Chapter 4

The Role of Standards in Technology Driven Commodity Chains: The Information and Communication Technology Services Industry in Dalian, China, and Bangalore, India[1]

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1 Introduction

In July 2007, IDC (International Data Corporation), a consulting firm, developed a Global Delivery Index (GDI) to compare 35 cities in 18 countries in the Asia Pacific region as potential offshore delivery centers for information and communication technology (ICT) services. The comparison was based on 30 criteria including cost of labor, cost of rent, language skills and turnover rate (Table 1). The Indian cities Bangalore, New Delhi and Mumbai were ranked first, third, and fourth while the Chinese cities Dalian, Beijing and Shanghai, were ranked fifth, sixth and seventh. IDC predicted that, by 2011, Chinese cities like Dalian would outstrip their Indian counterparts to become the most preferred global delivery locations in the world.

Table 1: **IDC's Global Delivery Index-Asia/Pacific (2007-2008)**

Position	2007	2008
1	Bangalore	Bangalore
2	Manila	New Delhi
3	New Delhi	Manila
4	Mumbai	Beijing
5	Dalian	Auckland
6	Shanghai	Shanghai
7	Beijing	Mumbai
8	Sydney	Brisbane
9	Brisbane	Dalian
10	Auckland	Kuala Lumpur

Source: http://www.businessweek.com/blogs/asiatech/archives/2007/07/idc_says_china.html
Note: 2008 rankings are based on different parameters

But, the industry in Dalian does not seem to be living up to the prediction about outstripping its competitors. By 2008, Dalian slipped to the ninth position in

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2008 IDC's GDI. Even as Dalian slipped, Bangalore was secure at the top, with New Delhi in second position. Among Chinese cities, it was Beijing which moved from the seventh position to the fourth position, while Shanghai retained its sixth position. Although the criteria used for the two years were not identical, and one year is too soon to come to definitive conclusions about an urban or regional economy, regions that maintain or improve their position despite changing criteria, can claim to have a dynamic comparative advantage, whereas the same cannot be said about regions that slip in the rankings.

The relative positions of Indian and Chinese cities in the IDC list, leads us to ask: how do late-late industrializers in the early 21st century, such as China and India, enter the international division of labor and maintain their comparative advantage amidst changing technologies, shifting demand conditions, and new competitors? Of particular interest in connection with the ICT services industry, is the ability of late-late industrializers to enter and move within technology driven commodity chains (TDCCs) which are "production networks where control over technological design, standards and trajectories is the central to the creation element of business power" (O'Riain 2004, p.643).

This paper will compare the trajectories of the ICT services industry in Dalian and Bangalore to argue that being part of a production network with open standards is crucial to mobility within the TDCC. The paper will attribute Dalian's position to the closed standards which it is forced to adopt to serve its major market in Japan. India's advantage in ICT services provision thus far has come from its commitment to open process standards and embracing internationally accepted technology standards. On the other hand, despite the size of China's domestic market, a combination of techno-nationalism and techno-regionalism have led to the creation of proprietary technological standards that either isolate the domestic market from the international market or fragment it.

The following section raises a couple of empirical questions by examining the data on Dalian's rise as a ICT services producing region. Section 3 describes the regulatory and institutional changes which facilitated the rise of an ICT service industry in Dalian. Section 4 shows how the characteristics of the Japanese market, and its outsourcing and offshoring practices, have shaped firm behavior in Dalian. Section 5 explains the rise and dominance of Bangalore as an outcome of public policy initiatives and a reliance on open standards. Section 6 contrasts the experience of Dalian with those of Bangalore, Beijing and Shanghai. The essay concludes by summarizing the three main lessons from this comparative analysis.

2 The emergence of the ICT service industry in Dalian

The revenues of the ICT service industry in Dalian reached 30600 million RMB in 2008, making it the eight-largest location for the production of such services in China (Table 2). Although Dalian moved from being the tenth-largest location to just the eight-largest location between 2002 and 2008, Table 3 indicates that the local and national significance of Dalian's ICT service industry go beyond what the absolute increase in revenues suggest. Thus, in the same period, the share of the local ICT service industry in China's ICT service industry grew to 4.04% from 2.13% (and from 1.65% in 2000), while the contribution of the software industry to the local GDP grew from 1.67% to 6.87% (and from 0.22% in 1998). Not surprisingly, the location quotient shows that, by 2008, the ICT service industry was nearly thrice as important to the local economy as the Chinese economy. There is another aspect to the growth in revenue of the ICT service industry. By 2008, Dalian was the third largest ICT service export location from China in absolute terms (Table 4), while the city was only behind Shenzen in the importance of exports to the local ICT service industry (Table 5).

Table 2: **Leading ICT service producing locations in China, 2002-2008**
(in 100 million RMB, by region and rank)

Location	2008	Rank	2007	Rank	2006	Rank	2005	Rank	2004	Rank	2003	Rank	2002	Rank
Beijing	1573	1	1174	1	970	1	780	1	520	1	385	1	334	1
Shenzen	1195	2	911	2	753	2	560	2	433	2	291	2	200	2
Shanghai	1005	3	745	3	616	3	455	3	302	3	201	3	117	3
Guangzhou	500	4	460	4	341	4	242	4	182	5	140	4	65	5
Nanjing	471	5	362	5	258	6	166	6	109	6	71	6	42	7
Chengdu	427	6	310	7	206	7	135	7	100	7	66	7	51	6
Hangzhou	397	7	340	6	261	5	236	5	183	4	130	5	99	4
Dalian	306	8	215	8	145	8	103	9	72	9	47	10	23	10
Xian	230	9	182	9	112	10	83	10	62	10	49	9	35	9
Tianjin	193	10	152	10	124	9	108	8	78	8	57	8	37	8

Source: Annual Report of Dalian Software and Information Service Industry, various years

Table 3: **National and local significance of Dalian's ICT services industry**
(as a share of software revenues and GDP (in 100 million RMB) and by location quotient (LQ))

Year	Dalian		China		Significance of Dalian's software industry		
	Revenues	GDP	Revenues	GDP	to China	to local GDP	location quotient
	(1)	(2)	(3)	(4)	(1)/(3)	(1)/(2)	(1/2)/(3/4)
2008	306.0		7573		4.04%		
2007	215.0	3131	5800	246619	3.71%	6.87%	2.92
2006	145.0	2570	4800	210871	3.02%	5.64%	2.48
2005	102.7	2150	3900	183868	2.63%	4.78%	2.25
2004	71.9	1962	2424	159878	2.97%	3.66%	2.42
2003	46.7	1633	1633	135823	2.86%	2.86%	2.38
2002	23.4	1406	1100	120333	2.13%	1.66%	1.82
2001	15.3	1236	796		1.92%	1.24%	
2000	9.8	1111	593		1.65%	0.88%	
1999	5.5	1003				0.55%	
1998	2.0	926				0.22%	

Source: Annual Report of Dalian Software and Information Service Industry, various years

Table 4: **Leading ICT services exporting locations in China, 2002-2008**
(in 100 million RMB, by region and rank)

Location	2008	Rank	2007	Rank	2006	Rank	2005	Rank	2004	Rank	2003	Rank	2002	Rank
Shenzen	600.44	1	286.74	1	231.20	1	147.42	1	105.94	1	48.84	1	33.11	1
Shanghai	102.85	2	95.07	2	78.93	2	55.69	2	39.40	2	21.93	2	14.48	3
Dalian	72.97	3	55.29	3	35.88	3	25.39	3	17.55	4	9.35	5	4.14	5
Nanjing	55.60	4	29.66	5	23.92	6	17.20	6	6.62	6			1.41	6
Hangzhou	45.17	5	29.21	6	30.61	4	21.29	5	13.24	5	9.44	4	8.11	4
Beijing	37.53	6	35.75	4	28.70	5	24.57	4	18.79	3	11.42	3	18.21	2
Chengdu	20.85	7	12.17	7	8.77	7	2.54	8	1.66	8	0.25	7		
Xian	11.81	8	5.02	8	4.07	8	3.28	7	2.48	7	1.66	6	1.41	6

Source: Annual Report of Dalian Software and Information Service Industry, various years
Note: Original figures given in 100 million US dollars converted to RMB using conversion rates from http://fx.sauder.ubc.ca/

Table 5: **Share of exports in leading ICT service producing locations in China, 2002-2008**
(as a percentage of revenues, by region and rank)

Location	2008	Rank	2007	Rank	2006	Rank	2005	Rank	2004	Rank	2003	Rank	2002	Rank
Shenzen	50.25%	1	31.48%	1	30.70%	1	26.33%	1	24.47%	1	16.78%	2	16.55%	2
Shanghai	10.23%	5	12.76%	3	12.81%	3	12.24%	3	13.05%	3	10.91%	3	12.38%	3
Dalian	23.85%	2	25.72%	2	24.74%	2	24.65%	2	24.37%	2	19.90%	1	17.99%	1
Nanjing	11.80%	3	8.19%	5	9.27%	5	10.36%	4	6.07%	5			3.35%	7
Hangzhou	11.38%	4	8.59%	4	11.73%	4	9.02%	5	7.24%	4	7.26%	4	8.19%	4
Beijing	2.39%	8	3.04%	7	2.96%	8	3.15%	7	3.61%	7	2.97%	6	5.45%	5
Chengdu	4.88%	7	3.93%	6	4.26%	6	1.88%	8	1.66%	8	0.38%	7		
Xian	5.14%	6	2.76%	8	3.63%	7	3.95%	6	4.00%	6	3.38%	5	4.02%	6
China (a)					9.47%		7.42%							

Source: Derived from Table 2 and Table 4

The growth of the ICT service industry in Dalian raises a couple of empirical questions. First, how did a software industry of significant importance to the local economy develop with an export focus, especially when most leading ICT services producing locations in China predominantly the domestic market? The second question has to do with the historical specificity of China's integration into the international division of labor in the ICT services industry. In contrast to India, which was the fifth largest exporter of ICT and ICT-enabled services in the world in 2007, China was tenth (UNCTAD 2009, p.77).[2] Whereas most of India's exports go to the US, it has had difficulty penetrating the Japanese market. According to India's National Software and Software Services Companies (NASSCOM), although the Japanese IT outsourcing market is second only in size to the US, Japan accounts for less than 2% of India's IT exports (NASSCOM 2008, p.5). Further, India receives only 19% of the work outsourced by Japan, whereas China receives more than 60% (*ibid.*, p.22) which, our research indicated, Dalian has benefited from.

Public relations brochures in Dalian answer these questions by emphasizing the skilled labor pool provided by the 22 universities and colleges in Dalian (and 182 in the northeastern provinces of Liaoning, Heilongjiang and Jilin provinces).[3] Further, this labor is located in close proximity to the Japanese market, and the legacy of Japanese colonization of the region has given it familiarity with the Japanese language. These explanations are akin to arguments about how the linguistic advantage conferred by British colonial rule helped the Indian software industry, with access to a large pool of highly skilled but relatively low-wage professionals, compete in English speaking markets. Similarly, the 12.5 hour difference between Indian Standard Time and Pacific Standard Time helped Indian firms undertake offshore maintenance and re-engineering work for US customers after regular workers there had left for the day (Parthasarathy 2004). The linguistic and geographic factors which have serendipitously conferred advantage on the ICT services industry in both regions are, what Krugman (1991) refers to as, historical accidents. However, while such accidents can help regions to enter global markets, the ability to remain entrenched in the international division of labor, demands that any analytical explanation go from merely listing the sources of static comparative advantage to specifying the sources of dynamic comparative advantage.

[2] Specifically, India's share of world IT and ICT enabled exports in 2007 was 4.22%; the corresponding figure for China was 2.92% (UNCTAD 2009, p.127).

[3] In addition, there are 120 vocational and language training schools which, in 2006, trained 27,000 students.

3 The context for Dalian's emergence as ICT service producing region

Taking advantage of the Japanese colonial legacy in Dalian, or the region's human capital, to nurture the ICT service industry had to wait until the 1980s. This because the region had to wait for the globalization of the industry, and for policy changes that were required after China began to reform its autarkic centrally-planned economy in 1978 by decentralizing decision making, offering market incentives, encouraging exports and opening up to foreign investment.[4] Economic reform in China made "explicit use of geography in its implementation", in part "to make the policy more effective through external visibility and agglomeration economies" (Dicken 2007, p.226). Thus, in 1979, the Fifth National People's Congress backed the establishment of four Special Economic Zones (SEZs) in Shenzen, Zhuhai, and Shantou, in Guangdong province, and in Xiamen in Fujian province to replicate the economic success of export processing zones elsewhere in newly-industrializing Asia. These SEZs were far from China's major urban and industrial areas but close to foreign markets and overseas Chinese investors in Hong Kong, Macau and Taiwan.

SEZs were open to wholly foreign owned firms, state enterprises, equity joint ventures between foreign and local firms, or contractual ventures (where the foreign partner supplies technology and capital input with a pre-determined share of return negotiated in advance). Firms were entitled to duty-free import of inputs needed for export production. Firms willing to commit investment for ten years were eligible for a tax holiday for the first profit making year, and a 50% reduction in the tax rate in the second and third years. In December 1984, the tax holiday was extended to two years while the reduced tax was applicable from the third to the fifth year. After the tax holiday, investors face a tax rate of 15%, about half of what they would pay outside the zones. Additional tax incentives, often negotiated on a case-by-case basis, are available to firms bringing in advanced technology, to those exporting at least 70% of their output, or those involved in developing infrastructure.

The experience with SEZs, led to fourteen more coastal cities, including Dalian, being opened to foreign investment. Within the cities, designated Economic and Technology Development Zones (ETDZ) were established between 1984 and 1988 with the same incentives as SEZs. Outside the ETDZ in these cities, the incentives were less liberal. For instance, unless firms made technology intensive investments of US$30 million or more, they attracted a tax rate of 24% instead of 15%. Subsequently, in 1988, Dalian was also included in the Torch program, in an attempt to create what Yeung and Lo (1996) label as the Pan-Japan Sea Economic Zone.

[4] Unless otherwise mentioned, details of China's economic reforms are drawn from Bell et al (1993).

The Torch program was launched in May 1988 as part of an effort to create a decentralized science and technology system. Specifically, it was meant to promote innovation, by encouraging individuals to leave public-sector research institutions and establish their own non-governmental (*minying*) enterprises, and to encourage greater research and development and commercialization in state owned enterprises (SOEs) (Segal, 2003). Based on study trips by the Chinese Academy of Sciences to understand the institutional foundations of innovation and entrepreneurship in Silicon Valley, the program was tied to the development of science parks and High-Technology Development Zones (HDTZs) co-located with universities. The 1992 State Basic Policy on High-Tech Industrial Zones offered tax incentives that were similar to those offered at the SEZs. In addition, firms were given preferential access to foreign exchange and allowed to establish branches overseas. The pricing of new products that were developed were freed from state control. The Torch program had limited central funding, with the administering institution, the Torch High-Technology Industry Development Center (under the Industrial Science and Technology Department of the State Science and Technology Commission), raising and channeling funds from financial institutions rather than being a funding agency. Risk funds and venture capital were also permitted within the zones. By 1993, there were 52 nationally designated HDTZs and, by 1997, 12,606 projects were approved in five sectors, of which microelectronics and information accounted for 23.4% (*ibid.*, p.32).[5]

It was within the Dalian HTDZ that the Dalian Software Park (DLSP) was established in 1998 as a wholly owned subsidiary of the Yida Group, a private real estate developer in Northeast China. DLSP is a "Supported by the Government invested and run by a private company" initiative to help promote the ICT services industry in Dalian.[6] The blurred distinction between state and private enterprise that DLSP represents, typifies the importance of long-term social connections and personal ties, or *guanxi*, for doing business in China (Hsing, 1998). While the state controls resources such as land, and undertakes administrative functions such as allocating finances, there is a symbiotic relationship, as local officials also rely on businesses in the intense economic competition between provinces and local governments unleashed by decentralization policies (Fairbank and Goldman 2006). Just as new businesses cultivate relationships with powerful state actors (Wank 2001), the incentive for local officials to help local firms outperform firms from neighboring provinces holds true in software as much as in other industries (Saxenian and Quan 2005). Thus, authorities in Dalian have used state policies after economic reform to

[5] The others were new materials, energy, biotechnology and electromagnetic devices.

[6] Interviews with Yoshihiko Mikami, Japanese Business Director, and Wendy Liu, Manager, DLSP, 24 August 2009.

build on the competitive advantage of the region (Way 2008). One interviewee said that, "…the attitude of the Dalian city government has been different from other regions in China, they are happy to take the back seat and let us proceed. They provide a framework and give us the freedom to implement within the guideline."[7] The performance of the local government resulted in the appointment of the then mayor of Dalian, Bo Xilai, as the Minister of Commerce between 2004 and 2007.

DLSP uses various means to draw multinational corporations (MNCs) and local firms to Dalian. It uses the preferential policies for HTDZs and assists firms in their dealings with the local government.[8] In addition, DSLP offers build-to-suit options wherein firms can specify their requirements for employees, space and infrastructure. DLSP then provides these on a contract basis until the firms are confident of establishing pemanent operations on their own.[9] DLSP also helps firms recruit employees through its partnerships with local universities and colleges, while its Human Resource Development Center (DLSP-HRDC) is a training and certified test center that prepares both tailored and certification courses to meet the requirements of employees and students seeking employment.[10]

With DLSP providing physical infrastructure, and skills training to supplement the graduates from the local universities, Dalian began to cultivate markets. In April 2000, Bo Xilain led a delegation of 13 government members and 95 business representatives to the US and Canada for a number of events.[11] Dalian also hosted the first China International Software and Information Service Fair (CISIS) in 2002.[12] About 100 Chinese software firms, and a handful of their Japanese counterparts, took

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[7] Interview with Calvin Chan, Assistant General Manager; Araki Toshihiro, Senior Manager (Software Office Leasing) and Wen Lu, Manager (Software Office Leasing), Dalian Tiandi, 24 August 2009.

[8] Interview with Chen Yan Ming, Director International Cooperation Department, and Li Dong, Director Software and Information Service, Administrative Department, Dalian Bureau of Information Industry, 28 August 2009.

[9] One firm for whom this model has worked well is CISCO. Interview with Hong Wen, Senior Manager, CISCO GSC, 25 August 2009.

[10] Interviews with Tian Feng, Vice President (Career Skills Improvement Center), Han Qiand, General Manager (Additional Service Division) and Megumi Taniguchi, Japanese Skills Trainer, DLSP-HRDC, 26 August 2009.

[11] Details of the visit are available at http://www.zaptron.com/china/dalian/visit.htm. The event was sponsored by the Ministry of Science and Technology, the Ministry of Education, the State Office of Overseas Chinese Affairs, the Liaoning Provincial Government, and the Dalian City Government. The Dalian delegation also cultivated ties with existing communities, as evident in the Silicon Valley Chinese Overseas Business Association being a part of the organizing team.

[12] Information on CISIS is from interview with Sun Peng, Secretary General, Dalian Software Industry Association, 24 August 2009.

part in this business matching exercise. The success of the fair prompted the mayor of Dalian to lead a team of companies to Japan. Since then, the fair has become an annual event (Table 6) and smaller versions are also held in different regions of Japan. Other attempts to cultivate the Japanese market include the invitation extended by the Dalian municipal government to the Japan International Cooperation Agency to establish the China-Japan Friendship Center for Human Resource Development.[13] The focus of the institute, which was established in March 2006, is to enhance the software development capabilities of Chinese workers and their understanding of the Japanaese language, corporate culture and business etiquette.

Table 6: **China International Software and Information Service Fair (CISIS)**

Content	**2003**	**2004**	**2005**	**2006**	**2007**
Duration	27-30 Sept.	28-31 July	21-23 June	12-25 June	20-24 June
Scale (in sq. m.)	11,000	22,000	30,000	30,000	30,000
Exhibitors	300	500	800	800	800
Visitors	15,000	20,000	30,000	50,000	30,000
Booths	560	940	1200	1200	1200
Countries	12	22	30	32	32

Source: http://www.cisis.com.cn/news/279/450/2881/newsexdisen3558.aspx

The attention paid to the Japanese market was not without history. In 1989, the Dalian municipal government used IBM mainframes to establish the Dalian City Computer Center (DCCC) and the Computer Application Office. The former was responsible for the digitization of records within the Dalian municipality. The latter was responsible for data processing work in Dalian; it also began to take on outsourced projects from Japan for companies such as NTT.[14] However, as Tables 2 and 4 show, it was not until the initiatives from the late 1990s that an export oriented industry in the private sector began to grow.

To meet the demands of a growing industry, DLSP initiated a 12 square kilometer Phase II (whereas Phase I was about 7 square kilometers) with three new parks, including the Neusoft Institute of Technology (part of Neusoft, a software firm with a Japanese lineage), Dalian Ascendas and Dalian Tiandi. Dalian Ascendas is a joint venture between the Yida Group and Singapore-based Ascendas, with each party

[13] Interview with Hamahashi Katsuyoshi and Cui Yan, China-Japan Friendship Center for Human Resource Development, 24 August 2009.

[14] *Ibid.*

having an equal share.[15] Ascendas provides project management skills and marketing expertise whereas the Yida Group brings the experience of the first phase of DLSP. Dalian Tiandi is a joint venture between Shui On Land, a Hong Kong firm, and the Yida Group, with the latter having a 30 percent stake.[16] Dalian Tiandi is being developed on agricultural land that has been appropriated by the government. Land acquisition was simpler due to the Yida Group's experience with the local authorities. As an interviewee stated, "The role of a local Chinese company in most real estate partnerships is one of a sleeping partner. They are essential when it comes to dealing with the Chinese authorities for various negotiations. Acquiring land in China has never been an issue and a local real estate developer can ensure things move faster."[17]

The growth was also reflected in the changing composition and role of the Dalian Software Industry Association (DSIA).[18] DSIA was established in 1992 with 50 members. Although 30 were private firms, DSIA served as a conduit for government policies. In recent years, however, it has become more of a voice for the new industry and a bridge with the government. Besides being a member of the Chinese Software Industry Association, DSIA also has strong links with the Japan Information Technology Services Industry Association and with similar foreign organizations.

4 The ICT services industry in Dalian and the Japanese market

While firms in Dalian can be categorized broadly as subsidiaries of Japanese MNCs, other (non-Japanese) MNCs, or Chinese firms, Japan looms large over Dalian. For instance, even the presence of non-Japanese MNCs typically takes the form of a "global support center", partly dedicated for the Japanese market. While the first such center was established by GE (later Genpact), it was followed by others, including Dell, SAP and Cisco.[19] The Japanese market also provides the business rationale for the subsidiaries of the Japanese MNCs and most Chinese firms in Dalian. Since it is this market which dictates the technological practices and, ultimately, the skill levels

[15] Interview with Jeffrey Tan, General Manager; Qu Jing Jei, Senior Executive (Marketing and Lease); Zhi Yong Zhang, Senior Executive Manager (Marketing and Lease) and Steven Qui Chang Hui, Assistant Manager (Marketing and Lease), Dalian Ascendas, 25 August 2009.

[16] Interviews at Dalian Tiandi, 24 August 2009, *op.cit.*

[17] Interviews at Dalian Ascendas, 25 August 2009, *op.cit.*

[18] Details of DSIA's changing role from interview with Sun Peng, *op.cit.*

[19] Interviews at DLSP, *op.cit.*

of these firms, understanding the offshoring and outsourcing practices of Japanese firms is essential.[20]

Japanese outsourcing and offshoring must be understood against the backdrop of the productivity challenges that plague software development and make it a labor intensive process, and an ageing population (Parthasarathy 2004). Table 7 shows the labor intensive nature of software production and the challenges of improving productivity. Even as the number of firms in Dalian grew four-fold between 2000 and 2008, and the average number of employees per firm grew from 35 to 100 (2.85 times), revenues per employee grew from 14,000 RMB to 38,300 RMB (2.7 times). This is starker when one compares the period between 2003 and 2008, when the number of firms more than doubled from 358 to 800 (2.23 times), but the revenue per employee went up only from 30,300 RMB to 38,300 RMB (1.26 times). Similarly, between 2004 and 2008, the number of employees per firm doubled, the revenue per employee barely grew by 20%.

Table 7: **ICT service firms in Dalian and their characteristics, 2000-2008**
(number, average number of employees/firm, average revenue/employee in 10,000 RMB)

Year	**2008**	**2007**	**2006**	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**
Number of firms	800	700	600	520	450	358	270	220	200
Certified 'software companies'	375	327	292	235	185	124	88	36	
Average number of employees/firm	100	83	77	59	50	43	45	45	35
Average revenue/employee	38.3	37.0	31.5	33.1	31.9	30.3	19.5	15.3	14.0

Source: Annual Report of Dalian Software and Information Service Industry, various years

Next, Japanese industry is characterized by high quality developed with proprietary technology and processes (NASSCOM 2008). This characteristic is also evident in the software industry (Cusumano 1991) and influences outsourcing in a couple of ways. First, it leads to a "….Japanese focus on maintaining the proprietary knowledge base within the confines of the company. Japanese managers try and protect their risk of IP theft by breaking large projects into small modules. The small project modules are outsourced to different vendors ensuring that only the client can piece them back together. Furthermore, in order to protect the IP [intellectual property], the Japanese ensure that the critical project design and solution architecture is kept inhouse as vendor involvement is low in these stages" (NASSCOM, 2008:30). As Table 8 shows, the main attributes that Japanese firms consider when deciding on offshore vendors is the latter's ability to communicate in Japanese, followed by the

[20] Interview with Kasunori Mori, Chief Operating Officer, Toyota Tsusho Electronics Dalian Co. Ltd., 27 August 2009.

quality and number of engineers. Figure 1 presents the same data differently. Chinese and Indian firms are at the bottom of the multi-tier subcontracting structures of Japanese *keiretsu*, far from the system design and integration, and with limited understanding of the final product or the standards to which it is built. Even the subsidiaries of Japanese firms in Dalian are typically established to test products developed in-house in Japan, or to work on maintenance and low level systems integration for their holding companies.[21, 22]

Table 8: **Technical factors influencing vendor selection by Japanese customers**
(by percentage)

Factor	High importance	Include in considerations	Not specifically evaluated
Information Security Management Systems (ISMS)	23.5	56.1	20.4
Privacy Mark System (inclusive of JIS Q 15001 certification for protection of customer information)	19.2	51.5	29.3
Development Standards	18.6	52.9	28.5
Formulation of information security policy	17.2	60.6	22.2
IT Skill level (ITSS)	11.2	42.9	45.9
ISO 9000, QMS	10.2	53.1	36.7
IT Infrastructure Library (ITIL)	9.5	38.9	51.6
CMM/CMMI, ISO/IEC 15504	4.2	45.8	50.0
Compliance with guidelines for information systems reliability improvement (METI)	4.1	47.4	48.5
Compliance with guidelines for sustained business (METI)	2.1	35.8	62.1
Compliance with sustained business guidelines (from the Cabinet Office)	1.1	35.1	63.8

Source: NASSCOM (2008: 31)
Note: ISO/IEC 15504, also known as SPICE (Software Process Improvement and Capability Determination), is a "framework for the assessment of processes" developed by the Joint Technical Subcommittee between ISO and IEC. ISO 9001:2008 series describes standards for a Quality Management Systems (QMS) addressing the principles and processes surrounding the design, development and delivery of a general product or service.
See www.iso.org for more details.

Finally, when it comes to the technical bases for vendor selection, as Table 9 shows, concerns about information security are paramount. Further, with their proprietary process standards, Japanese customers give little importance to the development process capabilities and quality procedures certified by the Software Engineering Institute's five-level Capability Maturity Model (SEI-CMM), or the ISO-9000/9001-3 standards established by the International Standards Organizations (ISO), which are widely accepted in North America and in Europe.[23] As an interviewee in

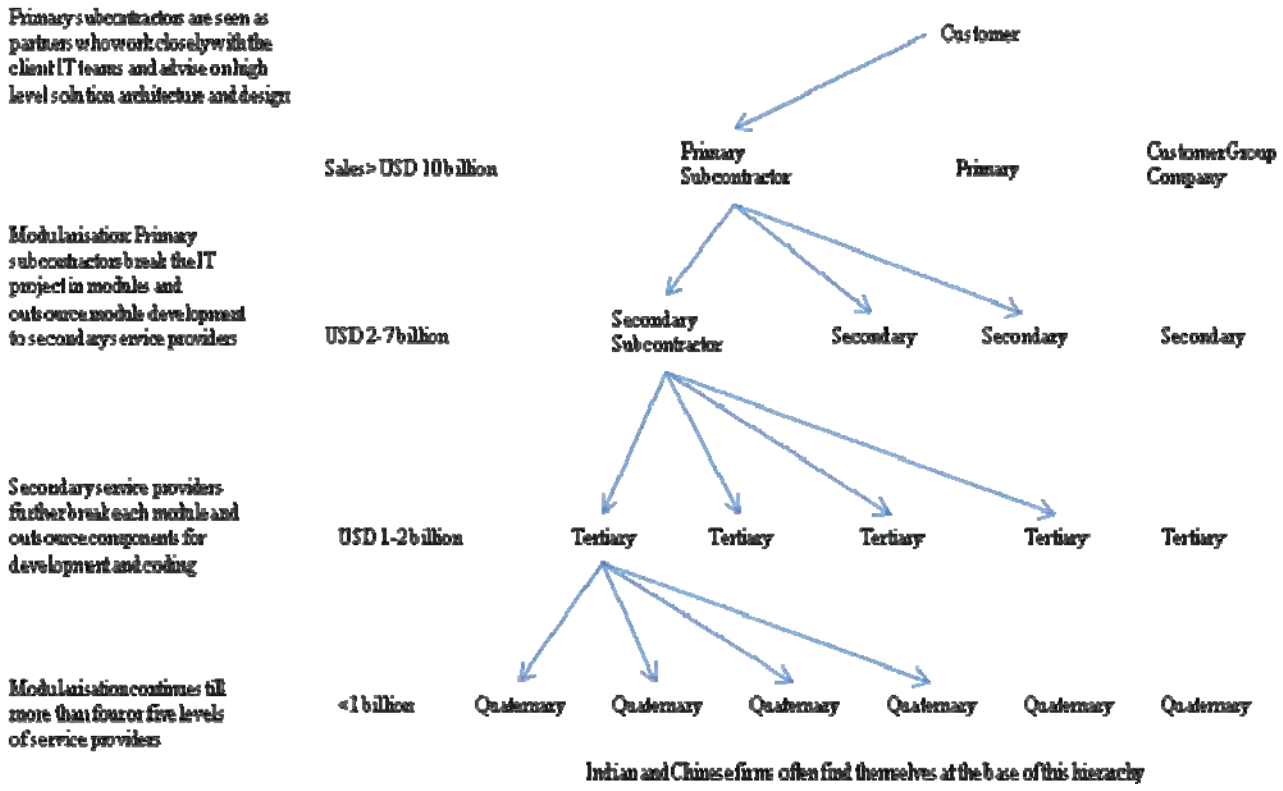
[21] Interview with Tsuneo Sakai, General Manager, Alpine Electronics (China) Co. Ltd. (Dalian R&D Center), 24 August 2009.

[22] Interview with Kasunori Mori, *op.cit.*

[23] Although SEI upgraded the CMM model to CMMi (Capability Maturity Model Integration) in 2000, the broad philosophy of the five-stage model remains the same. For details, see www.sei.cmu.edu/cmm/cmm.html.

Dalian stated, "…the nature of work undertaken for Japanese clients has to conform to their standards, and standards such as ISO and CMMi are not accepted in the Japanese market."[24]

Figure 1: Japanese IT Services Hierarchy



Source: NASSCOM (2008, p.28)

[24] Interviews at the DLSP-HRDC, *op.cit.*

Table 9: **Factors influencing offshore vendor selection by Japanese customers**

Factors	**(%)**
Japanese communication skills	65.3
Quality and number of engineers	57.3
Cost	37.4
Reputation of person in charge	28.2
Experience of existing Japanese clients	23.3
Certified qualifications such as CMM, ISO	9.9
Reputation of the management	9.5
Establishment of Japanese subsidiaries	9.2
Reference from trusted sources	6.9
Delivery speed	3.4
Reputation in the industry	3.4
Company size	2.3
Proximity to Japan	1.9

Source: Information Technology Promotion Agency (2009)
Note: The survey is based on 262 samples and participants provided multiple answers

Japanese concern with information security, especially the protection of the personal information of consumers on computers and computer networks, was evident in the passage of the Protection of Personal Information Act (Act No. 57 of 2003) on 30 May 2003, and its enforcement from 1 April 2005.[25] All firms handling personal information were covered by the Act and they had to establish a private information protection management system complying with Japanese Industrial Standards JIS Q 15001:2006. The certification of compliance is provided by the PrivacyMark which is administered by the Japan Information Processing Developing Corporation (JIPDEC).[26] The PrivacyMark provides visible assurance to consumers about the protection of their personal information and social credibility to businesses sporting the mark.

Since the PrivacyMark is available only for private enterprises based in Japan, DSIA developed the PIPA (Privacy Information Protection Assessment) standards based on the Japanese standard to ensure that local firms could comply with requirements in their largest market.[27] PIPA has three different standards: information security standards, information management regulations which are used for

[25] This Act was a revised version of Act No.95 of 1988, for the Protection of Computer Processed Personal Data held by Administrative Organs, which did not apply to the private sector. See: http://privacymark.org/ privacy _ mark/about/outline_ and _purpose.html

[26] JIPDEC established the PrivacyMark system in 1998, following instructions from the then Ministry of International Trade and Industry (currently Ministry of Economy, Trade and Industry (METI)). See: http://privacymark.org/privacy_mark/about/outline_and _purpose.html

[27] Information on PIPA is from interview with Sun Peng, *op.cit.*

information service management by the services industry, and the HR Skills standard. Interactions with Japanese clients, and the presence of Japanese firms in Dalian, gave DSIA the experience to establish the standard. As Japanese firms have accepted PIPA certification, 40 firms in Dalian obtained it by August 2009. Other Chinese cities have also approached DSIA seeking the authority to grant PIPA certification.

5 The role of standards in the rise and dominance of Bangalore

Until 1984, the ICT services and software industry in India was virtually non-existent, due to an autarkic, SOE-dominated, import substitution led industrialization (ISI) policy regime that discouraged entrepreneurship and foreign investment and proved inimical to innovation (Sridharan, 1996). Cautious efforts to liberalize these policies from the mid-1980s led to the emergence of an export-driven ICT services industry.[28] What helped drive the industry was an unforeseen consequence of the ISI period. Unsuccessful domestic efforts to build a commercially viable computer system, and high duties, which were a disincentive to import, meant that mainframe computers based on proprietary standards never had a significant presence in India (Harding, 1989). The few that were imported were of various vintages and sources. The experience gained by working on a variety of platforms in the 1970s, helped the Indians win labor-intensive contracts to maintain older systems in the 1980s and 1990s.[29] Further, with the growth in computer manufacture and usage in the 1980s, Unix became the operating system of choice. As the government undertook limited computerization of some of its activities, it played a role in encouraging the use of Unix, especially in public sector bank automation. This opportunity led to many innovations in the design of Unix-based systems (Heeks, 1996). Since Unix had a profound impact on almost every commercial operating system since its development at AT&T Bell Labs in 1969, Indian engineers entered the global market with a unique advantage (Udell 1993).

But, prior to 1990, exports involved little more than bodyshopping, or the practice of providing inexpensive on-site (i.e. at customer locations overseas) labor on

[28] Two key initiatives were the Computer Policy of November 1984, and the Computer Software Export, Development and Training Policy of December 1986 (Subramanian 1992).

[29] Examples of such contracts were those requiring the reconciliation of formats, such as those involving dates, of which the Y2K problem received the widest publicity. Jones (1998) points to other format problems with older software that manifest themselves in the 1990s. One date problem had to do with resetting the counters of global positioning system (GPS) satellites used for global fund transfers. The shift to the Euro, replacing 12 European currencies, from 1 January 1999, posed a different kind of format problem.

an hourly basis, for low value-added programming services such as coding and testing.[30] It was only from the early 1990s, coinciding with the provision of data communication facilities in Software Technology Parks (STPs) and greater openness to the world economy, that a territorially grounded industry emerged in India. With the establishment of the first STP, Bangalore became the leading region for the industry and came to be referred to by terms such as "India's Silicon Valley (IDG 2001).

The STPs and helped transform the industry in the 1990s. Besides attracting more MNCs to the country, the share of offshore services in software exports increased as software factories emerged in India, with the infrastructure, technology, quality processes, productivity tools, and methodologies of the customer workplace. Thus, India became home to the largest number of CMM and ISO certified firms in the world, although obtaining work in the Japanese market has remained a challenge. Nevertheless, Arora and Asundi (1999) identify two reasons why Indian firms seek quality certification. First, it is a marketing device, to signal to potential customers that the firm follows a well-defined and documented development process. Second, a well-defined process improves the ability of firms to estimate and manage the time and resources required for a project, helping them bid for larger projects, thereby expanding business. Although Arora and Asundi conclude that the relationship between certification and better rates is not very robust, they add that for firms with an on-going commitment to quality, getting bigger projects is a route to obtaining turnkey contracts that are more profitable.

Obtaining turnkey contracts forces firms to develop substantial management skills, as they have to coordinate a much wider range of tasks than just programming, and take responsibility for the overall project schedule, quality and productivity, in contrast to bodyshopping, which is little more than resume selling. Not only did some Indian firms get better work at better rates, they also began to move away from competing on hour-based productivity to IP based productivity, by converting knowledge gained from development projects, in specific application areas, such as banking, retailing or telecommunications, to a customizable generic product for clients with similar needs.

Indian ICT service and service exports continued to grow in the new millennium despite the global slump in demand for IT products following over-investment in the 1990s.[31] The growth has been accompanied by a further qualitative shift, as the offerings of the industry are no longer limited to low-valued added

[30] Unless otherwise mentioned, the next four paragraphs draw from Parthasarathy (2004).

[31] For instance, in the US, spending on IT, after growing by 16% in 2000, fell by 6% in 2001 (*Economist* 2002) and, in aggregate terms, technology spending declined from nearly 5% of GDP in 2000 to about 4% by 2003 (*Economist* 2003).

services. Instead, it increasingly provides R&D services, which demand IP creation. Central to the growth of R&D services is the provision of embedded systems.[32]

The activities of firms in India in embedded systems can be classified into three categories (Hari and Anand 2002). In the first category are firms offering contract design services for customers. This is similar to providing software services, in which Indian firms have become competitive globally, with one crucial difference. Those providing design services are very much a part of the embedded systems production chain and interact with either the customer's Chief Technology Officer or the R&D head. In contrast, software services that are outsourced, such as maintaining databases in domains like retailing, while contributing to essential information support systems, do not typically represent the mainstream activity of most customers. Service providers in this case tend to interact with the Chief Information Officer of their customers.

In the second category are firms that generate IP to derive revenue from a customer license fee or recurring royalty payments. While this is lucrative, especially when compared to providing software services on a man-hour basis, it is not without risks. Generating IP requires familiarity with emerging standards for which participation in the relevant international standard setting bodies is valuable.

Finally, there are vendors who design entire chips. While this is the most profitable category, it also requires deep pockets and, thus, is mostly the realm of MNCs such as Intel, Motorola, and Texas Instruments (TI). Chip vendors such as TI, however, do not develop their products in isolation. With the growing complexity of embedded systems and the rapid proliferation in their use, the industry is moving toward a design process that integrates reconfigurable, commodity system-on-chip platforms to offer differentiated products for a wide variety of users and application domains (Martin and Schirrmeister 2002). Platforms are a mechanism to accelerate the design and development of end-user products by providing pre-integrated, pre-verified collections of IP blocks organized into hardware-software architectures. Thus, while TI retains DSP development, in 2004, it had more than 600 independent DSP

[32] An embedded system is any computer that is a component in a larger system and relies on its own microprocessor (Wolf 2002). The use of embedded systems has grown with more powerful microprocessors. They now find application in everything from consumer goods to transport equipment and industrial process control systems. In these devices, embedded systems not only take over what mechanical and dedicated electronic systems used to do, but they increasingly connect to the Internet. It is the ability to digitally capture and simulate various mechanical or other functions that makes the globalization of R&D in various domains technologically feasible. Thus, for instance, automobile firms such as General Motors and Mercedes-Benz have established R&D facilities in Bangalore.

partners globally from whom it either bought IP or sought design services. Forty nine of its partners were Indian, thirty one of which were Bangalore-based.[33]

6 The impact of the Japanese market on ICT services industry in Dalian

Unlike in Bangalore, the export-based ICT services industry in Dalian has not been able to make any tangible entry into markets other than in Japan. The reason, we argue, is because its strength i.e., access to the Japanese market, is also a weakness. While the market has offered growth opportunities, the unique standards adopted by Japanese firms are limiting. One interviewee stated that "… entering Japanese markets would mean adhering to individual proprietary standards, whereas entering the global market would mean adopting open standards." [34] Working to process standards that are either closed (such as proprietary process standards), as opposed to open standards (such as CMM or ISO standards), or those that have limited recognition, such as PIPA, leads to lock-in effects (Varian et al. 2005). In Dalian these effects are manifest in the reluctance of local firms to adopt open standards to enter more competitive markets that are based on open standards.[35]

Firms in Bangalore had little option but to seek work overseas, both in terms of volume and scope, due to the limited domestic market (Parthasarathy 2004), despite the importance of a "walking on two legs strategy" (Schware 1992). Such a strategy entails developing a domestic market for various software application domains to also help firms hone their expertise and experience locally before serving global markets, and to minimize the risk of being confined to low-value added work. Although the size of the Chinese market could potentially confer an advantage, firms in Dalian also face constraints at home.

At one level, while China's joining the World Trade Organization is changing its approach to establishing standards, especially in the ICT industry, there is the legacy of techno-nationalism (Suttmeier et al. 2006). The active role of the state in standard setting is driven by the 260 special technical committees, which directly report to the Standardization Administration of China, and 422 subcommittees consisting of 27,800 individuals who draft standards, with little foreign or public input. In the US, the government does not dictate standards setting; instead, the process is

[33] Details of TI's activities are from a personal discussion that followed a presentation by Dr. Biswadip Mitra, Managing Director, TI India, at the International Institute of Information Technology, Bangalore on 10 April 2004, and from www.ti.com/asia/docs/India

[34] Interviews at Dalian Hi-Think Computer Technology Corp., 25 August 2009.

[35] Interview with Sun Peng, *op.cit.*

left to 450 standards developing organizations, including 150 consortia and numerous committees to address technical requirements and 93,000 active standards.[36] Thus, at the end of 2002, of the 8931 national standards that China had along the lines of international ones, 3794 did not complement international standards, while 2968 were modified versions. Even if firms from Dalian participate in setting domestic standards, unique standards blunt the international scope of any domestic opportunities. At a different spatial scale, the economic competition between provinces and manifests in what can be termed techno-regionalism: provinces creating their own standards to promote local firms by protecting local markets (Tschang and Xue 2005).

But even within the Chinese context, Beijing and Shanghai are instances of how history and policy can combine to create outcomes that are different from Dalian.[37] Both cities host a number of Research and Development (R&D) centers (MII 2003), despite the wages for software professionals and the attrition rate being higher in both cities (Tables 10 and 11). One result is that "… Master's students from the university rarely find jobs in Dalian for their skill sets, they tend to move to either Shanghai or Beijing; the industry in Dalian hasn't yet started R&D."[38] Just as Dalian used its historical advantages to enter the Japanese market, Beijing and Shanghai capitalized on their advantages, especially those conferred on them especially during the period of central planning between 1949 and 1978. While both cities are home to the largest pools of skilled labor in China, thanks to the presence of the nation's best universities and research facilities, they capitalized on their advantages in different ways. The local government in Beijing encouraged researchers to quit their jobs with the state and to establish *minying* enterprises in new technology areas. While the local government provided financial and administrative support without interfering in the management of these initiatives, the entrepreneurs could fall back on the technical community in the capital to develop new ideas and technologies. Besides the local backing, the national government too was keen on transforming the capital into the political and cultural center of the country, an endeavor in which building technological capability had a crucial role. These efforts, led to an agglomeration of software and internet firms in Zhongguancun in Beijing's Haidian district, which has been labeled China's Silicon Valley (Zhou 2007).

[36] http://www.chinabusinessreview.com/public/0305/weeks.html

[37] The discussion of Beijing and Shanghai in the next two paragraphs is from Segal (2003) unless otherwise mentioned.

[38] Interview with Xue Qiang, Vice Dean, School of Software, and Tao Zang, Liaison Officer, Dalian University of Technology, 26 August 2009.

Table 10: **Average annual pre-tax salary for a software development engineer, 2007** (by region, in RMB)

Shanghai	Beijing	Shenzen	Dalian	Chengdu	Tianjin	Wuhan	Xian
66451	63200	58790	47450	43600	42320	38630	38450

Source: Annual Report of the Dalian Software Industry Association, 2008, p.130

Table 11: **ICT service industry industry human resource mobility index, 2006** (by region, Xian = 100)

Shenzen	Shanghai	Beijing	Chengdu	Dalian	Wuhan	Tianjin	Xian
167	134	130	117	110	106	105	100

Source: Annual Report of the Dalian Software Industry Association, 2008, p.131

While Shanghai could boast of similar human capital as Beijing, it went about the task differently. Central to the local economy, which Yusuf and We (1997) describe as "the industrial workhorse of China", were SOEs. The importance of SOEs to the local and national economies, and the political ties between the SOEs and the local bureaucracy meant that Shanghai promoted the ICT industry by reforming the SOEs rather than by encouraging *minying* enterprises. At the same time, since Shanghai was attempting to position itself as China's gateway to the international economy, it attracted MNCs. The result was the creation of a production and service industry around ICT manufacturing.

7 Conclusions

This paper set out to explain how, late-late industrializing regions of the early 21st century, such as those in China and India, enter the international division of labor and maintain their comparative advantage amidst changing technologies, shifting demand conditions, and new competitors. Specifically, the focus was on the role of standards, controlling which is the source of power in TDCCs of ICT products and services. Drawing on the comparison of Dalian and Bangalore, the paper makes three points in this regard.

First, it shows that while regions can capitalize on advantages conferred by history to become a part of TDCCs, governance of the commodity chain matters. In the case of Dalian, entering the Japanese market for ICT services has proven to be a double-edged sword. On one hand, the Japanese market is the second largest in the world and offers a range of opportunities. Yet, the outsourcing and offshoring practices of the Japanese firms have, at least thus far, limited the scope of work that is

sent offshore. Thus, Chinese firms find themselves at the bottom of the Japanese subcontracting hierarchy. The work that firms in Dalian undertake is labor intensive and they have been unable to move into more productive activity. The negligible exposure of firms in India to the Japanese market has made them less vulnerable to the Japanese governance practices in TDCCs.

Second, integration into the international division of labor on the basis of open process standards allows firms greater access to markets and to benefit from the resulting network externalities. Catering to the proprietary process standards of their customers in Japan has made it hard for firms in Dalian to enter markets elsewhere. For firms in Bangalore, which also started off working at the bottom of the ICT service hierarchy, using open process standards allowed them, over time, to expand the scope of their work. Once convinced of the capability of Indian vendors, North American and Europe customers were willing to widen the scope of the contract to offer greater responsibility for the overall project schedule, quality and productivity. This also proved to be the first step toward developing innovative capabilities in various domains.

Finally, while the literature has argued that access to a domestic market can play an important role as a platform for international markets, this paper shows how it matters: it is not the absolute size but the standards that rule at home. A vast Chinese market has not helped Dalian's international aspirations; instead, they have been blunted by techno-nationalism and techno-regionalism which, either isolate China or fragment the domestic market. The Indian domestic market, though smaller than China's, has offered the necessary support for exports. Even in the 1980s, the value of Indian engineers came not merely because of an ability to speak English, but because of their exposure to various platforms and their familiarity with Unix, the most influential operating system ever. More recently, start-ups and large firms (both Indian and MNCs) are driving the creation of a cluster of the embedded systems industry in Bangalore. With local firms embracing international standards and protocols for chip design, they are lodged as creators of IP in the embedded systems commodity chain. Even within China, Beijing and Shanghai show how history and policy can combine to create outcomes that are different from Dalian.

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