

Technology policy, Human resource and Chinese Software Industry

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Abstract: The competitiveness of the Chinese software industry is relatively weak internationally. This paper discusses three important factors behind this comparatively weak competitiveness: late support from government, language specific industry context and poor education and training systems. But recently, the industry has been pushed in a comprehensive manner and will make a leap-frog in the future.

Key words: software, government intervention, human resources

1. Profile of Chinese software industry

A. Short history of Chinese software industry

The software industry in China emerged in the 1970s, much later than developed countries. At that time, China was closed to the outside, so China had autonomously developed its own operation system for the 130, 140 and 150 computer series. In the early 1980s, China was more open and some university and research institutes began contracting data entry and simple programming work from foreign companies.

About 1985, the electronics market was born in Beijing Zhongguancun area. Some professors or research fellows around that area resigned from their institutions and “went down to the sea” to open their own ventures, software companies were among them. Software companies like Kingsoft (Jingsan), ufoSoft (Rengyou), Kingdee (Jingdie), which are famous today were all born in that time. In that time, typical products were a Chinese word processing system---WPS and general use business software.

From 1999 to the present, the software industry has entered a golden development stage. Thanks to the new economy in the USA and the emerging competition from Indian software industry, both the business community and the Chinese government are determined to accelerate the growth and development of the software industry. The milestones of which were the release of two official documents called “No. 18” (Some policy to encourage the development of software and IC industry (2000)) and “No 47” (Action plan to rejuvenate software industry (2002)). Both include a package of policy tools like tax incentives, procurement, training and education etc. for the software industry.

By the end of 2002, the number of registered software companies reached 6282, with revenue of 110 billion yuen or 13.3 billion US dollar (Table 1).

Table 1 The sales of software industry of China(1991-2002) (billion yuen)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sales	0.5	2.0	4.0	4.9	6.8	9.2	11.2	13.8	18.2	34.0	79.6	110.

Sources: Ministry of Information Industry, Electronics information yearbook, 2001-2002, . Electronics Industry Press, 2003.

Notes: embedded software excluded.

But generally, the Chinese software industry is monopolized by foreign companies. For example, the operating system market is dominated by Microsoft. Domestic companies only get one third of total Chinese market. Besides the operation system, the main application software in the banking, securities, civil aviation and metal industry all use imported software. Qu Weizhi, page 5, in CSIA,2003. From Table 2, we can see that the world share of Chinese software industry is limited (Table 2).

Table 2 Share of software industry of some countries (billion yuen)

	China(share)	Korea	India	USA
2000	7.17(1.2%)	8.32(1.39%)	8.85(1.48%)	240(40.2%)
2001	9.63(1.5%)	9.90(1.60%)	10.2(1.6%)	261.2(42%)
2002	13.3(1.91%)	16.8(2.42%)	12.2(1.75%)	28.0(40.2%)

Source, CSIA(China Software Industry Association), Annual Report of China Software Industry(2002-2003). P.76.

In this paper, we analyzed the software of industry from perspectives of government support, industrial context and human resources. We found that the relative low competitiveness of the Chinese software industry was related to three factors: late support of government, the language related industrial context and a poor system of human resources training, as I explain below.

3. Technology policy for the software industry

A. Direct support for the software industry from government

In China, technology importation was a very important way for industrial change in China. For example, for a long time, technology importing expending was larger than autonomous R&D until 1999. In the same time, the government thought that hard technology was better than soft technology. So when importing technology, more money went to hard technology, less on assimilation which needs software and training (Table 3). Furthermore, software technology is not easy to transfer. It cannot be learned by reverse engineering or so like manufacturing technology. So generally, the software industry was not only in a *laisser-faire* condition, but also in a closed context with no intensive technology transfer from developed countries.

Table 3 Expenditure on technology related activity (billion yuen)

	R&D expenditure	Technology importing	Assimilation of imported technology
1991	5.86	9.02	0.41
1993	9.52	15.92	0.62
1995	14.17	36.09	1.31
1999	24.99	20.75	1.81
2000	35.36	24.54	1.82
2002	56.02	37.25	2.57

Sources: Ministry of Science and Technology, China Science and Technology Yearbook, 2003, China Statistical Press, 2004.

So, the government came rather late to help the software industry in China. In the big government “863” high-tech program which dated to 1986, in area of software, R&D support went more towards CAD/Cam, CIMS and MIS, the purpose of which was not to help the software industry, but as an important way to upgrade the traditional manufacturing industry.

The turning point for the software industry came at the beginning of 2000. That was an era for IT technology in the world. And it pressed the Chinese authority to make a concerted and determined effort to assist the software industry .A very big step following that was to launch a policy package under the “No.18” document. It is called “Some policy to encourage the development of software and IC industry” dated July 24, 2000. Following that, in 2002, the government launched a second very important document called “No 47” called “The principle of rejuvenating the software industry ” which covers more than the earlier one including financing, exporting, human resources, government procurement and others.

Since 2000 and the new policy initiative, the direct support to the software industry became stronger than ever before. In 2002, in “863” software R&D was about 0.4 billion yuen, almost double that of 2001, there was also a special project on software industry (MOST, 2003). “Fund for electronics and information industry” of the Ministry of Information Industry, “863 high-tech program”, “National S&T Breaking-through Program”, “Fund for S&T based SME innovation” of MOST, all perform specific R&D for the software industry. In the “No.47” document, it explicitly said that, from 2001 to 2005, the total national fund for R&D for software will be about 4 billion yuen. (CSIA, 2003)

The strategy of informationalization pushed the software industry and it was a strong push too. It not only opens a huge market for the software industry, such as e-government, but also gives local companies a good opportunity to develop an autonomous operating system software for this strategy. For example, government has already supported a lot of Linux-based projects. The on-going special project for Linux operation from MOST is about 140 million yuan.

B. Tax policy

The most important government effort for software industry is tax policy. For a long time, the taxes for software firms mainly are two: the value added tax and income tax. But before November of 1999, software companies did not have their own special taxes, though they could enjoy the favorite tax that general high-tech firms have. But the introduction of value-added tax in 1994 gave software companies a big hit as they do not have much equipment and material cost, their main cost is human labor. The result is that software companies have to pay a higher tax in real terms than most companies in other industries. Some have calculated that, under the 17% of value-added tax, after the cost reduction, most firms will pay a tax of 7-8%, but software firms have to pay a tax of 11%.(Su Jin, 2000)

In order to reduce tax costs of software companies, in July 24,2000, “No.18 ”was published. Observers have said that this document has milestone implication for Chinese software industry.

The new policy primarily said: “Government encourage domestic software companies to develop software product. Before 2010, tax administration authority will collect tax of 17%, but it will pay back to the companies if the tax rate is larger than 3%. ”

“Secondly, the new software companies can enjoy the free income tax for the first two years and half income tax in next three years since its profiting year”. “The subsidy can be used for R&D investment and further production ”

So the real income tax for software firm falls to 3% from previous 17%. This is a real big favor. It gives a lot of companies of advantages. For example, Tope Software in 2001 got this kind of subsidy of 11.6 million yuan, about 21% of their profit in the year (Su Jing, 2004).

But the tax policy has its costs. A government official estimated that, No.18 document has made the government loss of 2 or 3 billion yuan till now. So there will no more any tax policy for software industry in the future (Su Jing,2004).

The second important document is “No.47”, issued in September of 2002. The document explicitly said that when government needs to purchase software, it should buy the domestic product first as long as

the products are equal. It also suggests that the government tuse autonomous Linux for operating software and WPS for office software. It also requests that in the government information engineering project, the minimum share of money for software is no lower than 30%.

Procurement policy helps the software industry too. In 2002, the value of government procurement was 100 billion yuen, 20% of that was spent on telecommunications and IT products. For example, in 2002 the Beijing government purchased 3 million yuen of software products including Redflag Linux, WPS 2000 and others. Microsoft was not pleased by this decision.

C. Software park

Following the establishment of many high-tech zones in China, the software park has been the main channel for development of the software industry. Firms in those parks enjoy lot of policy advantages. But the policy came also late, not until August of 1996. By that time 22 national-level software parks in that year were open in China supported by MOST. Following that, eleven national software industry bases were established under support of Ministry of Information Industry and State Development and Reform Committee. By the end of 2002, there were 7128 companies in those parks, their total sales are about 95.7 billion yuen. We can say that almost all software companies are located in those parks.

3 Language related industry context

Language is an important element for software industry. For example, software application in financing system, administrative service; is closely related to language and local institutions. This specification makes software consumption different from general goods. For this reason, even Japan and Korea which thrive in the manufacturing business but so not have a large software industry (Table 2).

So, for language, culture and other reasons, domestic companies were the main actors in the industry, this makes the Chinese software industry relatively close to outside compared to other industries. The result is: in terms of sales, domestic companies take 82.26% of the market. The rest is taken by foreign related companies (Table 4). Usually in other high-tech industries like mobile phone, multinationals will dominate in sales and exporting.

Table 4 Share of domestic and foreign related companies in software industry

	Number of firms	Share	Sales (billion yuen)	Share
Total	4700	100	11.00	100
Domestic firms	4056	86.30	9.05	82.26
Joint venture	644	13.70	1.95	17.74

Source: MII, Economic Outline and Trend of Electronics and Information industry. Electronics Industry Press.2003

Language also explains why Chinese software companies are not competitive as Indian software companies. In contrast to Indian companies with a strong contracting service capability, Chinese companies are weak in contacting for outsourcing work because English intensively used in contracted work. Therefore volume of exporting from China to other countries is low and Chinese marketshare is limited (Table 5).

Table 5 Exporting of software of China billion yuen

	Total revenue of the industry	Value of exports	Share of exports
1999	44.15	2.10	4.8%
2000	59.30	3.30	5.5%
2001	79.60	6.00	7.5%
2002	110.00	12.40	11.2%

Source: CSIA, Annual report of China software Industry (2002-2003). P.106.

In 2002, the exports totaled 1.5 billion US dollars 60% to Japan and 21% Southeast Asian countries with only 12% exported to the US market (Table 6).

Similarly, Chinese companies are more able to export program software for the Japanese and Korean markets than American market. But in order to win the American outsourcing, both business and government are working to upgrade international competitiveness of the software industry in future.

Table 6 Share of software exporting of China in 2002

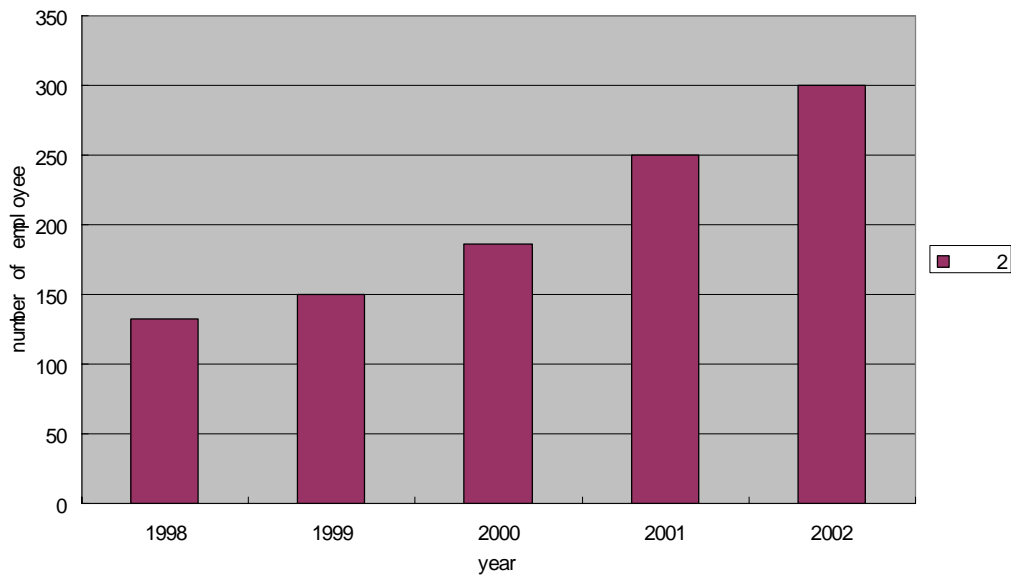
Regions	Japan	Southeast Asia	USA	European	Others
Share	60%	21%	12%	6%	1

China Software Industry Association(CSIA), Annual report of China software Industry(2002-2003). P.107.

4. Poor education and training system of human resources

Human resources are said the comparative advantage of China as the cost of software engineers is much cheaper than that of USA. China also has lots of universities to provide the engineers for software programming. In 2002, there were 300,000 software R&D engineers in China (Figure 1).

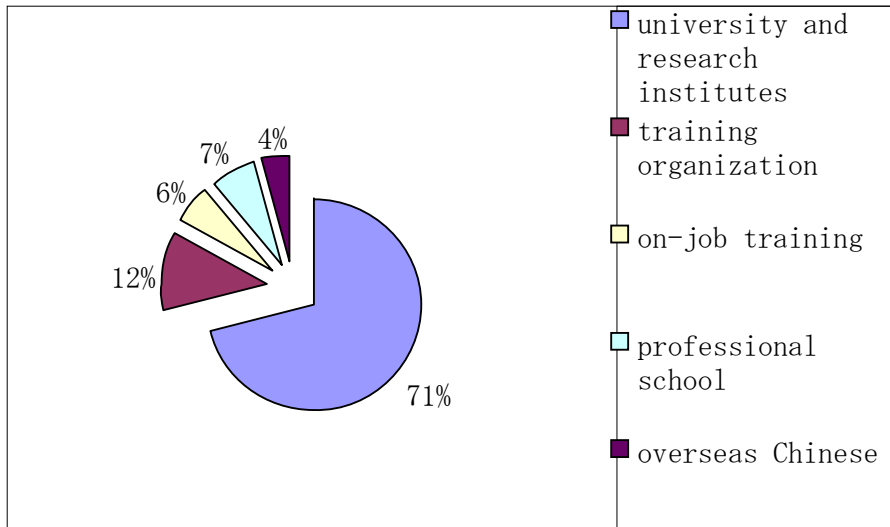
Figure 1 The size of software industry employee 1998-2002 (in thousand)



Source: CISA, Annual report of China software Industry(2002-2003), p.99

The main bases for software engineers are as follows (Figure 2):.

Figure 2 Sources of software engineers in China



Source: CISA, 2003, Annual report of China software Industry(2002-2003).p.153.

University: In 2002, there are about 7 million students in university, 7% of them majored in software and related areas. In 2002, 70,000 students who specialized in software went out of camps to become engineers. In order to expand training capacity, the government permits about 35 universities to open Demonstrating Software School, each with a size of 800 students annually. The government will provide 1 billion yuen to support the infrastructure and other use for these Demonstrating Software Schools.

Training school: training school is the most popular form of training and it is the very base of huge “blue collar” for China.

Regarding job training and open-university education: now there are 1.2 million Chinese who have passed some qualification exam for computer related jobs.

Business or Private training agencies: more and more software companies offer software related training. For example, APTECH of Peking University’s Blue Bird Software Company opened a ACCP software engineering train course. In 2002, it had enrolment of 12,000 students. At the same time, lots of software parks began opening software colleges jointly with universities

Return of Overseas Chinese: these are experienced and talented software engineers. Their number in China is limited but their role is important. About 4% of software engineers in China are overseas Chinese.

A very important emerging trend is that more and more foreign software companies and specialized training schools came to China to enter the training market after China become a member of the WTO. For

example, IBM has set up a joint training with Shangton University ---Shangtong-IBM software training base in September 26 of 2002. In collaboration with Jiangsu software park, IBM set up a joint training for engineers there. Microsoft does not lag behind. It signed an agreement with the Ministry of Education to implement a “Great Wall Plan ” to help China’s software engineer training. Oracle and Sybase have some similar ways of training. India’s NIIT has a joint company with a Tianjing-Tiancai to offer specialized training to model the Indian experience.

But in China, though having this positive progress, the education and training of software engineers is still very weak. As the software industry was seen as important for a long time, China has been facing shortage of software engineers continuously. For example, a report said that in 2002, the industry needs about half a million software engineers, but all education related institutions can only provide 100,000 qualified persons. It is said that the gap will be larger soon (CISA, 2003)

Not only the quantity is not enough for market, the big problem is the poor quality of education and training. The training courses usually give more “theoretical knowledge” and can not offer the students a good operating experience. Both professors and Chinese business engineers are not familiar with international standards. It is known that a lot of Chinese are good at textbook learning and poor in practical learning.

So, most of software education and training in China does not match the real demands of business. For example, reworking of course books in the USA takes about 18 months, in China, it takes 5 years on average to do so (CISA,p.167,2003). Because of this, people out of school need more time to adapt and fit the practical job requirement.

5 Conclusion

The software industry in China is a relatively young and small industry. Traditionally, it lacked an appropriate atmosphere in which to grow. Policy, education base and other factors were at the level necessary to support software companies in China. But we are seeing that everything changing in last four years. The big market is there, now government support comes, a more international training system is being established, with great opportunities for doing contact work for developed countries’, we are sure that a golden growth period is coming for software industry in China.

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