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Journal of Emerging Knowledge on Emerging Markets
Volume 3
November 2011

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The China software industry experienced rapid development during the past two decades since early 1990's. As one of the knowledge intensive industries, the software industry presents technology learning and product upgrades which contribute to "Late-developing Advantage" of high tech industry to a large extent.. Up to now, the software industry is mainly driven by demand based on domestic economy restructuring; however, the China software industry has been increasingly involved in international market since the 21st century and presents steady improvement in export performance. This is the result of vast amount of software-related task transferred from developed countries under the background of emerging service business between developed countries and developing countries. This paper is to observe new nature and tendency of software export in multiple aspects as well as the domestic development situation; for the latter part, the paper is to present contrasts between different regions in China, so that the understanding on software industry competitiveness in China can be furthered, which will help us to have more understanding on the factors closely related with industry internationalization in the future.

http://digitalcommons.kennesaw.edu/jekem/vol3/iss1/16
DOI: 10.7885/1946-651X.1048

Literature Review

Research on the topic of the China software industry by foreign scholars is very limited. Current research concerning this issue points out that the China software industry is in a primitive stage, and its driving force includes a large human resource pool, huge demand born from fast growing domestic economy and the government's promotional policies (Li & Gao, 2003). The comparison of China software industry's competitiveness with India is also a hot issue in this area; the related research making assessments of growing competitiveness of China's software industry point out the role of government policies in shaping the competitiveness (Yang, Ghauri & Sonmez, 2005). Research in progress by domestic scholars focuses on the model of governance under outsourcing supply by Chinese local enterprises and conclude that Chinese software outsourcing supply still stay at mid-low end of value chain concerned and involvement in innovation alliance partnership with outsourcing buyers as a key road for upgrading (Liu & Xiao, 2011).

Thus, current research in progress points out China software industry is an increasing power in software industry worldwide, and gives description of industry's overall growth and development. While limited research is put on detailed survey on industry development from regional level so far.

Review of China software industry and its internationalization

China's software industry experienced rapid development since early 1990's. As one of the knowledge intensive industries, software industry present technology learning and products upgrading during the past two decades, which contribute to "Late-developing Advantage" of high tech industry to a large extent. Due to its ever increasing qualified talents, software sector's average technology sophistication and productivity benchmark do not have huge gap with that of developed countries. Driven by the strategy aimed at pushing information of national economy, IT equipment manufacturing developed very rapidly and with high industry benchmark, which lead to huge demand on software products including embedded software products and other catalogues.

Software industry's involvement in global market

Since late 1990's to now, the IT industry has been shaping significant industry structure adjustments and technology restructuring worldwide. Under those circumstances, the China software industry experienced rapid FDI growth and technology acquisition and international market network building. Similar to other industries with high technology intensity, foreign investment compose important driving force to China software industry, which support establishment of Joint Venture (JV) projects and Wholly Owned Foreign Enterprises (WOF) Under those circumstances, Chinese local enterprises have been

involved in world market during the past two decades. Foreign invested companies, mainly of Japan JV-China JV contribute to the majority of software export from China and compose the base of export networking. In this field, JV invested by Japanese companies play an important role in promoting export as intra-firm trade in software and IT service.

We can observe that export of China software industry and this share of output present steady high growth during the past two decades (Figure 1).

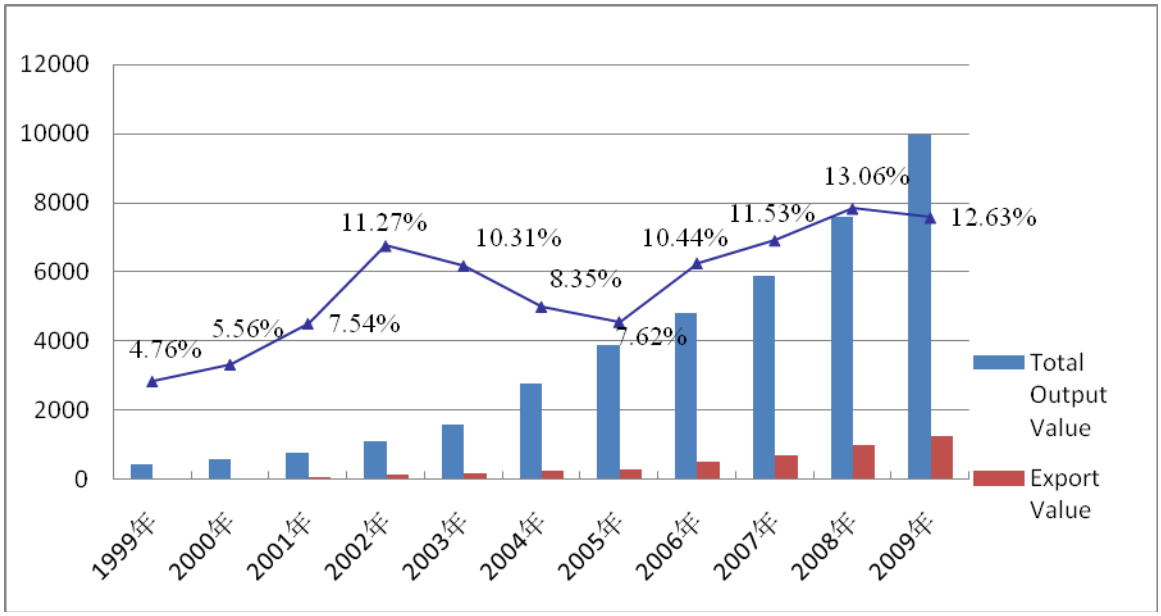

Figure 1 Output and Export Value of China Software Industry and Share of Export to Output Source: "China software export development report 2009"

Current performance since economic crisis worldwide

From 2005, cross border service mobility emerged rapidly due to higher technology feasibility driven by internet communication technology exploration. MNCs find it more convenient to pursue cost saving on IT management by means of IT business outsourcing. Under those circumstances, Chinese companies are more and more involved in the IT outsourcing market due to its cost advantage. During the past decade, information technology service outsourcing (ITO) became the main force for pushing offshore delivery of software development and IT system maintenance, so that cross-border software development businesses expanded by large proportion.

From the structural change, we can observe that the proportion of (tangible) software exports declined from the previous half to 30%, and the corresponding export contract amount fell by 3.8%; in contrast, export via information technology outsourcing contracts increased by 86.1%, and the corresponding export value increased by 162.5%. Concerning

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DOI: 10.7885/1946-651X.1048

the proportion of those two kinds of software export, the proportions of software products export and information technology outsourcing(ITO) took 26.4% and 73.6% respectively of total software export value in 2008, thus export via service outsourcing account for majority in software export. Within the ITO basket, export via offshore outsourcing mode account for 87.9% and its export value amounted to USD 6.39 billion, with a year-on-year rise of 141%. Thus the overall export income in China still kept its high growth rate development. Software export present increasing by 29.8% compared with that of 2007.

Actually, in world service market, the amount of ITO contracts reached over three times of software export, and it is also the tendency for China's every growing enlargement in world markets.

In 2008, under the background of world economy low speed growth, the world market presented shrinking, but MNCs express strong interest in outsourcing IT business of company to outsourcing suppliers abroad (See Figure 2). From the chart, we can observe that 44% of enterprises under survey reply increasing interest on service outsourcing. While only 20% of that reply decreasing in interest. In terms of that result of enterprises survey, we can observe the increasing interest in outsourcing service business after economic recession in developed countries. Thus, the increasing demand of IT service maket worldwide compose a strong driving force for software export of China.

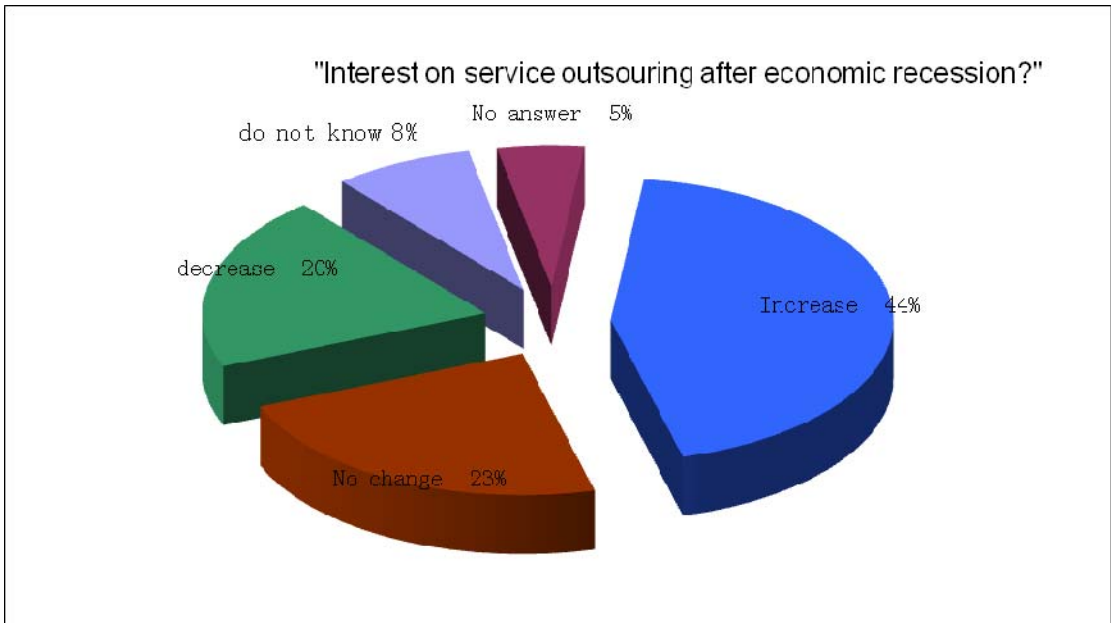

Figure 2 Survey of 400 companies under "Global Outsourcing Market Under Crisis?"
Source: www. outsouceworld.com, 2009 Jan

Performance of software export on product and market aspects

Along with the fast growth of software exports in scale, software export also experienced change in multiple aspects, including products catalogue and target markets. Structure change in software products and foreign market is significant.

Structural Features of export software product

In terms of technical complexity and usage of product, the catalogue of software products can be divided into three catalogues, and they are application software, system software and support software. The structure within three catalogues present changes during the past couples of years. Need to reference Figure 3. We can observe that application products, as the vast majority of export, experienced downsizing of proportion, and the other two categories including system software and support software were enlarged faster. By 2008, the proportion of system software increased from 5% of five years ago to 12% of total contract amount. Total export contract amount increased by 45% and the support software also increased to over 6% of total export amount, contracted amount of 53% over the previous year. Although the latter two kinds of software products still have a small share, the imbalanced situation of that structure has gradually transformed. The features of export structure tend to be complete.

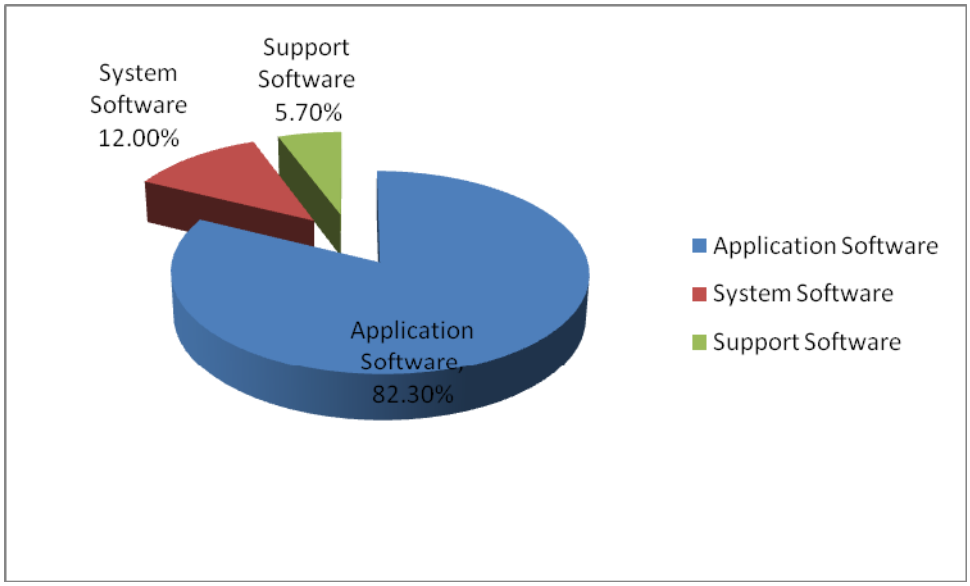

Figure 3 The structure of China's software products export in 2008 (as contract amount)
Source: "China software export development report 2009", Ministry of Commerce, People's Republic of China

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Dynamic target market for software export

Along with Chinese firms furthering their export networking building, the target market abroad presents a higher diversification picture than before. In the past, Japan has been the largest target market and crucial to China's software export. In recent years, though the software exports to Japan continue to expand in scale, they declined in proportion to total export year by year. Since 2005, the proportion of China's software export to Japan has dropped to present 1/3 level from past 2/3 level of total amount of China's software export. And the share of total software export to Japan declined to 37% in 2008 from 51% in 2007. In this context, the share of western market is expanding, especially the European market is currently involving in active growth cooperation with Chinese enterprises even with almost no trade before 2005. The amount of new software export contracts with France, which accounted for only 0.045% of total amount export, now rose to 3%, and the software export outsourcing undertaken form America accounted for 18.8% of total amount of export, which is shown below (Figure 4).

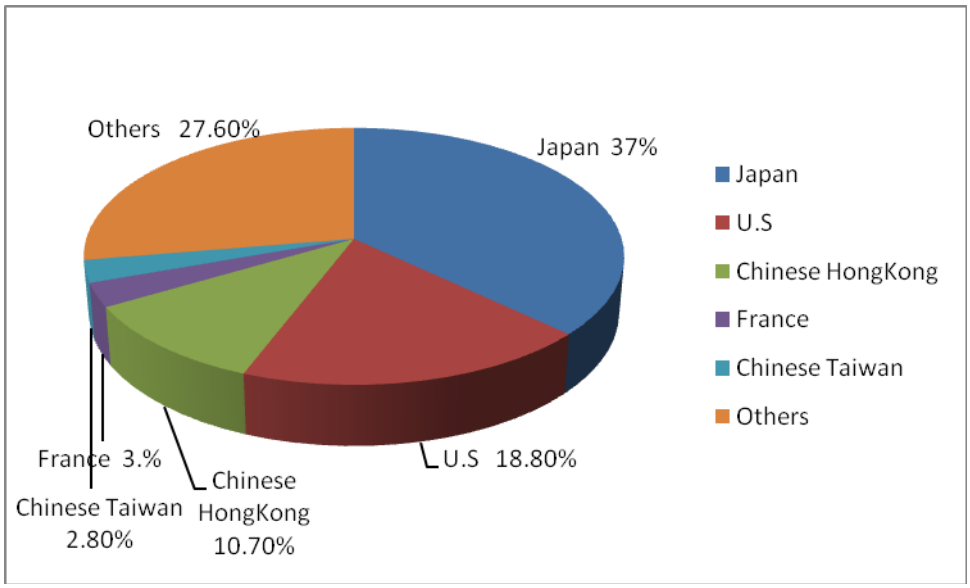

Figure 4 China software export market structure in 2008 Source: "China software export development report 2009" Ministry of Commerce, People's Republic of China, 2009

It is ten years since China's software export to Japan began, largely thanks to IT system integrity replacement of Japanese local enterprise. This multi-year process brought huge demand for import of software products and software services. A favorable condition of this trend is the continual perfection of the multinational communications infrastructure, thus the fragmentation of technical service activities is greatly improved, which brings more convenience for information technology services offshore delivery. The deepening cooperation of Chinese enterprises with Western Europe and US enterprises is pushed by "refocusing strategy" of local enterprises. The local enterprises actively seek for service

offshore supplier because of cost, which form a stream transferring software development and information service to foreign branches or abroad local enterprises, the major way is outsourcing the enterprise information processing and application software development to Chinese enterprise via outsourcing contracts. The competitive advantages and outsourcing states of China's export main market are summarized as follows Table 1:

Table 1 Characteristic of China's main market of software export

Market country	Importance for export market	Competitiveness of export	Business characteristic of outsourcing	Scale and technology content of outsourcing project
Japan	Accounting for 60% of Japan information service outsourcing and about one-third of China's software export	Chinese firms have advantage in language and culture, and low cost for mutual personnel dispatch and handover of order	Entire outsourcing is less, most undertake sub modules after decomposing enterprise information management system design and structure analysis, and embedded software matching with products of Japanese enterprise in China.	Projects with average small scale, the technical content of outsourcing business primarily in code and test is low, the complex link outsourcing projects have a rising trend in recent years
U.S	Accounting for over nearly one-third, and low competitiveness compared with India, but have huge potential in development space	In the cost, form the competition with traditional partners of U.S. market -- India enterprises	Software businesses are likely to present entire outsourcing cooperation with Chinese software companies and long-term orders of large projects.	With average large scale projects and high technology content, the requirement for overall development ability and overall design ability of project management are higher.
Chinese Hongkong and Taiwan	Current small scale due to its new market but present high increasing rate of about over 30% on outsourcing contracts increase	Culture and language are close, mainland enterprises get advantage of cost and related personnel exchanges.	Besides HongKong local enterprise projects, there are US and EU sub-contract projects through HongKong, i.e. "Hong Kong contract - subcontract to mainland"	Technical content of application software projects is not high, but the requirement for management standardization is high.

Source: "China software export development report 2009", Ministry of Commerce, People's Republic of China, 2009, organized by author

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As India has been the largest contractor of American business outsourcing projects since the end of 1990s, India almost dominates the outsourcing business from U.S clients and also fragments outsourcing projects to other emerging countries. At present, most offshore businesses undertaken by Chinese enterprises come from subcontract of Indian enterprises. To a certain extent, it promotes Chinese enterprises to understand and comprehend the service cooperation experience within Western enterprises. Meanwhile, the expansion of high technology product trades between China and Western local enterprise is also largely promoting the cooperation space of corresponding application software outsourcing. The rapid increase of Chinese local software human resource and accumulation of international business experience also help Chinese enterprise to gain access to the international prevailing market channel, as well as helping to promote China's offshore software services market position in which the main body is America.

The adjustment of export target markets has brought changes of software export modes and service forms, which is closely related to international business of enterprise of different regional markets. In contrast to Japanese enterprises that tend to outsource partial module after decomposition of information management system according to the function professionalization, American enterprises and Western European enterprises prefer to outsource more entire information service. Consequently, the service providers cooperating with U.S & European clients get more chances to undertake integrated software services involved with multiple functional links. Under that situation, direct promotion for software enterprises providing composite business including application software, support software and system software. Therefore, the change of customer source plays a positive role in upgrading the structure of China's software export. With low level of Japanese market acceptance for new software products and high level of protection for their local enterprises, new products developed by Chinese enterprises are difficult to enter Japanese market. While the demand of western countries market for new products from Chinese enterprises is constantly increasing, Chinese independent innovated software is widely applied. The embedded software such as ERP, ZW CAD, Rising antivirus and Huawei, ZTE have all accessed into EU market. With the increasing market share of software export to EU and US markets, the occupation of software value chain of Chinese software developing service is extending, enlarging from programming to maintenance and management for whole system, which requires higher technological capabilities and overall project management level. In this sense, for China's software export, the export market development is an incentive for the rise of technological development ability.

Software Industry development at regional level in China

Like the imbalanced situation of Chinese economy region by region, east China provinces and municipalities are undoubtedly keeping ahead in software industrial on output scale and technical level. In order to make deep analysis, China will be distinguished, from economic meaning, into four groups - three regions including eastern region, central region, western region and municipalities.

Output performance at regional level in China

Similar with other high-tech industries, the Chinese software industry development is in the pattern of developed eastern and relatively backward in the Midwest. China's software exporters are highly concentrated in eastern coastal regions so far, which contribute to regional economic imbalanced development in China. For a long time, the eastern regions have formed a good foundation for software industry and export. It also nurtured a mature technical environment. Need to reference Figure 5 before it appears.

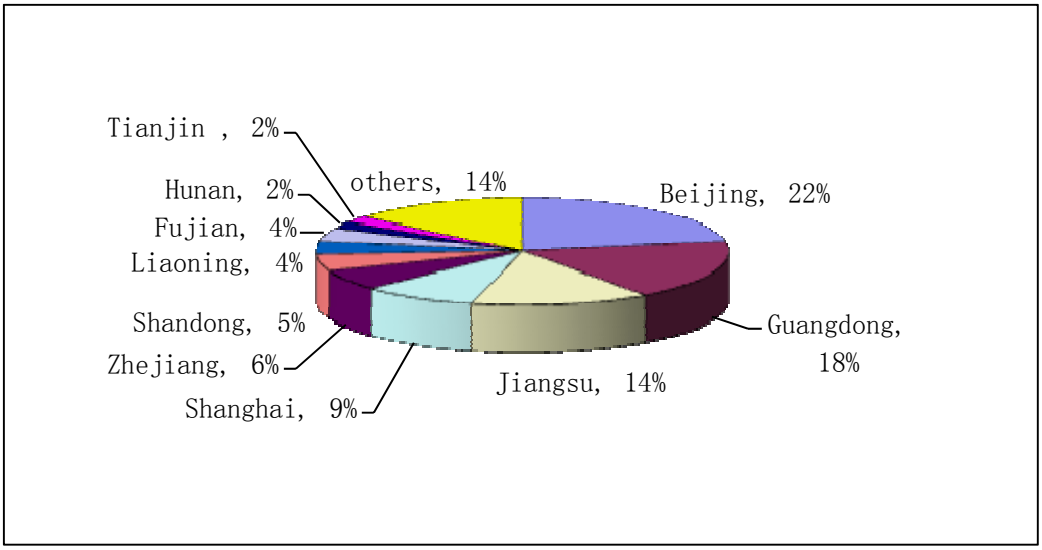

Figure 5 Distribution of industrial scale of several China's software industry most developed provinces Source: China software industry innovation development report 2010

The output value in eastern region takes more than 80% of the share (See Figure 3), and the most developed regions include Beijing and southeast coastal provinces. From the output share rankings for relevant provinces in the past 3 years (Table 2), we can see that Beijing and Guangdong are two provinces and cities with highest share of output, as long-term ranked first city in the software output value, Beijing was overtaken for the first time by

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DOI: 10.7885/1946-651X.1048

Guangdong in 2010, and Shandong overtook Zhejiang for the first time in 2010 and became the fifth province with highest production value.

Table 2 Top Five cities in Software Industry Output

Ranking	Year 2008	Year 2009	Year 2010
1	Beijing (20.9%)	Beijing (19.7%)	Guangdong (20.2%)
2	Guangdong (18.8%)	Guangdong (18.3%)	Beijing (17.5%)
3	Jiangsu (15.9%)	Jiangsu (16.9%)	Jiangsu (17.2%)
4	Shanghai (7.6%)	Shanghai (7.1%)	Shanghai (6.9%)
5	Zhejiang (5.6%)	Zhejiang (5.3%)	Shandong (6.6%)

Data Source: WIND database “China's software industry data reports”, calculated and organized by the author.

From the table, we can see the share of main eastern cities and provinces including Beijing, Guangdong, Shanghai, Jiangsu and Zhejiang provinces, account for 69% of total national output. Thus, the industry output present as imbalanced within China, and east China composes the main base of industry development and concentrated by leading software enterprises with market reputation and technology sophistication.

In order to further investigate regional difference in software industry growth, especially the competitive situation of the first-tier cities of municipalities and other provinces, we take eight provinces and cities with the largest number of enterprises as the study objects, and investigate the concentration and performance level in each city (regional). Due to the data availability, herein we choose enterprise quantity and average sales income as the indices (Table 3). Through comparing we can see an overall fast growth trend in enterprise quantity, and enterprise quantity in eastern provinces is growing at a faster rate than in three municipalities, this is related with the fact that compared with the industrially mature cities such as Shanghai and Beijing, it is a relatively junior region of software industry and in its growth stage.

Table 3 Enterprise average sales revenue of main software base cities

		2008年	2009年	2010年
Beijing	Enterprise number	4418	4507	3501
	Enterprise average sales revenue (RMB ten thousand)	3560	4129	5434
Shanghai	Enterprise number	1166	1199	1325
	Enterprise average sales revenue (RMB ten thousand)	4889	5597	5675
Tianjin	Enterprise number	252	296	339
	Enterprise average sales revenue (RMB ten thousand)	5356	6921	6581
Suzhou	Enterprise number	1340	1492	1805
	Enterprise average sales revenue (RMB ten thousand)	8964	10759	10357
Zhejiang	Enterprise number	853	865	1063
	Enterprise average sales revenue (RMB ten thousand)	4950	5842	4425
Guangdong	Enterprise number	2798	2658	2755
	Enterprise average sales revenue (RMB ten thousand)	5056	6508	7967
Shandong	Enterprise number	518	511	1203
	Enterprise average sales revenue (RMB ten thousand)	7307	9471	5991
Liaoning	Enterprise number	510	625	750
	Enterprise average sales revenue (RMB ten thousand)	7300	8962	9586

Source: WIND database "China software industry development provincial data " obtained by calculating

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From the table, we can observe that three leading cities experienced downsizing in software industry, while those cities of second tier present an active development tendency. With the longest history in software industry development and the biggest overall scale city, Beijing has gradually reduced in the quantity of software enterprise even still with the largest number at present, while for four provinces of Jiangsu, Zhejiang, Guangdong and Liaoning, although their average enterprise quantity is far less than that of Beijing and Shanghai, their average enterprises sales income is higher than that of Beijing, and with a larger growth rate, except that the average sales income of Zhejiang enterprises has slightly dropped in the past three years, which is related with its developing momentum with 13% growth rate of software enterprise quantity. In the above four provinces, Liaoning gets the least number of software enterprises, but its average sales income is leading to the other three provinces, ranked second after Jiangsu in east.

To make contrast between different provinces, compared with Jiangsu, Zhejiang, Guangdong and Liaoning province, Shandong is a promising province, its enterprise quantity has increased more than five times compared with 2005, but as a software industry up-rising star, it is worth noting that with the enterprises quantity high-growth, its average sales income has dropped 18% in the past two years. This is related with the "extensive" development path in the early of industrial development. In Shandong, building new small and medium-sized enterprise is fierce due to the strong inclining policy on software industry, which results in rapid growth of enterprise quantity in the industry.

Export performance at Province level in China

Under the circumstance that software industry output is born from East China, talents and investment of this industry is highly concentrated in big cities of that region, which lead to “city cluster” of software industry. In this area, government policy oriented with pushing software export is implemented actively during the past five years. In 2006, the Ministry of Commerce and National Development and Reform Commission in China introduced a series of incentive policies to encourage enterprises which make efforts to expand software exports. A group of 11 cities are named as national software export base.

Moreover, the practice of service outsourcing on IT business is composed by the collection and integration of various software development services. And those outsourcing suppliers are local or foreign invested enterprises that undertake software development for a long time. Under the background of emerging service outsourcing development in service trade of China, policy makers put more emphasis on pushing competitiveness on export via outsourcing from local outsourcing suppliers. In 2006 and 2008, the Ministry of Commerce, Ministry of Industry and Information technology, Ministry of Sciences and Technology and Ministry of Finance issued a basket of incentives policies that include subsidies for technical reformation of export projects, R&D funding and talent training on strengthening capacity of service outsourcing of Chinese enterprises,. In practice, those policies are put into effect in big cities of East China province. Currently, a certain group of

cities are named as "service outsourcing base city", and the corresponding effort on the local level presented as software and outsourcing park establishment where incentive policies is put into effect. From the city list in the table, we can observe those two group of cities are overlapped highly (Table 4).

Table 4 List of base cities of two catalogues related to software industry promotional policy

City	National software export base (identified in 2006) 11 cities	Service outsourcing Base city (identified in 2006 and 2008) 14 cities
Beijing	√	√
Shanghai	√	√
Xian	√	√
Dalian	√	√
Chengdu	√	√
Jinan	√	√
Hangzhou	√	√
Guangzhou	√	√
Changsha		√
Nanjing	√	√
Shenzhen	√	√
Tianjin	√	√
Wuhan		√
Hefei		√

Source: WIND database "China software industry development provincial data " obtained by calculating

From the above table we can see that two kinds of base cities are overlapped over 90%, namely the vast majority of cities are identified as two kinds of bases. Those 11 cities of software export bases are concentrated by large number of software parks enjoying preferential policies of software export, and gathered software enterprises and their matching service providing institutions by preferential policies. Software export bases in 11 cities experienced high growth rate increases. In 2008, the total export contracted amount of these 11 software export bases was over $2.58 billion, an increase of 56.2% year-on-year

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and accounted for 76%[1] of total software export amount in this year, which present a powerful export force push from the spatial concentration of software industry.

In terms of the city list, we can see cities of central and west China, which were regarded as less developed cities in the past. The software industry in those cities experienced high growth rate development within a relatively short time driven by great-leap-forward development of IT and internet infrastructure and encouragement environment due to their status as pillar industries in those cities. During the past decade, local government in those provinces issued a series of incentive policies targeting export of software products, which compose a positive environment for software enterprises.

Pushed by a series of encouragement policies, software export in province capital and second ties cities are experiencing booming during the past couple of years, which contribute to very high share of export to output of industry at east China regions. We can see that Guangdong province and Liaoning province present very high export share compared with Beijing and Shanghai. (Table 5).

Table 5 Export Income and its share of output of eight largest software export cities (ranked by software industry output) (Unit: 100million USD)

Year / Provinces	Export Income					
	2007		2008		2009	
	Value	Share(%)	Value	Share(%)	Value	Share(%)
Beijing	4.59	2.77	5.35	2.41	10.48	3.80
Guangdong	48.39	34.51	91.30	42.08	105.40	36.41
Jiangsu	17.40	15.88	28.60	16.54	35.00	14.89
Shanghai	5.50	7.93	7.57	9.06	10.00	9.76
Zhejiang	5.99	13.65	6.80	11.16	5.35	7.07
Shandong	3.70	9.22	3.12	5.66	3.01	3.51
Liaoning	6.90	20.34	8.30	18.18	16.70	19.63
Tianjin	8.20	49.52	7.80	40.12	6.20	21.07

Source: China Electronic Information Sector Year Book (Software industry Chapter) (Year 2007, Year 2008 and Year 2009)

Note: exchange rate for converting export volume in USD to RMB use annual average exchange rate published by Bank of China.

[1] Data source: China software industry innovation development report 2010

From the table, we can see Guangdong province and Liaoning province present higher export share than municipalities. Those cities are experiencing the rise of enterprise internationalization and become new power of software industry in China. The emerging of those cities is determined by low cost advantage of software firms to a large extend. Driven by this force, software export in China emerge an obvious decentralization trend in recent years.

Software sub-industry development and its features at province level

With the constant breakthrough and development of software technology innovation and application category, software industry internal branch is developing in diversification trend in recent years. According to the differences of their mainstream technology, business type and application object, we divide the software industry into five sub-industries, and they are IC design, embedded software system development, software product development, software technical services and system integration respectively.

Table 6 Industrial income of five sub-industries

	IC design		**Embedded software system development**		**Software product development,**		**Software technical services**		**System integration**	
	In 2008	In 2009	In 2008	In 2009	In 2008	In 2009	In 2008	In 2009	In 2008	In 2009
Beijing	2.77%	1.67%	0.05%	1.07%	41.45%	41.80%	30.36%	30.29%	25.37%	25.17%
Shanghai	6.32%	5.22%	7.02%	7.45%	42.27%	42.92%	23.16%	24.59%	21.23%	19.82%
Tianjin	0.22%	4.05%	71.98%	46.34%	8.24%	21.95%	15.66%	21.95%	3.90%	5.71%
Eastern region*	2.69%	2.17%	21.90%	25.97%	41.69%	29.23%	15.65%	20.89%	18.07%	21.74%
Central region	0.42%	0.39%	5.29%	11.12%	50.06%	47.96%	13.76%	12.80%	30.47%	27.73%
Western region	3.09%	3.21%	4.34%	3.98%	45.45%	42.64%	15.94%	17.69%	31.18%	32.48%

Sources: WIND database “China's software industry data reports”, calculated and organized by the author. *except Beijing, Shanghai and Tianjin

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Note: herein the division of east, central and west refers to economic meaning, namely, eastern region includes Beijing, Tianjin, Shanghai, Guangdong, Fujian, Zhejiang, Jiangsu, Shandong, Hebei, Hainan, Liaoning, Heilongjiang and Jilin, central region includes Shanxi, Henan, Hunan, Hubei, Jiangxi, Anhui, and western region includes Shaanxi, Gansu, Ningxia, Qinghai, Tibet, Xinjiang, Sichuan, Guizhou, Yunnan, Chongqing, Inner Mongolia, Guangxi. As there is no data for Qinghai and Tibet in the database, western region includes 10 provinces (autonomous regions) without these two provinces (autonomous regions) in the table.

Comparing the shares in five sub-industries for each economic group, ie, structural features in the software industry development for each region, we can recognize the competitive advantages in the process of software industry development in different regions. From the data in the table, we can see that the comparison among four groups shows that the software product development industry takes the largest share in all sub industries among all the regions. This reflects the fact that the software development based on tangible product is still the uppermost business resource of all software enterprises; this is also consistent with the traditional advantage of the product development business of software enterprise currently. But it is worth noting that, except Tianjin, the income share of this sub-industry is gradually declining in all provinces and cities, especially in the eastern region, the software product income share declined from 41.69% in 2008 to 29.23% in 2009. While the shares of other three sub-industries including software technical services, system integration and embedded software system are generally close, and the first two sub-industries shares are close in each region, the incomes of these two sub-industries accounted for around a quarter of all software industry income in 2009 in each region. But from the change of both shares, we can see that the software technical services income share is improved greatly, while the share of system integration is dropping in most provinces and cities. From the comparison among different regions, we can see the growth of eastern region is larger than that of three municipalities and the Midwest. The scale of embedded software system varies in different regions, it takes very small share and in a modest increase in this industry in Beijing and Shanghai. While as a “Rising Star”, half of Tianjin’s software is consisted by the embedded software system. However, since the whole software income is very low in Tianjin, its absolute level of embedded software industry is still very small. Anyway, eastern region becomes the region with biggest share of embedded software. In these five sub-industries, as the highly technical required industry of software development activities, IC design accounts for the smallest share in each region, its share is in downward trend in Beijing and Shanghai, and less than 5% in all regions.

For the technology intensive degree and business mode in five software sub-industries, software product development has long been the "traditional business" of China's software industry, with higher technological standardization degree, it’s still the core business of the software industry, and takes the largest share in the output income, but it has presented a downward trend, which is consistent with the business model trend of software industry turning to service oriented. And as service industries for IT hardware industry including

communication industry and IT equipment application, the embedded software development and software technical services industries have become the most actively demanded industries in present software market. But what is worth noting is that these industries are highly concentrated in eastern cities rather than Beijing and Shanghai, this is closely related to the swift process of the urban information facility construction in eastern region in recent years. And as the most technical complexity industry, IC design services industry is still the emerging industry at the growth stage because of its closest connection with the product innovation of IT industry and high dependence on the modernization management ability of software enterprise. But currently its industry revenue contribution is rather small, this is related to the "application oriented" instead of the "innovation oriented" in the whole software industry in China.

When adjusting the data in above table based on the dimension of sub-industries, we can interpret the differences of the five sub-industries and understand their industrial advantages across different regions (Figure 6). According to these output shares of five software sub-industries in four regions, we can see that five sub-industries incomes are highly focused on eastern 10 provinces and three municipalities. Therein the most shares is taken by the embedded system service. As the most important business of China's software export in recent years, the embedded system service becomes the most important growth point of software export in eastern region and most outstanding field with competitive advantage of the second-tier cities in eastern region relative to the three municipalities, while for other sub-industries including software IC design, system integration and software technical services, their distributing shares of software products in four regions are very similar, namely eastern region accounts for around 50% of all country, three municipalities 30% or so, and the rest is distributed in the Midwest. It is worth noting that as high knowledge intensive sub-industries, the output value of software system integration industry or IC design service industry appears small drop trend contrary to the overall higher level of software industry in three municipalities, while its share of eastern region is rising marginally, there is no industry with most advantage in three municipalities, basically, it takes the share of 40%, higher than the embedded system software, and it is worth noting that the software technical services income with higher share is in gradually declining trend in three municipalities, while its share in eastern region has improved significantly.

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DOI: 10.7885/1946-651X.1048

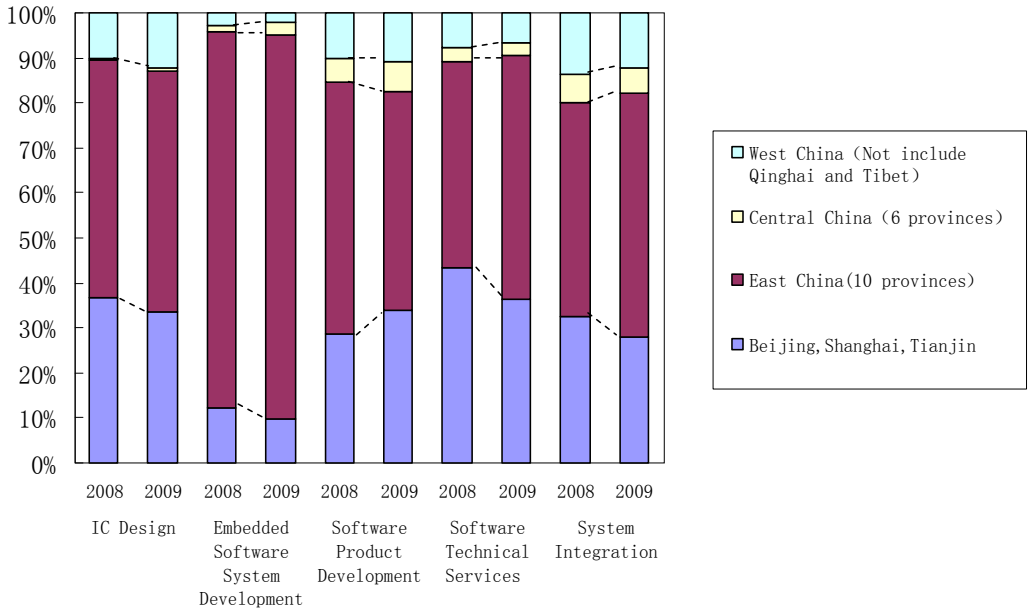

Figure 6 Share of four regions with the dimension of five sub-industries

Data Source: WIND database "China's software industry data reports", calculated and organized by the author.

Conclusion

Although currently the software export heavily concentrates in the East China provinces, the huge potential of the central and western regions provides vast hinterland for the industry and profession of eastern regions. Those cities in central and west China are experiencing software industry development and present increasing competitiveness in software export. In recent years, with the rise of second or three-tier cities in the east, the software industry has developed significantly, the space layout of the software industry expands from the economically developed municipalities to second or three-tier cities, the latter have vigorously promoted the development of the software industry cluster by park construction and incentive policies in recent years, and the increased speed of new enterprises number has proofed its developing vitality.

Software exports present the tendency of more balanced situation, i.e. second tier cities and capital cities in Central and West China are involved in aggressive export promotion policy and present active export performance. Under that circumstance, the export orientation development between leading cities in East China and second tier cities in Central and West China is under convergence tendency. The likely reasons include two aspects: first, those cities do make great effort in software industry investment by local government in infrastructure building and encouragement policy to all enterprises in that industry. Second, multinational companies are establishing subordinate institutions in second or third cities in China guided by cost-saving strategy, which promotes local software export capacity improvement. A batch of enterprises represented by Neusoft have set up branches or development centers in second-tier cities such as Nanjing, Xian, Chengdu, Chongqing, Wuhan, and the latter acting as the local cities of those branch companies outside the headquarters have built globally oriented software delivery centers.

For overall tendency in software export, all the regions in China perform downsizing in software products while upsizing in software service so far. And embedded software system dominates software export for most regions in China. And three municipalities, as the leading cities in software industry nation-wide, present higher share in software service export of high knowledge intensive catalogue than other cities, while they still have not yet composed absolute advantage in specific software service catalogue. In other words, four regions in China present similar export advantage so far. The reasons include: first, local firm has very limited self-innovation capacity and less developed marketing networking, second, cities in different cities is put under similar development strategy and software firms have very similar export planning, which causes the similar homogeneous competition pattern.

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