun-wing (Hong Kong: Chinese University Press, 1996), 1-24, 9.

[28]Weiping Wu, *Pioneering Economic Reform in China's Special Economic Zones: The Promotion of Foreign Investment and Technology Transfer in Shenzhen* (Aldershot: Ashgate, 1999).

[29]Segal, *Digital Dragon*, 91.

Figure 1
Utilized FDI in Shenzhen and Shanghai as Percentage of Total FDI in China, 1983-1998



Source: CSSB, *Xin Zhongguo wushinian lai tongji ziliao huibian*; SZSB, *Shenzhen tongji nianjian 2007*.

of the economic reform, Shenzhen's per capita GDP was only 600 *yuan*, much lower than Shanghai's 2,600 *yuan*.[30] However, Shenzhen soon overtook Shanghai, and by the end of 1984 its per capita GDP reached 3,504 *yuan*, five times as high as it had been in 1979.[31] It was not until 1996 that Shanghai once again took the lead in this contest. "Shenzhen speed" confirmed that favorable policies could turn a laggard rural town into a wealthy urban region. It is noted that Shenzhen's phenomenal growth could not have been achieved without a great deal of foreign direct investment (FDI). FDI utilized by Shenzhen accounted for more than 10 percent of the total utilized FDI in China during the period 1979-85, and in 1986, the ratio was 19 percent (see figure 1). The value of FDI attracted to Shenzhen during

[30]CSSB, *Xin Zhongguo wushinian lai tongji ziliao huibian*; Shenzhen Statistics Bureau (SZSB), *Shenzhen tongji nianjian 2007* (Shenzhen Statistical Yearbook 2007) (Beijing: China Statistics Press, 2007).

[31]SZSB, *Shenzhen tongji nianjian 2007*.

this time was much higher than that absorbed by Shanghai. Shanghai only started to play a pivotal role in attracting FDI once again at the beginning of the 1990s when the Chinese government, with the success of its experiment in Shenzhen in mind, declared that Shanghai would become the "head of the dragon" and act as the economic, financial, and trading gateway to the Yangtze River Delta and even the whole country.[32]

Despite Shenzhen's outstanding achievement in attracting FDI, the city was seen by the government more as a manufacturing and processing base than as a center of technological innovation. In the mid-1980s, the central government selected several east coast locations, namely, Beijing, Shanghai, Jiangsu Province, and Guangdong Province, as future high-tech centers, with the intention of promoting the economic and technological performance of the electronics industry using China's limited national resources.[33] However, Shenzhen was not given the same level of priority. When Shenzhen was selected by the central government to become China's first and foremost SEZ, it was positioned to attract an influx of foreign as well as domestic capital and massive in-migration of young and cheap labor from all over the country. The aim was to develop a rapidly growing urban economy with manufacturing and services as its two main pillars. Lacking research institutes and universities, Shenzhen was in no position to undertake technological innovation and advancement at that time. According to Simon and Rehn, there were thirteen main facilities and eight major research institutes involved in R&D and manufacturing of integrated circuits in China in the 1980s, none of which was located in Shenzhen.[34] In sharp contrast, Shanghai had been assigned a significant role in this area. The central government's strategic regional plan for the software industry did not include Shenzhen either. In 2001, the central government consolidated the country's forty software parks into eleven national soft-

[32]Yeung, "Introduction," 16.

[33]Denis Fred Simon and Detlef Rehn, *Technological Innovation in China: The Case of the Shanghai Semiconductor Industry* (Cambridge: Ballinger, 1988).

[34]Ibid.

ware industry bases located in Beijing, Shanghai, Dalian, Chengdu, Xi'an, Jinan, Guangzhou, Changsha, Hangzhou, Nanjing, and Zhuhai.[35] Once again, Shenzhen was left out of a significant development in the software industry.

The open-door policies and rapid growth of Shenzhen in recent decades created a local culture of rapid production and market occupation which values immediate economic returns but downplays long-term investment in R&D. One of the objectives of establishing the SEZs was to absorb technology transferred from overseas and to train the local workforce, but Shenzhen failed to deliver on either of these. FDI, especially the capital investment from Hong Kong, Macao, and Taiwan that has dominated Shenzhen's industrial development, was mainly lured there by low labor and land costs, with operations being confined to simple assembly and packaging work during the initial period of economic reform.[36] These foreign-invested firms tended to regard Shenzhen as just one of a number of manufacturing and processing bases with a specific focus on lower production costs rather than R&D activities, so they failed to train up the local labor force or transfer valuable technologies to Shenzhen. Many local firms, founded to provide professional services for foreign-invested firms, therefore developed an agile production and business model that was designed around a prompt response to the market and customers' requirements.[37] This agile business model did indeed bring investors considerable wealth in the short term and the city grew rapidly. However, in an environment that values speed and immediate rewards, firms are hardly likely to be enthusiastic about time-consuming and expensive innovation, the rewards of which can only be reaped in the long term.

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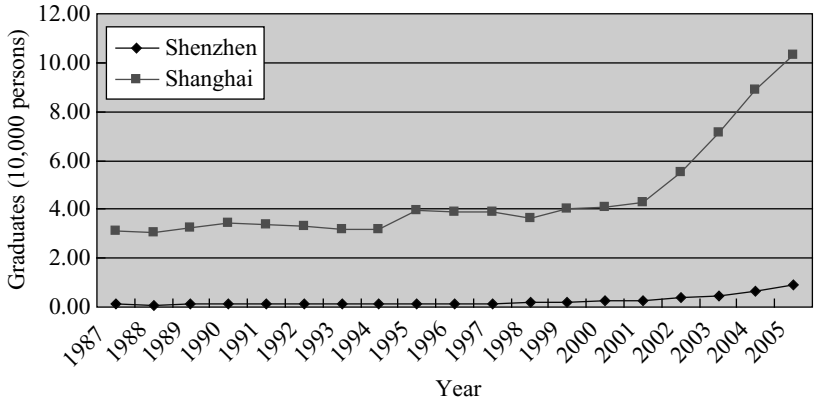
[35]Michael Pecht, *China's Electronics Industry: The Definitive Guide for Companies and Policy Makers with Interests in China* (New York: William Andrew, 2006), 221-22.

[36]Kwan-yiu Wong and David K. Y. Chu, "Export Processing Zones and Special Economic Zones as Locomotives of Export-led Economic Growth," in *Modernization in China: The Case of the Shenzhen Special Economic Zone*, ed. Kwan-yiu Wong and David K. Y. Chu (Hong Kong: Oxford University Press, 1985), 1-24.

[37]Authors' interview in Shenzhen, July 20, 2008.

Figure 2
Graduates of Institutions of Higher Education in Shanghai and Shenzhe



Source: SSB, *Shanghai tongji nianjian* (Shanghai Statistical Yearbook), in various years (Beijing: China Statistic Bureau, 1990-2006); SZSB, *Shenzhen tongji nianjian 2006* (Shenzhen Statistical Yearbook 2006) (Beijing: China Statistic Bureau, 2006).

The Strategic Selectivity of Local Government: Creating a Supportive Environment

The local institutional environment in which firms operate has a crucial influence on their innovation-related motivation and strategies, and consequently affects the innovative performance of the region as a whole. The local institutional environment for innovation can be shaped by the state through the nurturing of the local labor force and efforts to attract global talent, as well as by enriching local science and technology resources and developing an active market for technology. However, the quality of this institutional environment depends on the capabilities of the local government, preexisting local conditions, and many other influential factors. There are three main areas in which the local governments of Shenzhen and Shanghai differ in terms of capability and power.

First of all, Shenzhen has failed to attract and train as many talented personnel as Shanghai has done. There were no higher education and research institutions in Shenzhen before the beginning of the economic reform, and Shenzhen University was not established until 1983. Shanghai,

in contrast, had forty-three institutions of higher education in that year and produced over twenty-nine thousand graduates. During the entire period 1987-2005, Shanghai produced far more graduates than Shenzhen (see figure 2). The first class of 1,028 students graduated from Shenzhen University in 1987, while in that year, Shanghai produced over thirty thousand graduates from fifty-one institutions of higher education. Shenzhen opened another eight higher education institutions over the next two decades and in 2005 it produced nine thousand graduates, still significantly less than the one hundred thousand produced by Shanghai.

Meanwhile, Shenzhen has suffered from a lack of research institutes to support and accelerate the process of innovation among local firms, whereas Shanghai has many well-established R&D institutes that contribute a great deal to local technological innovation. At the end of 2005, Shanghai had 140 independent R&D institutions with more than thirty thousand employees, in sharp contrast to the five independent R&D institutions with only 104 employees in Shenzhen.[38] Judging by their sources of funding, these five institutions had not established any research relationships with local firms at all, while in 2005, the independent R&D institutes in Shanghai obtained 9 percent of their science and technology funding—worth 697 million *yuan*—from enterprises.[39] This suggests that the research carried out by Shanghai's R&D institutes is valuable and can be commercialized by local firms. R&D institutes in Shenzhen spent an average of 0.26 million *yuan* on experimental development. They were not interested in the kind of basic or applied research that is rarely conducted by firms but plays a significant role in the process of innovation. In sharp contrast, independent R&D institutes in Shanghai spent an average of 32.08 million yuan on R&D activities, 55 percent of which went to basic

[38]CSSB and Ministry of Science and Technology (MOST), *Zhongguo keji tongji nianjian 2006* (China Statistical Yearbook on Science and Technology 2006) (Beijing: China Statistics Press, 2006); Guangdong Statistics Bureau (GDSB) and Guangdong Science and Technology Bureau (GDSTB), *Guangdong keji tongji nianjian 2006* (Guangdong Statistical Yearbook on Science and Technology 2006) (Beijing: China Statistics Press, 2006).

[39]See note 38 above.

and applied research.[40] It is interesting to note that 20 percent of the intramural R&D expenditure of Shanghai firms was used for the kind of basic and applied research that firms in Shenzhen show no interest in at all. This reflects their tendency, mentioned above, to focus on quickly occupying the market at extremely low prices.[41] From this analysis we can see that firms in Shanghai tend to emphasize more creative activities rather than the simple modification of existing technology to cater to market demand.

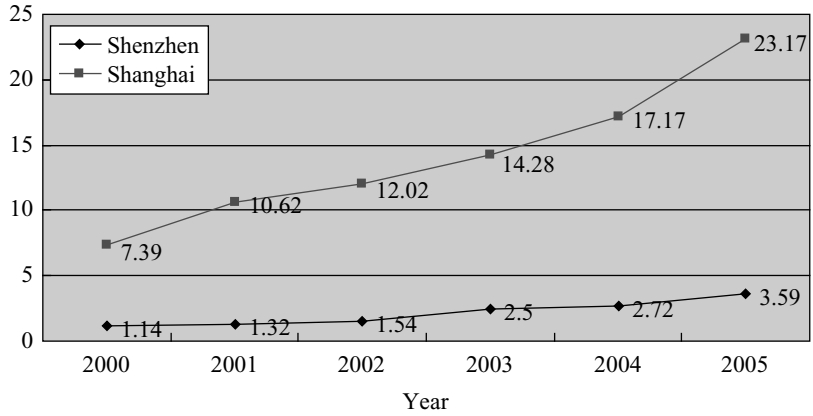
Finally, compared to Shanghai, Shenzhen has a much less active local market for technology that can offer a platform for local firms to acquire complementary knowledge and technology in a convenient and timely way. The frequency and value of technology transactions in a particular region reflect that region's technological foundation and the enthusiasm of local actors to pursue new technology and innovation. Shanghai has established quite an active technology market in which contracts were worth 7.39 billion *yuan* in 2000, almost seven times more than those concluded in Shenzhen that year. Though the number of technology deals in both Shenzhen and Shanghai increased during the period 2000-2005, Shenzhen's development was good deal slower than that of Shanghai (see figure 3). At the end of 2005, the value of such contracts in Shanghai reach 23.17 billion *yuan*, compared to only 3.59 billion *yuan* in Shenzhen.

Different Degrees of State-Firm Strategic Coordination

What are the responses of the software firms in Shanghai and Shenzhen to their external environment? The firms' location selection strategies to some extent reflect their attitude to innovative activities. From our questionnaire, we found that firms in the two city-regions had different strategic considerations Among the software firms in both Shenzhen and Shanghai, the most popular reason for choosing their location was access to skilled labor and clients. Comparatively speaking, co-location with their peers was viewed as important by firms in Shenzhen while firms in Shanghai

[40]See note 38 above.
[41]See note 38 above.

Figure 3
Value of Contracts in Local Technology Markets, Shenzhen and Shanghai (billion *yuan*)



Source: CSSB and MOST, *Zhongguo keji tongji nianjian 2006*; GDSB and GDST, *Guangdong keji tongji nianjian 2006*.

laid great emphasis on local market potential. This reveals a long-term development strategy rather than one that is orientated toward short-term benefits among firms in Shanghai. Firms in Shenzhen were mainly attracted by local agglomerated economies, such as co-location with clients, suppliers, and peers. By contrast, one important reason for software firms to locate in Shanghai is local preferential policies. This suggests, on the one hand, that the Shanghai municipal government has built a more attractive industrial environment, and on the other, that firms in Shanghai pay more attention to their external environment and government behavior than their counterparts in Shenzhen.

The differences between the selectivity of central and local governments as well as between the strategies of local firms in Shanghai and Shenzhen have shaped the differences in the degree of state-firm strategic coordination in these two city-regions. First of all, information-based coordination is measured here by firms' evaluation of the importance of innovation-related information provided by the state. Firms who considered that the state plays a very important role in providing innovation-

Table 3
Role of Government in Providing Innovation-Related Information

	Shanghai		Shenzhen	
	Frequency	Percent	Frequency	Percent
Unimportant	24	**20.0**	33	**47.1**
Medium	26	21.7	14	20.0
Important or very important	70	**58.3**	23	**32.9**
Total	120	100.0	70	100.0

Source: Authors' questionnaire survey.

related information are likely to have a higher degree of information-based coordination with governments. As a result, the more firms there are in a region that view the state as very important or important in providing innovation-related information for their production, the higher the degree of state-firm information-based strategic coordination there is in that region. Over 47 percent of software firms in Shenzhen reported that information from government did not help their innovation-related activities at all while over 58 percent of firms in Shanghai viewed the information from government as important or very important to their technological innovation (see table 3). The T-test result further confirms that information-based state-firm coordination in Shanghai is significantly better than it is in Shenzhen (t=2.968, p=.004).

A manager in Shenzhen revealed the reason why they did not value information from the local government:

> We located in Shenzhen to be close to our clients in order to understand their product demands and specific requirements as quickly and as well as possible. If we had wanted a better relationship with governments, we would have gone to Beijing or Shanghai. The advantage of Shenzhen is its active market. We don't think that local government can give us any valuable information that will enable us to survive the fierce market competition (interview notes, August 13, 2008).

In sharp contrast, a firm manager in Shanghai expressed a very different opinion of the role played by the government in providing innovation-related information:

> The industrial strategy of the government has played a significant role for us. In order to catch up with the advanced economies and build up our own technological foundation and capability, the state has started to establish its own technical standards in many fields. We are one of those firms that have adopted our national homegrown technical standards to develop products. This is very risky for us because the market demand for products produced to homegrown standards is unknown. The extent to which the government wants to support our own standards determines how much we should invest in the products produced to national standards. Therefore, it is extremely important for us to obtain related information from the government. We should be very cautious about adopting national standards as they are obviously much less mature than the prevailing standards in the world. There is no way that we can fight with international giants without any support from the government at the beginning of our development (interview notes, July 22, 2008).

Secondly, product-based coordination between the government and firms is much less effective in Shenzhen than it is in Shanghai. Product-based coordination is measured by the share of government procurement in a firm's total sales revenue. On average, government procurement only contributes 13 percent of sales revenue among Shenzhen's software firms, significantly less than the 21 percent it contributes in Shanghai ($t=1.661$, $p=.099$). A recent study has already demonstrated that government procurement is largely responsible for innovation among ICT firms in China.[42] Our study also reveals that more firms in Shanghai benefited from local government procurement than they did in Shenzhen. As shown in table 4, 54 percent of Shanghai's firms had formed no product-based relationship with governments compared to 64 percent in Shenzhen. Almost 16 percent of firms in Shanghai sold over half of their products to central or local government while only 9 percent of Shenzhen's firms had achieved that level.

Finally, there is much less funds-based state-firm strategic coordination in Shenzhen than there is in Shanghai. Since there is no data available on funds-based coordination in the software industry, our analysis of funds-based strategic coordination relates to a wider industrial scale. Funds-based state-firm coordination can be measured by the value of innovation funds provided by the local government to encourage and stimulate innovation-related activities among local firms as well as by the proportion of

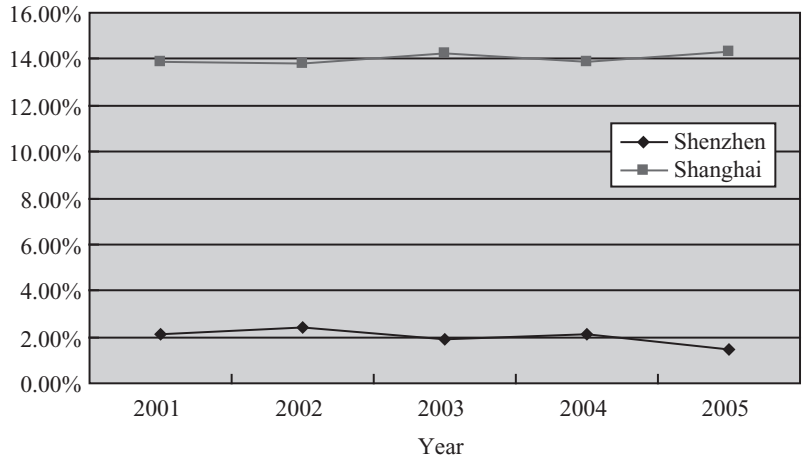
[42]Lin et al., "Placing Technological Innovation in Globalizing China," 2999-3018.

Table 4
Share of Government Procurement in Shenzhen and Shanghai

	Shanghai		Shenzhen	
	Frequency	Percent	Frequency	Percent
0%	65	**54.17**	**44**	**63.77**
1-25%	24	20.00	12	17.39
26-50%	12	10.00	7	10.14
51-100%	19	**15.83**	6	**8.70**
Total	120	100.00	69	100.00

Source: Authors' questionnaire survey.

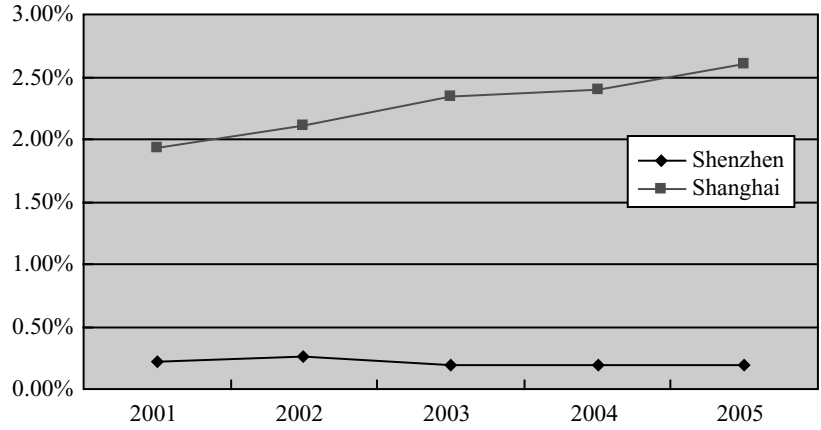
Figure 4
Ratio of Innovation Funds for Enterprises to Financial Expenditure of Local Government in Shanghai and Shenzhen



Source: SSB, *Shanghai tongji nianjian 2006*; SZSB, *Shenzhen tongji nianjian 2006*.

firms' science and technology funds that comes from the state. Shanghai municipal government has spent a great deal of money on supporting innovation among local firms. The municipal government's innovation funds accounted for 14 percent of total government expenditure in 2001-2005, compared to only 2 percent in Shenzhen (see figure 4). The proportion of

Figure 5
Ratio of Innovation Funds to GDP in Shanghai and Shenzhen



Source: SSB, *Shanghai tongji nianjian 2006*; SZSB, *Shenzhen tongji nianjian 2006*.

its GDP spent by the Shanghai municipal government on supporting innovation among local firms increased steadily from 2001, when it spent just over 2 percent of GDP, up to 2005. In Shenzhen, the municipal government spent around 0.2 percent of its GDP on innovation in 2001 and 2002, and the ratio actually fell during the period 2002-2005 (see figure 5). Shenzhen's expenditure as a percentage of GDP is much lower than the national level of 0.5 percent during the period 2001-2006.[43]

Industrial firms in Shanghai obtained a larger proportion of their science and technology funding from the government—around 22 percent, compared to less than 4 percent for Shenzhen firms in 2005.[44]

According to one interviewee, the Shenzhen municipal government has a passive attitude to guiding the local economy and industry while the Shanghai municipal government has been more active in helping to improve certain industries and firms, which is leading to a different product-

[43]CSSB, *Zhongguo tongji nianjian 2007* (China Statistical Yearbook 2007) (Beijing: China Statistic Press, 2007).
[44]CSSB, *Zhongguo keji tongji nianjian 2006*; GDST, *Guangdong keji tongji nianjian 2006*.

based and funds-based state-firm strategic coordination in that city-region.

The development of high-tech industry in a region is to a large extent affected by the local government. However, the Shenzhen municipal government pays much less attention to its industry. For instance, the value of the innovation funds for firms established by the Shenzhen municipal government is much lower than it is in Shanghai. Also, take the integrated circuit (IC) design sector for example, why does Shenzhen's IC design sector lag behind that of Shanghai? One of the reasons is that the Shenzhen municipal government has no vision for creating a better platform for local firms. Since we are far behind the advanced countries in this industry, one of the most effective ways of developing the local IC design sector would be to attract investment from international IC manufacturing giants to drive the growth of small IC design firms, an area in which the Shanghai municipal government has done a great job. However, Shenzhen has failed to attract such giants until now because it hesitated to invest in such a huge project, which to some extent reflects the limited ability of the Shenzhen municipal government to guide and support a high-risk, high-tech sector. High-tech firms in Shenzhen have also suffered from a shortage of office space, something which the government is not about to work on.[45]

Another interviewee further pointed to differences in the ability to guide the development of high-tech sectors between the local governments in Shanghai and Shenzhen, another indicator of the different degrees of state-firm strategic coordination in these two city-regions:

> Governments should and must do things that firms are unable or reluctant to do in order to pave the way for high-tech industrial development. The Shanghai municipality is very wise in this respect, which is another advantage for Shanghai. While the Shenzhen municipality might be willing to do something to improve its IC industry, it either has no idea how to do it or it lacks the ability to do it (interview notes, August 4, 2008).

[45]Authors' interview in Shenzhen, September 13, 2008.

Conclusion and Discussion

Recent studies seeking to understand regional differences in technological innovation in China have paid a great deal of attention to localized knowledge spillover in a cluster. Focusing as it does on the acquisition of knowledge, the existing literature undervalues the impact of intra-firm strategies and the external institutional environment on technological innovation in a transitional economy. This study provides a new framework that highlights the strategies and selectivity of both the state and firms in the process of technological innovation. To verify this framework, this study compares the degree of state-firm strategic coordination in Shenzhen and Shanghai and explains how differences in this area have led to regional variation in technological innovation. It does this through an examination of the strategic selectivity of central and local government as well as the reactivity and selectivity of firms.

Shanghai has traditionally played a strategic role in China as the cradle of industry and as a significant source of state revenues, whereas the small town of Shenzhen was selected as the location for an experiment with reform and opening-up. The different roles played by these two city-regions are both the cause and the effect of the strategic considerations and arrangements of the central government. The attention paid by the central government to Shanghai and that city's historically significant role in the Chinese economy paved a way for its development and technological innovation. At the same time, the Shanghai municipal government has been trying to create a better institutional environment for supporting innovation. The municipal government in Shenzhen, in contrast, has not shown as much interest in efforts of this kind. For instance, Shanghai has attracted, trained, and retained an abundance of skilled personnel, is home to more science and technology resources, and has established a more active technology market to support local innovation-related activities. As a result, Shanghai offers a better platform for its firms to innovate and achieve success while firms in Shenzhen lack motivation to innovate due to the area's less developed institutional environment and the less supportive attitude of the Shenzhen municipal government. A

close examination of the three types of state-firm strategic coordination, namely, information-based, product-based, and funds-based coordination, reveals that Shanghai has a higher degree of state-firm strategic coordination than Shenzhen.

The fact that the Shenzhen municipal government is less active than its counterpart in Shanghai in boosting local industrial innovation can also be understood in another way: the institutional environment in Shenzhen may be seen as allowing more freedom for market forces to operate. We admit that the role of the market cannot be ignored in the process of innovation by firms. However, although the Chinese economy has undergone a profound market transition, the lack of a well-developed market environment has hampered investment in innovation. The role of the state is therefore still extremely important for national and regional innovation. As China continues to develop away from a planned economy, it is likely that market forces will play a bigger part in innovation in the future.

This study has major implications for research into technological innovation at a regional level. In the existing economic geography literature, much emphasis is laid on the ability of firms to acquire complementary technology and knowledge through their close proximity to related firms. One basic assumption is that firms are driven to invest in innovation-related activities because they would not be able to survive and grow if they did not do so. This assumption may be self-evident in Western economies with an established market environment and a well-developed economic system. This is not the case in the Chinese context, as China's ongoing transition from a planned system to a market economy still allows firms that do not engage in innovation room to survive and even to make satisfactory profits.

One study has pointed out that innovation is a trade-off between rountinization and change and there are more reasons for not investing in innovation than there are for investing in an underdeveloped institutional and market environment.[46] The attitude to innovation in Chinese business

[46]Marius T. H. Meeus and Leon A. G. Oerlemans, "Firm Behaviour and Innovative Performance: An Empirical Exploration of the Selection-Adaptation Debate," *Research Policy* 29, no. 1 (January 2000): 41-58.

circles can be seen from the saying, "not innovating is waiting to be killed, whereas innovating is as good as seeking to be killed" (**不創新就等死，創新就等於找死**). In this sense, before rushing to answer the question how can firms acquire the knowledge and technology necessary for innovation, we should first of all investigate the regional institutional incentives, the innovation-related motivations of firms, and the strategies, selectivity, and capability of local governments. As it stands, this comparative analysis of Shenzhen and Shanghai suggests that Shanghai's superior level of innovation has less to do with localized knowledge spillover and more to do with the incentives and pressure provided by the regional institutional environment, state support for innovation, and strategic coordination between the state and local firms.

For years, Chinese firms have been trapped at the low end of the global value chain and have been reduced to acting as the technological followers of their Western counterparts. In this situation, Chinese firms require effective intervention by the state to encourage, stimulate, and support their innovation activities. However, the role played by the state should not be oversimplified or overestimated. Government support is neither a precondition nor a sufficient condition for innovation. The efforts made by the state to create a favorable institutional environment and to support certain firms are one thing, the abilities, strategies, and motivations of individual firms are another. Favorable results can only be achieved through a joint effort by both the state and firms. While this conceptual framework may not be applicable in other institutional contexts, this study has contributed to economic geography by stressing the significance of the strategies, motivations, and business models of firms as well as the strategies and vision of the state in the process of technological innovation.

This paper has its limitation. Firstly, the types of firm should be taken into account in the analysis of state-firm strategic coordination. Shanghai is well-known for its cluster of large multinational corporations. Failure to pay adequate attention to the ownership structure in Shanghai may reduce the power of the state-firm strategic coordination framework to explain innovation. Secondly, our survey only covers one year. A more historical perspective should be adopted in order to further verify our theoretical framework.

Finally, time and budgetary limitations have forced us to concentrate on a comparative case study of Shanghai and Shenzhen, ignoring the case of Beijing, the location of China's densest cluster of software firms. Although this limitation does not prevent us from answering the questions raised at the outset, further study of Beijing may reveal a different kind of state-firm strategic coordination and contribute to our understanding of the uneven distribution of technological innovation in China. Beijing is one of the most innovative city-regions in China and its growth and innovation trajectory differs from those of Shanghai and Shenzhen. Being the capital of China and having an abundance of science and technology resources, Beijing has a very distinctive regional institutional and market environment that merits deep investigation. As one recent study has revealed, the selectivity displayed by the Beijing municipal government with regard to high-tech firms is quite different from that of the Shanghai municipal government.[47] Furthermore, the central government is thought to favor Beijing because it is the capital city. The business interests and strategies of firms in Beijing might be correspondingly different from those of their counterparts in Shanghai and Shenzhen. As the analysis in this study has suggested that the dynamics of technological innovation are embedded in the process of state-firm strategic coordination, further empirical research should be carried out in Beijing to test the validity of this argument.

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[47]Segal, *Digital Dragon*.

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