

Master Thesis in Informatics



The Future of China's Software Outsourcing Industry

- A Choice of Region to Source from

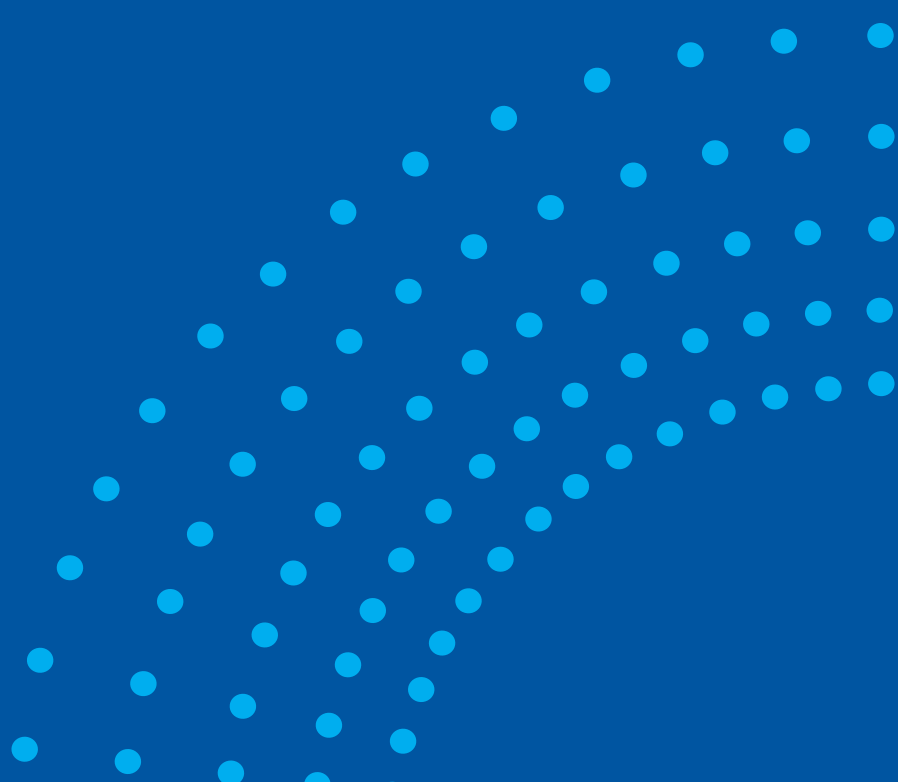
Stefan Klotz

Göteborg, Sweden 2004

IT University
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GÖTEBORG UNIVERSITY AND CHALMERS UNIVERSITY OF TECHNOLOGY
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SUMMARY

Currently outsourcing is one of the strongest growth areas in the IT industry. Forrester estimated that the number of US IT jobs going offshore would rise from 27,000 in 2000 to a cumulative total of 72,000 by 2015. Previously, India has been the main focus point for offshore software development efforts. This is now slowly starting to change with challengers such as the Philippines, Russia and China entering the stage. This study focuses on the future of China's outsourcing industry and how different future developments may affect the attractiveness of different Chinese regions from the perspective of locating an offshore development center. The report starts by analyzing the Chinese business environment and the software industry. Trends are identified that will contribute to the shape of China's future software industry. Based on this analysis, scenario technique is then used to outline the positive and negative features of different regions' development prospects from a software sourcing perspective.

At the moment Beijing and Shanghai are able to offer the deepest human resources pools, the most famous universities, the best infrastructure and the highest level of development, but at a high cost. Nanjing and the surrounding region can provide almost the same quality of education and research but much cheaper. The alternatives that most likely will remain cost competitive in the long run are Xi'an and Chengdu in the western regions of China. The main risks for the developed coastal area are wage inflation and over-development. The future threats to the inland regions are brain drain and a significantly slower pace of development than in the coastal regions. The major threat to all of these regions is stagnating development and economic downturn caused by unsuccessful reforms, rampant corruption and political turbulence.

Keywords: outsourcing, offshore software development, China.

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If I initially would have known, what it would take to complete this piece of work, I think I would have thought twice about doing it. Still, after finally completing it, I am very happy that I did it.

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Stefan Klotz

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Acronyms and Abbreviations

ADM	Application Development and Maintenance
AMC	Asset Management Companies
BPO	Business Process Outsourcing
CCP	Chinese Communist Party
CIS	Clinical Information Systems
CJV	Contractual (Cooperative) Joint Ventures
CMM	Capability Maturity Model
CR	Computer Radiography
CRM	Customer Relationship Management
CSIA	China Software Industry Association
DC	Developing Country
DR	Digital Radiography
EIT	Enterprise Income Tax
EJV	Equity Joint Venture
ERP	Enterprise Resource Planning
ETDZ	Economic and Technological Development Zone
FIE	Foreign Invested Enterprise
HIS	Hospital Information System
HISS	Hospital Information Support System
IPR	Intellectual Property Rights
ISO	International Standards Organization
ISV	Independent Software Vendor
IT	Information Technology
LIS	Laboratory Information Systems
M&A	Mergers and Acquisitions
MIS	Management Information System
MOH	Ministry of Health
NPL	Non-Performing Loan
ODC	Offshore Development Center
PACS	Picture Archiving and Communication System
QA	Quality Assurance
R&D	Research and Development
RMB	Ren min bi, Chinese Currency unit
SCM	Supply Chain Management
SE	Software Enterprises
SEI	Software Engineering Institute
SEZ	Special Economic Zones
SOE	State Owned Enterprise
SW-CMM	Capability Maturity Model for Software
T&M	Time and Materials
TRIPS	Trade-Related aspects of Intellectual Property Rights
TVE	Township and Village Enterprise
WFOE	Wholly Foreign Owned Enterprises

Introduction

One of the strongest growth areas in the IT industry is outsourcing services. Gartner predicts that US outsourcing to India will grow by 25% in 2003, while Forrester estimated the number of US IT jobs going offshore would rise from 27,000 in 2000 to a cumulative total of 472,000 by 2015. The trend in Europe is also strong, with Gartner predicting a 40% growth in the offshore outsourcing market in 2003 (Moran 2003).

The initial destinations for these outsourcing services were primarily India, Israel and Ireland. These countries now face competition from countries in Eastern Europe, Russia, the Philippines, and China. India enjoys a first mover advantage with companies such as Tata Consultancy, founded in 1968. Due to past British influence, India also has a culture more similar to western countries than China, for example, which means that the business environment has been easier to understand. Such a long history in providing software services has enabled India to develop high-level skills and services, which might lead to wage inflation. Given this and the continued growth in demand of software outsourcing services, opportunities are opening up for a country like China where costs are still relatively low, and the market is relatively immature. One example of the differences in cost level is found in a recent issue of Business Week, where the monthly wage for a software engineer in Shanghai is said to be US\$ 500, in India US\$ 700 and in the USA US\$ 4000 (Einhorn and Kripalani 2003). In places like Xi'an or Dalian, the average salary level would be less than US\$ 250 a month (ChinaHR.com 2000). Global demand for outsourcing services might also have a positive impact on China's role in the offshore outsourcing market. India currently has 445,000 IT-workers and this is expected to grow to 625,000 by 2005. Global demand, on the other hand, is expected to reach 1 million by that time (Qu and Brocklehurst 2003), and this gap has to be filled.

Another reason to consider China for IT-service is the 1.3 billion people marketplace that China constitutes. The market opportunities will further increase as China fulfils the entry requirements of WTO, and a number of industries are opened up for foreign competition. Some examples of sectors that need a remake of their IT-infrastructure are banking and insurance. This opens up further opportunities for foreign software vendors.

Although there are a number of compelling factors for software development in China, there are also a number of issues. The most commonly cited ones are: insufficient process maturity, insufficient language skills, cultural differences, lack of project management skills, intellectual property rights issues, infrastructure problems, poorly developed sales channels, etc. Another obstacle is the evident lack of service providers with international experience. Even though China's software industry is roughly of the same size as India's, the biggest of China's software enterprises focus mainly on contracts with local customers in the domestic market. This is one of the reasons why Chinese software exports are just a tenth of India's (Qu and Brocklehurst 2003). Although the problems are evident, Gartner predicts that China will be one of the top three countries for software application outsourcing by 2010. One sign of change is the increase in CMM certification. Now there are around 70 companies in China that have reached CMM2 and above. Most of these have passed the assessment in the last two years.

For entrants into the Chinese market, the different culture, language, history, political system and ways of thinking all act as hurdles to understand the business environment. This report provides an overview of the macro-context, analyzes the software industry and identifies driving forces, uncertainties and trends in the business environment. On this foundation scenarios are used to analyze which regions will be most beneficial to source from for software application development. This can then form the foundation of sourcing strategy for software application development in China.

Question

The report contains three different parts. The first part introduces the Chinese business environment for software development, the second part analyzes the Chinese software industry and the final section merges the analysis of the software industry with scenarios of China's future to evaluate:

Which will be the most beneficial region for the establishment of an offshore software development center with the timeframe of 2015?

The intended audience for the analysis is someone that is interested in or researches offshore software development and want to know more about regional differences in China in terms of locating software development centers as well as how the advantages and disadvantages with one location may change over time. The evaluation will be broadly based on the following factors:

- Human resources in terms of
 - Labor cost
 - Size of overall labor pool
 - Competition for labor
- Education system and Universities
- Government support mainly in terms of tax benefits
- Country risk
- General development level
- IPR
- English language skills and cultural adaptability to western markets

Theory

Software Development and Outsourcing

During the last ten years a lot of the academic and management literature has focused on the phenomenon of outsourcing software development. India has been one of the catalyzing forces and has become something of an icon for offshore software development. The questions that these studies have focused on can be centered around three themes: why outsource, what to outsource and how to outsource (Heeks, Krishna et al. 2001)? Heeks and Nicholson have also been influential in terms of looking at the factors that affect the development of a software industry, where some attention also has been spent on China (Heeks and Nicholson 2002). Still, China's software industry and the opportunities for offshore software development have generally not received much attention in academic writing. Two of the rare articles are "China's Budding Software Industry" by Ju de hua (2001), and "What Will It Take for China to Become a Competitive Force in Offshore Outsourcing? An Analysis of the Role of Transaction Costs in Supplier Selection" (Qu and Brocklehurst 2003). The first article is an overview of the Chinese software industry and the problems and opportunities that exist. The second article argues that the transaction cost is more important in offshore software development than currently perceived. The authors also argue that China will have difficulties in competing with India due to higher transaction costs. The use of scenario technique to analyze the Chinese software industry has also been relatively limited. One example is a project, where scenarios were used to analyze the development opportunities of the software industry in Guangdong in southern China (Yang, Zeng et al. 2000). The results of the project were presented in the proceedings to an IEEE conference in 2000. On the other hand, the opportunities of Chinese low-cost outsourcing are currently receiving a lot of attention in reports that deal with IT and in other business oriented media.

In the next section, the concepts that are useful for this study are considered in further detail. A lot of the models and concepts might be of a general character, some of which have been derived from Indian examples. Still, all of them are relevant for the research. The first section considers development strategies on a national level. The second section provides success factors for developing a national software industry. The third section considers sourcing and offshore software development from a corporate perspective. The final section outlines some criteria for evaluating offshore development vendors and regions for outsourcing.

Software Development Strategies for Governments in DC's

Heeks (1999) provided one way of considering the strategic software development choices of a country (figure 1). He measured their choices along two dimensions: market served and type of software business. Except these extreme strategies, companies can also adopt strategy positions between these extremes, otherwise known as strategy E.

The most attractive positions are often seen to be A or B due to the seemingly high rewards. However, it is rare for developing countries (DC's) to break into square B. Most of the software business falls into square A. There are a number of barriers to entering these markets. One is the cost of creating infrastructure that supports software development. Another barrier is the "FUD" factor. "FUD" stands for "fear, uncertainty and doubt" (Kumar 1998 in (Heeks 1999)) and signifies the skepticism that companies may express towards outsourcing to a DC.

The fact that countries like India and Singapore established themselves as service providers far earlier also renders entry into square A difficult. B could even be seen as even more difficult to enter, since the since development cost is just 30-40% of the total cost (US Department of Commerce, 1984 in (Correa 1996)). This implies that the potential cost advantages are less attractive.

		Software Business	
		Services	Packages
Market Served	Export	A	B
	Domestic	C	D

Figure 1, Strategic Positioning for Developing Country Software Enterprises

For those countries that have already reached square A, there are three generic strategies that can be pursued according to Heeks (1999). One is to diversify in the service market and take advantage of trends such as Y2K and Euro adaptation. Another desirable strategy is to climb the value chain. One approach to achieving this goal is through industry specialization that leads to improved trust of the client and also raised skill levels. Inter DC's markets are also an option. Some recent examples are Japanese, Korean or Indian companies outsourcing to China.

For the late-comers, on the other hand, the former approaches may not be viable strategies. Two more suitable options for them are a low-cost strategy or a niche strategy (Heeks and Nicholson 2002).

According to Heeks, position D in the matrix is not desirable. In particular, being competitive in producing general application software, like word processing, spreadsheet applications etc, is very difficult. The main reason for this is the inflow of pirated or legal international products. Global software giants such as Microsoft also have a distinctive advantage, since its R&D spending can dwarf the IT spending of whole countries.

Heeks claims that most of the firms in DC's pursue a *square C* strategy. This means providing services to a local market and then using this as a springboard to reach into exports. If the local market is sizeable and demanding, potential cooperation with foreign firms might lead to development of skills. Heeks asserts that most local markets are rarely sizeable or demanding, which leaves the development opportunities limited.

The second most successful strategy after A is something that Heeks (1999) calls the E strategy, a strategy moving between the squares in figure 1. What one can find here are companies that have found some kind of niche such as language adaptation or some sectoral

niche such as banking or insurance. Two generic strategies that have proved successful are to find a local niche that can sell overseas and that provides synergies and leverage, or to find demanding globally competitive customers on the local market that serve as a “springboard”. Blocking the path for this kind of strategy is normally the skills profile, that in most cases is too programmer heavy. According to Correa (1996), 85% or more of the DC's workforce is made up of coders, which leaves a gap in terms of analysis and design skills. Finance is also an obstacle with a low supply of venture capital in DC's.

Based on reviews of countries in South America and Asia, Correa (1996) provides another perspective of national strategy and outlines three basic types of software export strategies. Some of these can be seen as the stages in a development process, although it cannot be said to apply in all the cases.

Export of Work

This means short term work at the clients' premises, or body-shopping. The risk for this kind of operation is generally low and the value added component is also low. Through these kinds of contracts, experience in the fields of management and methodologies can be accumulated, whereas it has a limited contribution to the development of design skills.

Export of Software Development Services

This generally takes three forms: development of custom-made software in accordance with clients' specifications, development of software in the framework of subcontracting, or establishment of software development centers as joint ventures. This requires higher investments. The risk will also be higher as well as the value added component. Some of these options will lead to higher marketing costs than the “export of work” option. The costs will still be lower than the option of “export of products”.

Export of Products

This approach requires capital management skills, marketing and product support services. The value added component is higher than in the previous alternatives and the opportunities for high profits are superior if successful. Yet, the risk is higher and odds of succeeding are limited.

Success Factors for Software Development in DC's

For the software industry to develop and grow there are a number of factors that need to be catered for. This is a summary of the factors that could be seen as fundamental for the development of a national software industry (Heeks and Nicholson 2002).

Demand

Demand can be divided into domestic and international demand for software-related services and products. International demand has had a clearly positive effect on the industry's growth. Whether domestic demand has been beneficial to develop an internationally competitive software industry or not has differed from case to case. In the case of Israel, local demand enabled the industry to build skills that later could be sold in the international market. For India on the other hand, the lack of local demand forced the industry to proceed abroad to find customers. One crucial factor seems to be if the clients constituting the local demand have high requirements.

National Vision and Strategy

In the cases of the three leading software developing nations, India, Israel, and Ireland, a national strategy with support on government and business has guided the development of the industry. In the case of India, the initial strategy emerged in the 1970's.

Linkages and Trust

In order for the software enterprises to reach outside the country and act on an international level, there needs to be linkages and trust. To strengthen these areas, there are a number of measures that can be taken. These are some examples.

- Make it easier for people to get out: reduce the red tape and other restrictions on movement of professionals to other countries.
- Encourage people and money and ideas to flow in: this will particularly focus around creating a positive climate to foreign investment, through tax incentives, liberalization of financial controls and investment limits, and reduction in other bureaucratic overheads. It will also include stronger contacts with nationals overseas, and the use of workshops, seminars and the like to get ideas into the country.
- Facilitate relationships: investment in both general and specific meetings both in country and overseas that can help build trade relationships.
- Build trust: address the perceived risks of software exports. Some areas are obviously outside the control of the government. However, measures that can be taken include improved legislation regarding, for example, software piracy, subsidies for ISO9000 or CMM accreditation, and setting accreditation requirements for government purchase.

Software Industry Characteristics

The development also depends on the industry forces. These are some of the factors that relate to the capability of the industry (Heeks 1999).

- Ability to identify demand-growth markets and synergies
- Ability to come up with concepts for cost and service innovation
- Marketing capability
- Access to investment and working capital
- Access to programming, analysis and management skills

- Access to information technology
- Capability to develop networks on three levels: Internal Networks, Peer Networks, External networks stretching abroad.

Domestic Input Factors and Infrastructure

Table 1 shows different areas that relate to infrastructure and input factors and how these can be supported in the government's overarching strategy.

Factor	Possible Promotional Interventions
People	General education at primary to tertiary levels; specific further and higher education and training in IT- and software- related skills/knowledge; investment/subsidies for research and development; encouraging diffusion of best practice
Technology	Investment in telecommunications infrastructure; encouraging/facilitating greater involvement of private and foreign investment in telecommunications; reduction of tariff barriers on IT imports
Finance	Investment in and facilitation of venture and working capital funds; encouragement of foreign investment
Research and Development	Investment in freely- accessible market research; subsidized marketing activities, promotion of information sharing in areas of common interest such as creation of industry associations; investment/subsidies for marketable research and development
Other	Investment in transportation and utilities; reduction in bureaucratic procedures

Table 1, National Government Tactics to Support Software Related Infrastructure

Based on these factors, Carmel (2003) goes further in evaluating their importance and breaks up some of the subcategories to form stand-alone success factors. The nine factors that emerge from his analysis are:

- **Government Vision and Policy**
- **Human Capital**
- **Quality of Life**

- **Wages**
- **The Industry**
- **Capital**
- **Technological Infrastructure**
- **Linkages**
- **Other Factors**

Corporate Software Development

Some of the more recent driving forces for offshore software development as the service offering has matured are faster-time to deployment, focus on core activities, access to critical technology skills, improved quality, and improved resource management (Aberdeen Group 2002). Still, the main argument from the beginning has been the potential to lower costs. Since the process of developing software is labor intensive, labor accounts for more than 75% of the cost. There are clear incentives to outsource this type of operation to developing countries, where labor costs are lower. Sourcing can be divided into different branches. The following is a common way of categorizing different strategic approaches as outlined by King (2001):

Outsourcing

This can be seen as the use of external agents to perform activities that were previously performed in-house.

Insourcing

Simply means that the services are performed internally.

Strategic Alliances

Strategic alliances are activities conducted by two or more organizations, for example, a joint venture. The primary basis for a strategic alliance is the ability of one partner to provide a capability, asset or service that complements that of the other partner, and the unwillingness or inability of the second partner to provide that resource on their own.

Internal Markets

This implies that the IS department does not just provide services internally but also to external parties. The IS department then has to bid on internal projects and in that way deal in a competitive environment.

In an article in McKinsey Quarterly (Amoribieta, Bhaumik et al. 2001), the software development process is divided into six different steps: project initiation, analysis, logic design, physical design, implementation, and maintenance. Generally, the initial steps of the process are poorly suited for outsourcing since they require a lot of interaction.

Selections Criteria for Vendors and Regions

There are a number of factors that companies give different weight to and use to evaluate the suitability of an outsourcing vendor. According to the Aberdeen Group, the top five factors are: technological expertise, vertical industry expertise, supplier viability, price, and previous successful service relationship. Brocklehurst and Qu (2003) introduce a more detailed picture of common criteria. The focus of their article was on transaction cost which can also be found in this listing.

- **Production costs differentials**

The authors of the article argue that small differentials in production cost might not be very important, and that transaction cost might also have an important role.

- **Language barriers**

Where these are low, communication costs fall and there is less misunderstanding, which leads to lower uncertainty.

- **Government support**

Incentives reduce production costs and attract more investment into the sector. High-level commitment by government may reduce the opportunistic behavior of vendors.

- **Pool of IT professionals and education system**

This guarantees the availability of human resources, which reduces uncertainty and avoids increases in production costs due to labor shortages.

- **Quality**

This is the basic requirement of a product or service and reduces monitoring costs.

- **Culture fit**

People prefer to work with those who come from the same culture for a reassuring atmosphere. Given a good cultural fit, it is easier to communicate, understand and monitor and thus reduce contractual costs.

- **Political stability**

This means lower uncertainty.

- **Financial robustness**

If the vendor goes bankrupt, this would lead to no delivery and force the buyer to find a new vendor and increase contract cost.

- **Process and methodology (CMM)**

By means of standardizing processes and third-party monitoring, uncertainty/complexity is reduced. Still, given that vendor has passed the test, it is no guarantee that the processes are carried out in that way on a daily basis.

- **Supplier reputation**

Giving consideration to reputation in source selection can reduce opportunism by sellers, thereby reducing the uncertainty and thus the transaction costs for buyers.

- **On-site representation**

This could reduce the transaction costs for buyers. However, it increases sellers' transaction costs.

- **Expertise**

Hardware/Software: a Windows–Intel platform, as well as common developing tools and skills, produces lower asset specificity for suppliers. Equipment such as mainframes could be provided by clients or accessed through the Internet, thereby reducing asset specificity for suppliers as well. However, some special skills or business knowledge required by a customer may only be useful for that specific customer. This will increase asset specificity on the supplier side.

- **Commitment of outsourcing**

- **Experience/Heritage**

Since the two parties know what the partner can provide, the outsourcing process is made easier.

- **Proven offshore methodology**

This might be seen as more important than a quality rating.

A.T. Kearney, an American consultancy firm, has developed a quantitative evaluation model to rank different countries in terms of attractiveness for offshore business processing. These are the factors that they used as inputs to their model (A.T.Kearney 2003).

Cost

- Cost of labor
- Cost of management and infrastructure
- Tax and treasury impact

Environment

- Risk (political and economic)
- Country infrastructure
- Cultural compatibility
- Geographic proximity
- Security of intellectual property

People

- BPO and IT process experience
- Size of labor market
- Education level of workforce
- Language barriers and literacy rates
- Employee retention

The sections about “Software Development Strategies for Governments in Developing Countries” and corporate software development are mainly here to provide some context. The section about “Success Factors for Software Development in DC’s” serves an important role by providing the areas to analyze to determine the future development path of the software industry. Some of the factors in “Selections Criteria for Vendors and Regions” are later used to determine the attractiveness of different software regions in the context of the different scenarios.

Methodology

Research Philosophy

When discussing research approach, it is common to refer to qualitative and quantitative perspectives. The traditional quantitative approach regards the world as more or less objective, and the observer as being separated from the objects that he studies. When assuming a qualitative perspective, reality is seen as an individual, social and cultural construction (Backman 1998). Since the result of the research primarily depends on the analysis, and factors that are considered as important by the interviewees, as well as the researcher's interpretation of the data, this thesis would fall into the category of qualitative research. Qualitative research is also descriptive. This can be said about descriptive research:

The purpose of the major part of descriptive research is restricted to describing something that exists, although there is also descriptive research that indicates causal relations. One does not include any manipulation of the research object or measures to be taken. The researcher perceives things as they are (McMillan and Schumacher, 1984 in (Merriam and Nilsson 1994)).

This quote also reflects another goal of this thesis, to describe the complex system that the Chinese environment for software development forms and create a picture of what forces affect the strengths and weaknesses of the regional software industries.

In a piece of writing about how to write academic articles, Sørensen (1994) categories the type of result one can expect from research along two dimensions. The first dimension sorts research into theoretical or empirical approaches. The second dimension divides the result into analytical or constructive results. Since most of the data for this research is empirical and scenarios are used to represent potential future development patterns, the results of the research would be classified as using the empirical approach, since most of the data is empirical. This approach was used to reach constructive results by highlighting important macro forces that have an impact on how the software industry develops in different regions.

In article called Future Studies: Science or Art Niiniluoto (2001) argues that the kind of answers that one can find by using scenarios is conditional answers that are based on logical reasoning. As an illustration, in this study the topic is the attractiveness of different regions for software development. Since each of the scenarios are based on logic, such as if one currently is in a situation A, situation B, or the finishing date of the scenario, can be reached by satisfying X and Y. Therefore, if region 1 is most attractive in situation B, this answer is conditional to X and Y being satisfied, i.e. the answer is conditional.

Choice of Methodology, Scenario Technique

Louis Pasteur's well-known dictum states: "Luck favors the prepared mind" (Van der Heijden 2002). What scenario technique essentially does is to prepare the mind. This preparation allows the researcher to notice important developments in the macro environment and the potential future impact these developments may have on the micro environment, when the impact will appear, and how to prepare to react to the impact. Without this preparation, these things may not have been noticed at all. Basically, scenario technique is a way of dealing with uncertainty.

Scenario thinking has a long history, yet it did not come into common use until the Second World War. At that time, scenarios became a formal approach to counter different potential enemy maneuvers according to the circumstances. After the Second World War, scenario planning was brought from the battle field into corporate and public sectors to support strategic planning. From then until now, it has received the attention of various academics, which means that there is now no single definition of scenario planning. These are some definitions of what scenarios and scenario planning are:

- Devices for ordering one's perceptions about alternative environments in which one's decision might be played out, as stated at the presentation given at the World Futures Society's General Assembly by Ogilvy and Mandel 1984 (Mack 2001)
- An internally consistent view of what the future might turn out to be (Porter 1985)
- The part of strategic planning which relates to the tools and technologies for managing the uncertainties of the future (Ringland 1997)
- A disciplined method for visualizing possible futures in which organizational decisions may be played out (Shoemaker 1995)

There are three basic concepts for scenario development. Kahn emphasized a qualitative approach based on reasoned judgment and intuition. Management scientists Amara and Lipinsky used a quantitative approach based on structural algorithms and mathematical modeling. This process, called Management Science or Operational Research, soon became computer driven. Between these two extremes, Millet and Randal generated procedural scenarios that incorporated both intuitive and quantitative techniques (Chermack, Lynham et al. 2001). The type of scenario method that will be used in this report is similar to the first approach developed by Schwarz and Van der Heijden. The reason for choosing their technique is their dominance in literature and well described methods. Both have their roots in the Shell Corporation, which has been a pioneer in integrating scenario thinking in its strategy process.

There are different uses of scenario planning. According to Van der Heijden (2002), scenario projects can be expressed along two dimensions (Table 2).

- Scenarios can either be of a "once only" character or ongoing, promoting organizational survival.
- The scenario project can either open up an organization stuck in a loop or motivate a decision in an organization that is drifting.

	Once only Problem Solving	Ongoing Surviving/Thriving
Opening up Exploration	Making Sense Make sense of a difficult situation.	Anticipation Make sense of the signals in the environment to anticipate future events.
Closure decision	Developing Strategy Clarify in what direction the organization is heading.	Adaptive organizational learning Make sense of the signals in the environment to anticipate future events.

Table 2, Different scenario uses

Van der Heiden argues that scenarios are a prerequisite for a strategic conversation. In this study, previously written scenarios are used to evaluate the strategic question of “where to locate a software development center”. Since it is a once-only event, it fits into the lower left field of “Developing Strategy”.

Scenarios	Forecasts
Possible, plausible futures	Probable future
Uncertainty based	Based on certain relations
Illustrate risks	Hide risk
Qualitative or quantitative	Quantitative
Needed to know what we decide	Needed to dare to decide
Rarely used	Used daily
Strong in medium to long-term perspective and medium to high uncertainties	Strong in short-term perspective and low degree of uncertainty

Table 3, Differences between scenarios, forecasts and visions (Lindgren and Bandhold 2003)

There are also a number of other methods for dealing with the future and uncertainty. Some examples are Delphi technique or forecasts. Next, some of the reasons for using scenarios are outlined. Table 3 compares scenarios and forecasts.

One difference in terms of handling uncertainty between scenarios and forecasts is that the latter often is based on probabilities. This may lead the decision maker to choose the option with the highest probability. This might lead the organization to prepare for only one option, whose likelihood often stems from a pattern of historical data or estimates. Arguably, the problem with historical data is that it might not repeat itself. Estimates, which are commonly

used if the event has never occurred before, may not easily be tested and may therefore not be reliable. Scenarios, on the other hand, although they have small predictive value, enable the decision makers or researcher to go through different situations and discuss actions or consequences (Lindgren and Bandhold 2003).

Apart from the advantages mentioned above, there are two major reasons for using scenario technique. Firstly, scenario technique enforces systematic thinking. An often used metaphor in scenario planning is the one of the iceberg (Figure 2).

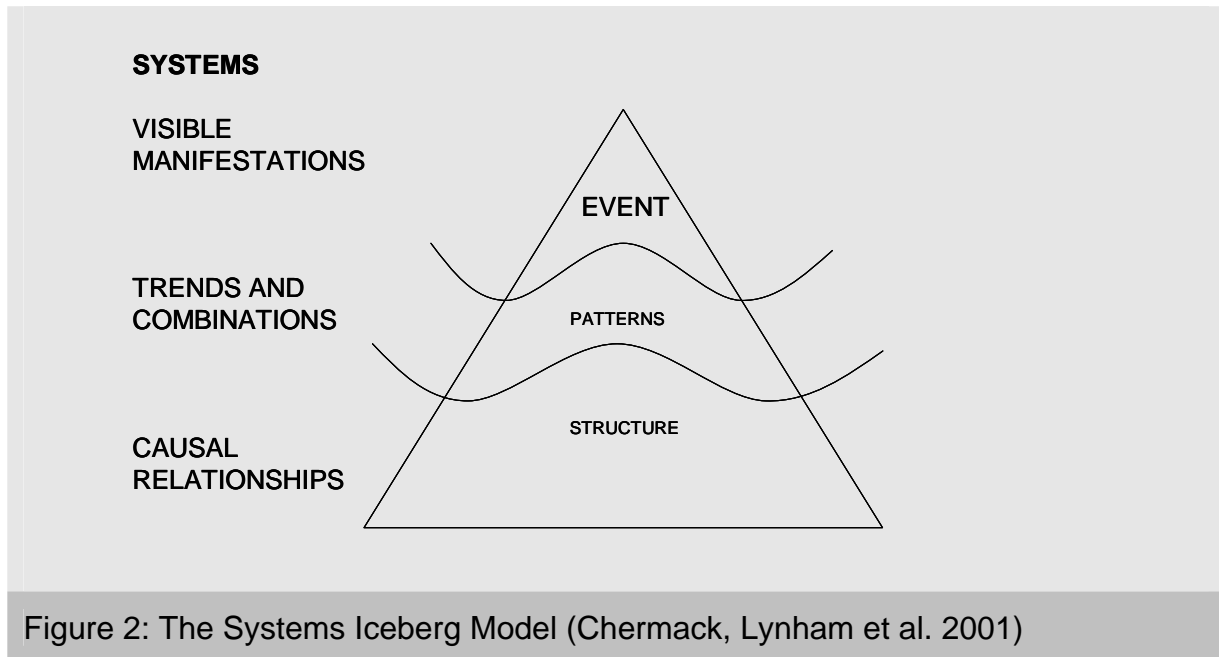


Figure 2: The Systems Iceberg Model (Chermack, Lynham et al. 2001)

At the top of the iceberg model is the event that affects the company's focus area. This event could be a raise in salaries of software developers in a certain area of the country. Considering the middle of the iceberg, one can see the patterns and trends that cause the wages to rise. At the bottom of the iceberg, one can find structural changes that lead to the patterns. By outlining these relationships, one can gain a better understanding of the way the wider business environment affects one's focus area. Secondly, it has an ability to highlight the links between the outside world and the direct business environment. See Figure 3.

This study carries out a two part analysis. The first part focuses on the outside world, or macro environment. That is the part outside the circle. The second part, analyzes the direct business environment or the software industry. This is called the micro environment in the study and is represented by the area inside the circle in Figure 3.

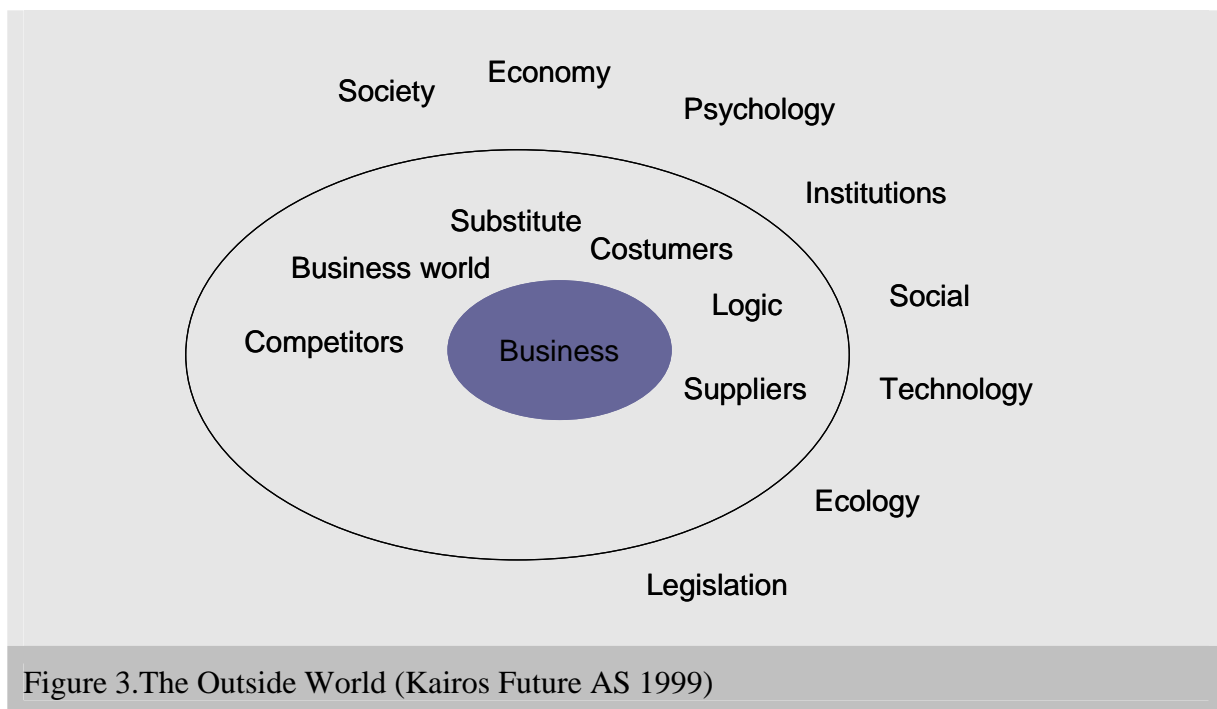


Figure 3. The Outside World (Kairos Future AS 1999)

Data Collection Methods

Interviews

One of the reasons for choosing interviews to collect data is that it gives more and better information more cheaply than other methods (Dexter 1970). The way that I tried to find my interviewees was through a network approach. The originating point was in most cases Swedish Trade, a trade advisory agency linked to the Swedish embassy. Other people were found through a network of friends and from recommendations. Some people were also found through the international outsourcing fair held in Shanghai during the Autumn of 2003. The interviewees mainly come from the following groups.

- Indian and Western companies that deal with software development
- Local suppliers of software development services
- Companies that deal with quality training and assessment
- People working for Swedish Trade

The interviewees were mainly used to find relevant topics for further research. The people at Swedish Trade provided very good general advice about the Chinese macro environment.

Patton (Patton 1987) outlines three basic types of formats for in-depth interviews: the informal conversational interview, the general interview guide approach, and the standardized open-ended interview. The interviews that I carried out fall into the first and second categories, whereas the third category was not used.

In the initial phase most of the interviews were of an explorative character. Explorative structures could be used when the researcher does not have enough information to ask more specific questions. One reason for using a more explorative structure is to find out more precise questions for the next interview and also topics to research further (Merriam and Nilsson 1994).

For the more structured interviews, Kvale's and Torhell's "Den kvalitativa forskningsintervjun" (Kvale and Torhell 1997) was used as a reference. To cover the topic intended, an interview guide was created for each occasion according to the guides described in "How to use qualitative methods in evaluation" (Patton 1987). The interviews were in most cases recorded in order to concentrate further on the dialog itself.

Written Material

The written information for this study stems from a number of different sources. Some examples are:

- Chinese newspapers and magazines (in English and in Chinese)
- Country reports on China
- Academic articles related to software development in China
- Indian newspapers that relate to Chinese software development
- Books relating to software development or China in a broader perspective
- Industry specific reports (one important source was Chinese Software Industry Associations report on the Chinese Software Industry published in May 2003)

- Additional sources

This data covered three basic areas: theoretical framework, China's software industry, and China in a broader perspective. Some of these sources come from Swedish Trade, some of the information was bought over the internet, or was publicly available, and some material was found through Chalmers' and Göteborg University's databases. Other sources were also used but to a lesser extent.

Validity and Reliability of the Data

Validity can be divided into two different parts, external and internal. Internal validity deals with whether the result corresponds to reality and if the researcher really researches what he thinks he is researching. Is he measuring what he thinks he is measuring (Merriam and Nilsson 1994)?

Since qualitative research is based on the notion of reality as a social construction, the different reality constructions of the research objects become more important than reality as such. Guba and Lincoln (1985) argue that it is more important to represent the participants reality construction in a manner that they would agree corresponds to their view of reality. By following this formula, the reader of the report can estimate the level of truth. Based on practical research and literature, Merriam (1994) presents six strategies to improve internal validity:

1. Triangulation. Use of different methods, different evaluators and different information sources to confirm the results of the research.
2. Feedback from participants. Confirm with the participants that the interpretation of their statements is correct.
3. Observations during a long time. Carry out observations during a longer period of time or at repeated occasions to increase the validity.
4. Horizontal critique and peer review. This means that fellow researchers examine and provide comments and suggestions toward the results.
5. Participating approach. This implies involving the participants in all phases of the research.
6. Clearly stating bias. Before initiating the research, the researcher states his world view, starting point and theoretical perspectives.

These are some examples of the measures taken in this study to ensure internal validity:

- Some of the different types of triangulation that I used during the research were to try to mix methods and data sources to confirm that the findings were valid. Different theories were also, as much as possible, used to explain the data (point 1).
- For the interviews I tried to confirm with the sources that my conclusions about their statements were correctly represented (point 2).
- At regular intervals people familiar to scenario planning checked if the analysis was carried out in a correct manner (point 4).
- While writing this thesis, I have as much as possible considered my own position and include these elements in the report (point 6).
- I also used Chinese friends to assist in making sense of some data, since slightly different

data collection methods can at times be used in China.

A small note should also be added about Chinese statistics. The sheer size of China's population makes this kind of task difficult. Economic figures may be overstated to attract investors and avoid capital flight (Newton and Subbaraman 2002). Still, according to Yu and Sisci (2002), the biggest problem, especially in the countryside, might be that the officials may actually not know. One way out for officials might be to come up with a consensus that matches better known statistics in the region.

Since this study takes place in a foreign culture, there is a basis for misunderstanding. To lessen these problems, some books were used as references and sources of background knowledge about the research environment. The chosen books were either recommended by researchers or referred to in academic articles. Two of the three books directly relating to China are also written by Chinese. These are the books:

- Beyond the Chinese Face: Insights from Psychology (Bond 1991)
- Inside Chinese Business: A Guide for Managers Worldwide (Chen 2001)
- Chinese Business Negotiating Style (Fang 1999)
- Riding the Waves of Culture: Understanding Cultural Diversity in Global Business (Trompenaars and Hampden-Turner 1998)

Before commencing this research I spent one year intensively studying Chinese. During the time of the research I also lived with Chinese people to get a bit more insight into their culture and ways of living.

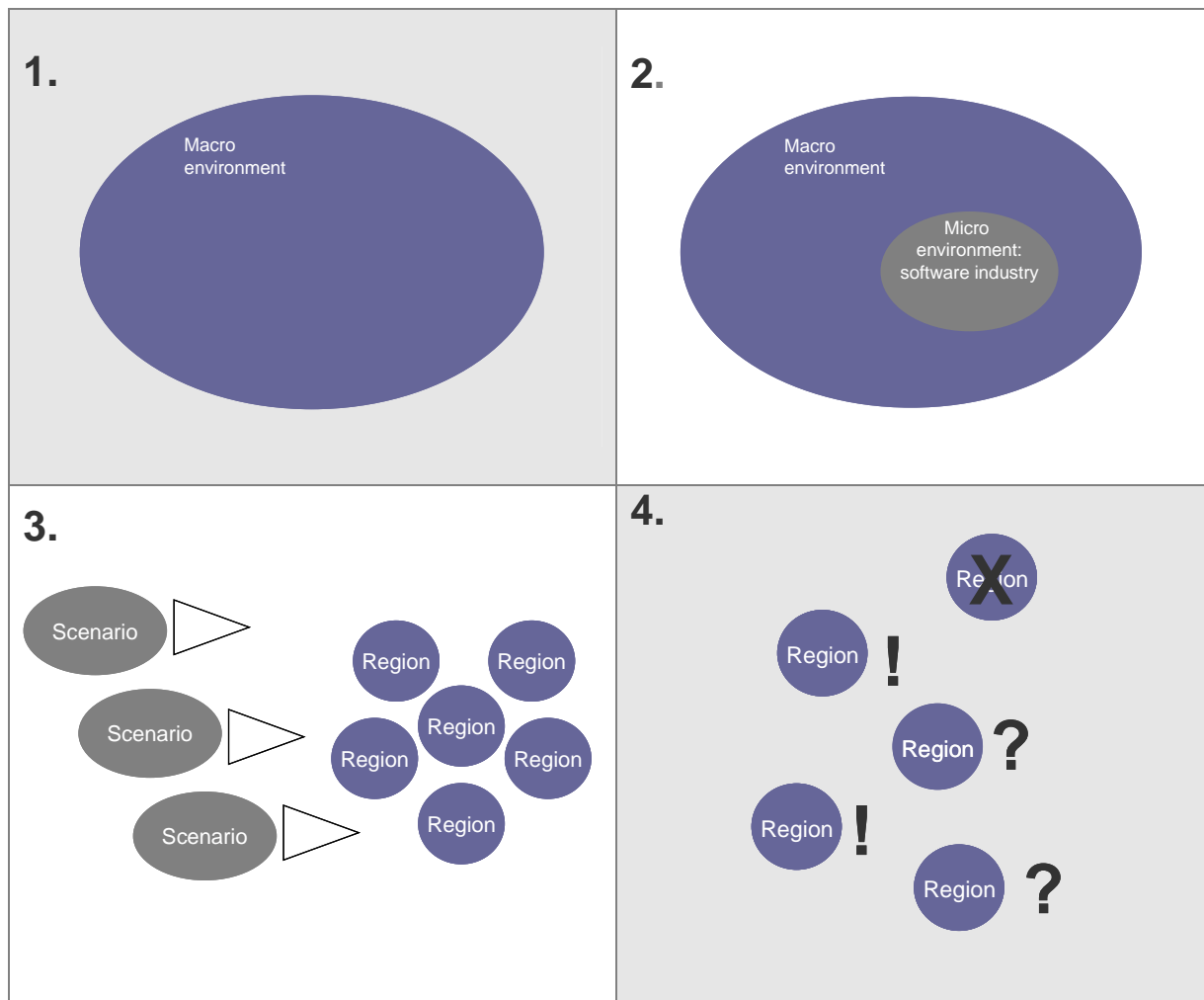
External validity deals with whether the results from a certain piece of research are generally applicable to other situations. One of the preconditions for validity is that the results are internally valid, since it is of limited value to generalize based on useless information (Merriam and Nilsson 1994). Granted, that goal is not the traditional one of knowledge creation, but an accepted goal for this context. It might not be possible to generalize on it in a universal manner; nevertheless, results of the research may be generally applicable for someone with a similar goal.

Reliability deals with to what extent the research can be carried out in the same way leading to the same result. If the study was carried out a second time, would it lead to the same result? Generally this is a problem within social science since people are not static, but change. Therefore, different groups might have different views of software development in China. Reliability is also based on the assumption of a sole reality (Merriam and Nilsson 1994). This assumption contradicts the basis of this thesis that the world is a social construction. One option instead of requiring that other researchers come to the same result, is to strive for meaningful, consistent and independent results (Merriam and Nilsson 1994). Goetz and LeCompte (1984) present some methods to achieve these goals:

- The standpoint of the researcher. The researcher explains assumptions and theories serving as the basis of the research, criteria to choose informants, and the social context that the informant stems from.
- Triangulation. Especially when it comes to using different methods for information collection and analysis, triangulation strengthens both reliability and the inner validity.

- Following the same track. The researcher has to describe his data collection methods in such detail that the report could be used as a manual to replicate or repeat the study.

Research Design



1: Introduction to Macro environment

The first part of the thesis provides an introduction to the macro environment in China. The main purpose of this is to facilitate the understanding of the continued discussion. The analysis is carried out based on the STEEP framework (Social, Technological, Economical, Ecological and Political topics) (Van der Heijden 2002). However, Technological area is left to be addressed in section the software industry section. Driving forces for China's future development and in the Chinese macro environment are also outlined.

2: Analysis of factors that have an impact on the development of the software industry

This factor falls in the following broad categories: international outsourcing situation, linkages and trust, local industry structure, supply factor such as finance and human resources situation, and national policy. These factors are based on the success factors for the development of a national software industry as outlined by Heeks (2002).. Each of these sections also presents some of the relevant trends. Finally, there is also section about different

corporate forms in China and their advantages and disadvantages. This is motivated by the fact that the topic is about where to establish a software development center.

3: Impact analysis on different regions

In the third step scenarios are introduced. These scenarios are based on the book China's Futures (Ogilvy and Schwartz 2000). Based on these scenarios, the impact of each scenario on each of the nine regions is determined. From this analysis, one can determine the suitability for sourcing in each region under each scenario.

4: Assessing the future of each region

In the final step, the overall impacts of the three scenarios are evaluated for each region to determine which regions have the most beneficial conditions for future software application development. Through this process, one is also able to determine risks associated with different regions.

Background about China and the Software Industry

Macro Environment

Political

Brief History

Due to the importance that Chinese attach to their long history, it is vital to have a basic understanding of it to understand the present China. Chinese history began ca 2000 B.C. with the mythical Xia dynasty, but was first unified under the emperor Qin Shihuang in 221 B.C. From this period up until today China has experienced many ups and downs. The final dynasty fell in 1911. This was followed by almost 30 years of turmoil and civil war that eventually lead to Mao Zedong's proclamation of the People's Republic of China in 1949. The state constitution describes China as a socialist state under the people's democratic dictatorship. The Maoist ideology faded after Chairman Mao's death in 1976. On the initiative of Deng Xiao Ping, China has since then pursued "a socialist market economy" (The Economist Intelligence Unit 2004).

Political System

The CCP is the dominant force in Chinese politics. Hu Jintao is general Secretary of the CCP and at the same time state president. Jiang Zemin, the previous state president, holds the position Chairman of the Military Commission that controls the armed forces. Wen Jiabao leads the government as premier. The standing committee of the political bureau of the CCP is the ultimate policy making body. The National Peoples Congress (NPC) is the legislature, although with limited powers. The Chinese People's Political Consultative Conference (CPPCC), that incorporates political, social and religious groups, serves as a delusion of power sharing (The Economist Intelligence Unit 2004).

An important issue to mention is that the size of the Chinese Government Sector is relatively small. China spends merely 9% of GDP on government on all levels. This can be compared with Taiwan and the USA that both spend 16% of GDP; Russia, 17%; Germany, 18%; France, 20%; and the UK 22%. If one would consider GDP per capita spent on government activities, the figure would be drastically lower. This illustrates the challenges of controlling the near 1.3 billion population (Ogilvy and Schwartz 2000).

The CCP's philosophy is enshrined in the "the four cardinal principles" (Newton and Subbaraman 2002):

- Keep to the socialist road
- Uphold the dictatorship of the proletariat
- Uphold the leadership of the Communist Party
- Uphold Marxism- Leninism and Mao Zedong thought

A new ideological element in Chinese politics is “The Three Represents”, which during the 16th congress was included in the CCP party charter. The theory states that the CCP must (Hu 2002): “*represent the development of China's advanced productive forces*” that can be interpreted as to include private industrial forces and foremost entrepreneurial capitalists; “*represent the ongoing direction of China's advanced culture*” meaning a combination of Chinese traditional culture, western culture and communist culture; “*represent the fundamental nature of the largest number of the Chinese people*” signifying workers, peasants, soldiers, intellectuals and, for the first time, private businessmen.

The theory was introduced by Jiang Zemin and can be seen as an attempt to be noted in history in the same way that Mao Zedong and Deng Xiaoping have been. On a more concrete level, the adoption of Jiang's theory into the Party doctrine marks a significant reversal for a political party that was established initially by peasants and the workers in order to crush capitalist forces in China. This ideological inconsistency is a fundamental problem of the Communist Party today. During the Cultural Revolution and the Great Leap Forward, the Communist party advocated forgetting about Confucius and the traditional values that have developed into what many see as the core of being Chinese. They did to a surprising extent succeed in destroying these values, but they did not provide any philosophy strong enough to fill the gap (Ogilvy and Schwartz 2000). “The Three Represents” can be seen as an attempt to adjust the party agenda closer to the people and reality. As Fred Hu, Managing Director of Goldman Sachs (Asia) L.L.C., sees it (2002), *The CCP is now anything but “communist”. It is today a party not too different from the Social Democrats in Western Europe or the old KMT (Kuo Min Tang, the National Party) in Taiwan.*

Legal System

One of the central differences between the Chinese and Western legal environments is based on philosophy. Chinese differentiate between *renzhi*, the rule of man, and *fazhi*, the rule of law. China has throughout history been managed by *renzhi*, and still is to a great extent. This means that the State has primacy. Still, in 1978, the need for a legal base was recognized to offer a greater degree of certainty for potential foreign investors (Newton and Subbaraman 2002). The process of implementing a efficient legal system is further accelerated by China's WTO entry.

The Chinese legal system is a mix of custom and statute, where the judiciary and the government are closely connected. This can be compared with developed nations, where the legal systems are independent (2001). The hierarchy of people's courts, ranging from local people's courts through intermediate and the higher people's courts to the Supreme People's Court, is headed by the Minister of Justice. The ministry was re-established in 1979 after having been abolished during the Great Leap Forward in 1959. Before 1979, arrests and sentences had to be approved by the Communist Party committees. Although this practice was abolished in 1979, criminal law is still largely applied as a form of public education, with periodic campaigns of mass arrests and executions used to frighten law-breakers.

People's courts, at all levels, deal with criminal, civic and economics matters in separate tribunals. Local people's mediation committees supplement the work of the courts by dealing with minor criminal offences and civil disputes, as well as helping implement government policy at street level, such as the one-child policy (2001). Generally, there is averseness against legal cases and it is often seen as a last solution.

Foreign Relations

Foreign relations since 1949 can be divided into four periods. From 1949 to 1960 China was allied with the Soviet Union, although this relationship was already under severe strain in the late 1950s. There followed, in 1960-72, a period of isolation during which China sought to identify itself as a natural leader of the developing world in its resistance to "US imperialism". From 1972 China found itself in de facto alliance with the US against perceived Soviet expansionism. That epoch ended in 1989 when relations with the Soviet Union were normalized. The Tiananmen episode introduced new and severe strains into Sino-US relations.

In the late 1990s, Sino-US relationships had generally improved. In 1997 Jiang Zemin visited the White House, where he received full honors. A later visit to China by Bill Clinton was marked by a joint declaration of "Joint Partnership" (Newton and Subbaraman 2002). This "strategic partnership" has now been revised by the Bush administration, who has taken a more critical approach - adopting a tougher line on Taiwan and issuing hawkish official reports on China's defense capabilities and the economic risks of China's expansion (Ridding 2001). The latest issue has been the Chinese exchange rate, which the administration considers undervalued and thus hurting US manufacturers. Still, the US and China have a common interest in solving the North Korean nuclear crisis. China's relationship with Pyongyang is of a more amicable character than the US and can therefore be seen as a resource for the US (World Markets Research Centre 2004).

Japan

The background to Chinese suspicion of Japan is the result of the complex, and at times catastrophic, nature of Sino-Japanese relations in the 20th century. At the start of the century, Japan was held up by Chinese imperialists and nationalists alike as a model for modernization. But Japan's seizure of Manchuria in 1931 and all-out war in 1937 left deep scars in China. These ties may slowly improve as China runs an increasingly large trade surplus with Japan (Newton and Subbaraman 2002).

India

When it comes to foreign policy, the Indians say: "A strong neighbor is a natural enemy". The Chinese say "One mountain cannot accommodate two Tigers" (Kynge and Luce 2003). Given these views, China has a sensitive relationship with its southern neighbor, although it has much improved since the two fought a war in 1962. In 1998, India's defense minister described China as India's biggest threat. Yet, high-level meetings between India and China and the signing of a landmark agreement where India for the first time recognized Chinese sovereignty over Tibet, suggests a thaw is well under way (Kynge 2003).

Trade between the two countries has more than doubled the last two years and is forecast to reach \$7.5 billion by the end of 2003. Indian software companies see China as a bridge to the Korean and Japanese market where China has an advantage. So, although Chinese IT-exports are dwarfed by Indian IT-exports, India is growing more interested in China. In 2003, 15 Indian IT companies had a presence in China. This means that 40% of India's IT-Exports involve companies that have presence in China (Kynge and Luce 2003).

Greater China: Macao, Hong Kong and Taiwan

The “one country, two systems” policy, established by Deng Xiaoping, has been the central principle for dealing with Taiwan and Hong Kong. Under this policy, a given region would be largely autonomous in governance terms, including its legal system, and have even greater economic freedom. Beijing would retain responsibility for foreign and defense policy. Its primary target was Taiwan. But Hong Kong became the first in 1997, closely followed by Macau in 1999 (Newton and Subbaraman 2002).

The success or failure of Hong Kong's transition is important in the sense that it probably will have an impact on the sentiment in Taiwan towards the mainland. Despite some occasional setbacks, even Martin Lee, the leader of Hong Kong's Democratic Party and one of the Beijing-backed government's most strident critics, admitted in 2001 that Hong Kong enjoys much the same freedoms that it did under the British (Newton and Subbaraman 2002). The “one country, two systems” policy has been tested a number of times. The last in the row of tests was the introduction of an internal subversion law that would give the government more power to suppress those considered subversives. This caused a public uproar with 500,000 people marching the streets in protests in summer 2003. The government in September 2003 eventually backed down from introducing the law.

China's behavior towards Taiwan demonstrates its determination about what it considers to be an internal matter. The Chinese government sees Taiwan as an inalienable part of China and therefore insists that it is not answerable for its conduct against Taiwan. A further blow to an easy solution has been the election of Chen Shuibian, the leader for the pro-independence Democratic Progressive Party in March 2000. Although China is arming fast, it lacks a realistic military option to absorb Taiwan by force (Newton and Subbaraman 2002). The big question mark for now is the upcoming elections in 2004, which will set the path for Taiwan's relation with the mainland.

Center-Regional Tensions

A central idea of the late Deng Xiaoping's reforms was to provide the localities with powers so that they could compete freely and forge their own links with foreign businesses. These freedoms have over time evolved into a tension between the local and central governments, where local governments may resort to local protectionism, adopt policies that might have negative effects on China as a whole but benefit the region, and in other ways act autonomously (Wong and Zheng 2002).

Jiang Zemin has during his leadership worked to move the power balance back towards the center. Some examples of the means that he has used is to introduce a new tax system that boosts the revenues directed to the central government and to regularly rotate civilian and military cadres to prevent them from building local power bases (Lam 2001). This has meant that local cadres are commonly assessed based on political loyalty instead of economic performance. A common method used to remove problematic local cadres has been to bring up corruption charges (Wong and Zheng 2002).

The relationship between local governments and the central government will most likely not change during the leadership of Hu Jintao. There might still be tensions. The regions that are able to provide the best business opportunities will also prosper. One of the challenges that

needs to be tackled in the future is the legal system. Today local officials can interfere with legal proceedings and discriminate in favor of local parties (Wong and Zheng 2002).

Corruption

Ex-President Jiang Zemin described corruption as threatening 'the very existence of the Party and State. It is also an important reason for the protests at Tiananmen Square. Corruption does to some extent arise through the Chinese system of guanxi in business. Deals may not be done until the Chinese business party has built up a close relationship with potential business partners through exchanges of gifts and favors as a token of trust. The problem arises when these favors and gifts are replaced by large amounts of money. This has now gone so far as to be considered a part of standard business practice. This is illustrated by a survey from Transparency International published in 2003, where China and other countries were rated for the likelihood of its business men to resort to bribery. China came 20th, with Russia being the only country to receive a worse rating. Three Chinese economists recently published a report that suggested that corruption may be affecting as much as 14.9% of China's entire GDP (World Markets Research Centre 2004).

The Communist party's campaign to crack down on corruption has been ongoing since 1992. It has led to the expulsion of more than 120,000 members and some 670,000 have been disciplined. Local leaders have also been sentenced to death for corruption charges. Yet, some analysts are doubtful about how earnest the government is in dealing with the problem. One event that reinforced this doubt was the nomination of Jia Qinglin, who was once a Provincial Party boss in the city of Xiamen, Fujian province, and is thought to have links with a recent high-profile multi-billion dollar smuggling, to become a member of the Standing Committee of the Politburo (World Market Research Centre 2003). Some analysts claim that the anti-corruption campaigns are just used as a tool to get rid of political opponents (Wong and Zheng 2002).

Economic Environment

Annual Indicators

	1998 ^a	1999 ^a	2000 ^a	2001 ^a	2002 ^a
GDP (US\$ bn)	954.3	998.7	1,079.4	1,191.4	1,237.1
Real GDP growth (%)	7.8	7.1	7.9	7.5	8.0
Consumer price inflation (%)	-0.8	-1.5	0.4	0.7	-0.8
Population (m)	1,239.1	1,250.5	1,261.8	1,273.1	1,284.3 ^b
Exports of goods FOB (US\$ bn)	183.5	194.7	249.1	266.1	325.7
Imports of goods FOB (US\$ bn)	-136.9	-158.7	-214.7	-232.1	-281.5
Current-account balance (US\$ bn)	31.5	21.1	20.5	17.4	35.4
Foreign-exchange reserves excl gold (US\$ bn)	149.2	157.7	168.3	215.6	291.1
Total external debt (US\$ bn)	144.0	152.1	145.7	170.1	181.4 ^b
Debt-service ratio, paid (%)	8.6	11.7	9.3	7.8	5.2 ^b
Exchange rate (av)	8.3	8.3	8.3	8.3	8.3

Origins of GDP 2002 ^b	% of total	Components of GDP 2000 ^a	% of total
Primary sector	14.5	Private consumption	48
Secondary sector	51.7	Government consumption	13.1
Tertiary sector	33.7	Gross fixed investment	36.5
		Exports of goods and services	25.4 ^b
		Imports of goods and services	-22.5 ^b

Principal Exports 2002 ^a	US\$ bn	Principal imports 2002 ^a	US\$ bn
Apparel & clothing	41.3	Electrical machinery	55.4
Office machines and data proc. Equipment	36.2	Petroleum and related products	17.2
Telecommunication equipment	32	Office machines and data processing equip.	17.1
Electrical machinery	31.9	Machinery for particular industries	15.6
Footwear	11.1	Telecommunications equipment	14.2

Main destinations of exports 2001 ^a	% of total	Main origins of imports 2001 ^a	% of total
US	21.5	Japan	11.1
Hong Kong	18	Taiwan	12.9
Japan	14.9	US	9.2
South Korea	4.8	South Korea	9.7
Germany	3.5	Germany	5.6
Netherlands	2.8	Hong Kong	3.6
UK	2.5	Malaysia	3.1
Singapore	2.1	Russia	2.8

^a actual, ^b estimates

Data: The Economist Intelligence Unit June 2003

China's economic development is twofold. After the reforms, the development in the major cities and costal regions quickly picked up pace, whereas the central and western regions of China have developed much more slowly. This means that the largest part, 499 m of the 711.5 m strong labor force is still considered to be rural (figures from 2000). China's peasants are

today estimated to 480-530 m. There is an urgency to industrialize the countryside, since creating non-farm employment for the millions of people there is vital to increase the productivity of agriculture and raise the living standard. Today there is a big discrepancy in terms of development between the costal regions and the western-central regions. This can be seen in Figure 4. The highest regional GDP per capita, US\$ 4020, found in Shanghai, is more than 10 times higher than in Guizhou, US\$ 373.

The Chinese economy is characterized by an industry's large share in gross output value. Economic growth has for many years been led on the supply side by increases in industrial output. After the reforms started in 1978, the agricultural sector grew in importance as it was privatized and prices were set more freely. As the industrialization of the countryside followed, the industry gained greater importance. Recently the service sector has experienced rapid growth as controls on the economy have been reduced and demand for personal services is increasing.

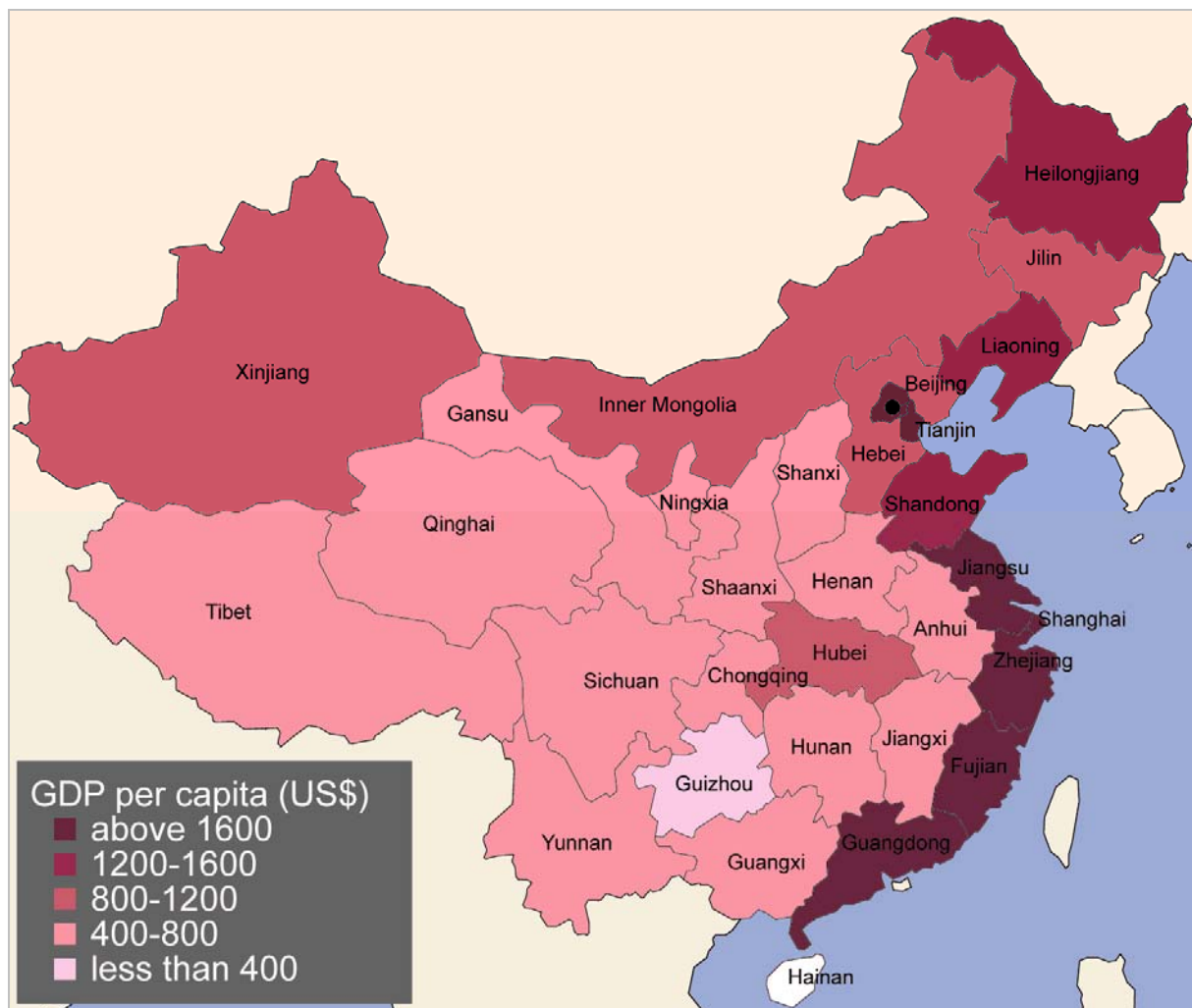


Figure 4, Regional GDP per capita (Data: Chinese Statistics Yearbook 2003)

Initially, industry output was dominated by large SOE's. This gradually changed, and collective enterprises under local governments became more and more important. They are

now slowly being replaced by a growing number of private entrepreneurs and enterprises with foreign involvement (The Economist Intelligence Unit 2004).

Fiscal and Monetary Policy

Since 1998, authorities have maintained an aggressively expansionary fiscal policy. This was adopted to compensate for the fall in demand following the 1997-1998 Asian financial crisis. State investment was stepped up in 2002 to guarantee expansion during the leadership transition, and by the first quarter of 2003, state spending accounted for nearly three-quarters of overall investment. This trend was sustained in 2003, in order to minimize the impact of SARS. This aggressive fiscal policy has caused the economy to be ever more dependent on investment by state-owned firms, whose share of overall investment grew from 52% in 1997 to nearly 80% in mid-2003.

In terms of monetary policy, the Bank maintained a loose monetary stance in support of demand since 1998. One-year deposit and loan rates were cut in February 2002 to 1.98% and 5.31% respectively - at which level they have remained since. Inflationary pressure returned into positive territory in 2003, and strengthened after the impact of SARS settled (World Market Research Centre 2004).

Growth Policy

The transformation of the last 20 years has brought China from central planning to something defined by the Communist Party as a socialist market economy. One of the central themes of this reform is to shift people from previously unprofitable areas of the government-controlled sectors such as farming and state owned enterprises into areas where they can find sustainable employment and contribute more to the country's economy. This requires the government to create new jobs and keep the economy growing. Chinese economists in the Labor Science Research Institute of the Ministry of Labor and Social Security estimate that every 1% increase in real GDP generates 700,000 to 800,000 jobs. This means that a growth rate of 8-9% is needed to maintain employment (Yardeni 2003). Currently, reforms are carried out on a number of different fronts, but these can be seen as the most crucial areas.

The Enterprise Reforms

At the center of the industrial reform agenda are the state owned enterprises (SOE's) and township and village enterprises (TVE's), both a remnant from the era of planned economy. SOE's were originally established, not to generate financial profit, but rather to help the government achieve wider social and economic aims. Consequently, they were initially weighed down by over-employment and expensive welfare provision structures (The Economist Intelligence Unit 2004). These are now staying afloat mainly because of the continued financial support of the government. In 1985 one in ten was unprofitable; by 1998 this was up to every second. Most of the SOE's can be found in the north-eastern and western regions of China. The share of industrial output produced by state enterprises dropped from 70% in 1980 to 28% in 2000. Yet, SOE's still employ 38% of urban workers, hold 65% of total net fixed assets and receive 80% of the country's state bank loans. The main challenges that have to be overcome are: reducing excess capacity, shedding surplus labor, lowering the

debt burden, upgrading productivity capacity, releasing resources by exit of unviable firms, determining which firms need to remain under government control and privatizing the rest. One of the main constraints is the rising unemployment and how to create work opportunities for the workforce (OECD 2000).

Arguably, the government takes the task seriously. One example of this is the 25 million workers that have had to go since 1998. Still, according to the research organization World Markets Research Center (2003), more change is required. The government needs to implement an efficient bankruptcy law to formalize and facilitate the restructuring of the state-owned sector. Legislation that allows state banks to vary interest rates according to risk also needs to be introduced, which would end the problem of “soft policy loans”. Asset management companies need to be given more power to restructure SOE's. Privatization also needs to increase. Therefore, the picture is mixed. Most of the progress so far has depended upon external factors and work still needs to be done in terms of efficiency increases, especially now when facing the increased international competition that the WTO entry brings.

Financial Reform

The Chinese financial system is still in an early state of development and suffers from a number of problems (OECD 2002).

- Credit is not allocated effectively. SOE's receive a disproportionate share of loans. On the other hand, small companies have difficulties gaining access to funds. Moreover, the main beneficiaries of the stock market have also been large SOE's. This also applies to issuance of bonds and commercial papers. The venture capital market is also in its early stages of development.
- Interest rates are regulated and do not reflect risk properly. Stock market listing criteria are also politically influenced. Credit culture is weak and SOE's face only limited sanctions if they do not repay.
- There is a lack of even simple financial instruments to deal with liquidity fluctuations and management of risk. For example, financial futures and options are not permitted. The fixed income market is still quite limited, and even the government bond market lacks depth and liquidity.

The banking sector is a major source of vulnerability for China's economy, partly because its assets are highly concentrated in the four state banks, but also because its sources and uses of funds are very narrow. 73% of household financial assets are invested in commercial bank deposits, and some three-quarters of state bank loans are directed to the inefficient SOE's, often at the order of the government. A central problem is that bank loans have been used as a policy tool to support the SOE's and lending is often based on political criteria instead of commercial merits. The official NPL ratio is somewhere around 25%, but since it is based on a loose definition of what a non-performing loan is, the actual ratio could be as high as 50% (Newton and Subbaraman 2002). The government's approach to solve this burning problem was in 1999 to create one AMC for each state owned bank. By the end of 2000, the four AMC's had bought non-performing assets worth RMB 1.4trn (US\$170bn) from the state banks, and 580 SOE's had agreed to swap a further RMB 405bn of debt for equity. Even before this, the government had injected US\$32bn of public funds into the Big Four, and officials have been encouraging these institutions to lend more to consumers and to small and

medium-sized enterprises. In early 2004, the government announced a further recapitalization, transferring ownership of US\$45bn of foreign assets to CCB and BOC. The government is also intending to list the banks on local stock exchanges to enforce market discipline on their operations (The Economist Intelligence Unit 2004). This has to some extent lessened the problem of bad loans to SOE's. The effect has, however, been offset by strong housing credit growth and large purchases by government securities used to finance the budget deficit.

Other problem areas in the financial sector are non-bank financial institutions that account for about one fifth of the financial sector. Their asset quality is not any better than those of the banks. The government has handled this by restricting the scope of these organizations' business, barring them from accepting deposits, etc. (Newton and Subbaraman 2002).

Pension Reform

The "one child" policy introduced in 1979 means that the elderly are rapidly accounting for an increasing proportion of the population. A working couple today usually need to support four retired parents. This is known as the 1-2-4 phenomenon – one child, two parents, four grandparents. Ensuring financial security for the elderly will be a major challenge because China's labor force growth is slowing; on some projections, by 2030 the total workforce will start to decline in absolute numbers. Today, there are ten people of working age for every pensioner; the World Bank estimates that by 2020 there will be six and by 2050 only three (Newton and Subbaraman 2002).

Even though reforms are carried out, China's pension system is today mainly restricted to retired SOE-workers in urban areas; and it is still under-funded, where generous payments to current retirees are financed almost entirely from the current pension contributions made by enterprises and workers. In order to avoid a crisis, China is starting to adopt the World Bank's three-pillared system, which combines social pooling with funded individual accounts. The first pillar provides a basic pension to keep pensioners above the poverty line. The second pillar comprises mandatory, fully-funded individual accounts, requiring employees to pay a certain contribution rate from their salaries. The third pillar is a supplementary pension, which employees could choose to provide or individuals could choose to save for. Yet, enforcement and implementation is still lacking in many areas. Under the old system, China's pension fund assets are estimated at only \$15bn, while the unfunded pension liabilities are fast approaching \$1 trillion. If the three pillar system is not firmly implemented, this figure may increase drastically in the next couple of years (Newton and Subbaraman 2002).

Economic Sectors

Agriculture

The initial successes of the agricultural reforms have over time not been sustained. Individual plots of land are in many areas tiny and often still owned by the state. In the cases where the farmers own the land, local politicians have been known to reclaim ownership or force the farmer to sell the land at nominal prices in order to use it for some other kind of economic activity (The Economist Intelligence Unit 2001). This deters farmers from creating larger farming plots and investing in equipment that would lead to efficiency in growing more grain that China needs. Besides, more and more farmers turn to cotton and other cash crops, as well

as other activities that give better returns. One of the reason for this is poorly carried out government grain purchasing programs. As a consequence, the grain crops have been falling. At this point, this is not a problem since there are reserves. However, in the long run, it will cause problems. These are some of the reasons (The Economist Intelligence Unit 2004):

- More grain is needed since the diet includes more meat and the animals need more grain feed.
- Farmers need to be shifted into other industries to make room for efficiency gains that could lead to increased living standards and higher rural income, that has been falling recently.
- The industry needs to adjust to future international competition caused by the WTO membership. Today, the subsidized national grain prices are above the international level. This is mainly due to the inefficiencies mentioned above.

Manufacturing

The manufacturing sector grew in real terms by an average of almost 11.4% a year during 1993-2002. In the beginning this was led by the government's development drive of town and village enterprises (TVE's) in agricultural areas. The promoted industries were often low-technology and labor intensive. Private enterprises and FIE's share of industrial output has been increasing and reached 11.7% in 2002, up from 4.5% in 1999. FIE's play an especially important role for the increase in China's merchandise exports. In 2002 FIE's produced more than 52% of China's exports by value. The importance of state-owned enterprises has been declining since the 1970s when they accounted for 80% of manufacturing output. In 2002 they accounted for only 15.6%. Yet, if one considers that the government during the 1990's sold shares in these companies, the fall is not that drastic with state-owned and state-holding firms together accounting for 40.8% of output. State ownership of industry was also concentrated in heavy industry. Yet, given the huge supplies of low-cost labor available, China's comparative advantage seems to be in light industry (The Economist Intelligence Unit 2004).

Construction

Given the size of China and its low level of development, there is a huge demand for construction of infrastructure. As a result, from 2001 onwards, government investment in capital construction almost doubled every year up until the end of 2003. This has brought about visible improvement, but there is still vast potential for further construction in the west.

The fastest growing sector in recent years has been the real estate sector led by the demand created by people that for the first time had the opportunity to buy their own houses. Previously, housing was commonly provided by government institutions and SOE's (The Economist Intelligence Unit 2004).

Financial Services

The banking sector is today dominated by four big banks that hold 60% of total banking assets. However, their financial state is not particularly healthy. The main reason for this is continued government intervention and regulation. They have been used as policy tools to

support the struggling SOE's. At the same time, interest rate restrictions have prevented banks from setting the cost of funds to reflect risk. Since the government implicitly guarantees loans to state owned enterprises, these have been dominant in the banks' credit portfolios. There are currently restrictions on the operations of foreign banks in China, but these will be gradually phased out.

In 1998 the Peoples Insurance Company of China was split into three parts. This in turn helped to boost the development of the industry. At the end of 2002 there were 14 domestic companies and 21 FIE's or JV's that offered insurance services. The size of the industry, however, is minimal according to international standards (The Economist Intelligence Unit 2004).

High Technology

China is rapidly expanding its high-tech sector, although in the past the emphasis has been on hardware rather than software. The capital, Beijing, is regarded as the nation's high-tech hub, although other regions, such as Shanghai, are also heavily involved. China's online population has boomed at an exponential rate, reaching 33.7m in December 2001 - up from 22.5m a year earlier. These figures have been questioned by many, but there is little doubt that the country will soon become Asia's largest internet market by size and, probably later, by value (World Market Research Centre 2004).

Retail

The retail sector grew up until 2002, but has been decreasing the last couple of years. The market of consumer appliances is saturated mainly with products from local manufacturers. Excess capacity has been maintained in many markets by local protectionism. This has made overall market penetration strategies hard to develop, and foreign entrants have had to take a region by region approach (The Economist Intelligence Unit 2004).

External Balances

Reflecting strong merchandise exports, surpluses on the balance of trade have created a current account surplus in recent years, offsetting deficits on the service trade balance. Simultaneously rising inflows of FDI have ensured recurrent surpluses on the capital account. However, accelerating imports, reflecting China's emerging role as a manufacturing processing center, are set to narrow the trade surplus, with the current account balance due to move into the red over the long term. Foreign exchange reserves have surged as a result of these combined surpluses, rising by US\$72bn in 2002 to US\$286bn, and now test the US\$400bn mark (World Market Research Centre 2004).

A rising trade deficit with the USA has also caused a trade row, where the US claims that manufacturing jobs are lost to China due to the undervalued RMB. The Chinese government is nevertheless unlikely to let its currency float within the next five years due to the dangers it would bring to China's fragile financial system. In the meantime, a re-pegging of the RMB towards a currency portfolio cannot be excluded as a halfway solution (World Market Research Centre 2004).

China's medium and long-term borrowing rose during the 1980's and the beginning of the 1990's but fell after 1998 when the Guangdong International Trust and Investment Corporation failed on its interest payments, that investors generally thought were guaranteed by the government. This led to a drastic drop in foreign debt inflow. This has recovered somewhat during the last few years and reached US\$ 170.1 bn (14.5%) of GDP in 2001 (Newton and Subbaraman 2002).

China's WTO Entry

Under the WTO agreement, China has committed itself to trade and investment liberalization over a two to five-year period. The main implication of this is that in return for limiting subsidies and restrictions on trade and providing full trading and distribution rights to foreign firms, quotas on textiles and clothes will be eliminated five years after entry (Citi Group 2003).

In the short term, China is likely to experience more bankruptcies and displacement of workers as competition increases. The industries that are likely to be hardest affected are banking, insurance, telecom and agriculture and other capital intensive industries such as automobiles, steel, machinery and petrochemicals (The Economist Intelligence Unit 2004). For the banking and insurance sector, this will mean that large investments have to be made into IT infrastructure in order to remain competitive. Foreign entrants on the telecom market will be free to use whatever kind of technology they see fit. The transportation sector is also likely to see an upgrading of their systems as a consequence of stiffer competition (Citi Group 2003).

In the long term, the WTO entry will most likely have a positive impact, since it will spur reforms. The apparel industry will be one of the obvious beneficiaries (The Economist Intelligence Unit 2004). Increased investment and companies will also contribute with much needed skills and technology that will contribute to the reforms. It will also bring focus upon the manner in which Intellectual Property Rights are handled in China. This will have a positive impact on the software industry (Newton and Subbaraman 2002).

Recent Developments

These are some of the issues that have brought attention recently (World Market Research Centre 2004).

- Despite the SARS crisis, the economy expanded by 9.1% in 2003.
- Rapid credit growth fuelled by surging money supply has ignited fears that pockets of the economy are overheating. The sectors mentioned are steel, autos and real estate.
- International critics, led by the US, have charged that the RMB is undervalued relative to China's huge foreign exchange reserves and the depreciating US dollar, effectively subsidizing exports.
- The economic program for 2004, unveiled at the annual National People's Congress in March, aims at cooling growth in order to avoid overheating of the economy. Moreover, booming government investment needs to be refocused.

Environmental Factors

Large-scale burning of coal, together with the rapid rate of economic growth achieved in recent years, has had a devastating effect on China's environment. Air pollution and the loss of water and land resources are serious problems. In 1999 only 33% of 338 cities for which data were available met China's own residential ambient air quality criteria. Water shortages, particularly in the north of the country, are becoming serious. This stems from surging demand. China has also been suffering from deforestation, leading to flooding. World Bank data show that the forested area in China contracted by an average of 1.2% a year between 1990 and 2000. Therefore, the need to take action to preserve China's natural resources has been moving up the political agenda (The Economist Intelligence Unit 2004).

Social Environment

The Chinese People

China's most rapid population growth was between 1963 and 1973. During that time the growth rate peaked at around 2.5 % per year. This meant that the population would double in 28 years. The rate has since then been falling. In 1990 it leveled off to under 1% (a doubling time of 70 years), which leaves it on the same rate as the United States (Ogilvy and Schwartz 2000). China's population was estimated to have reached 1,284.3 million in 2002 (The Economist Intelligence Unit 2003). As for future projections, the United Nations estimates that the population will grow to 1.45 billion (high estimate 1.51, low estimate 1.37 billion) by 2020. The same source estimates that the Chinese population will reach zero growth by 2030 (Ogilvy and Schwartz 2000).

Since the creation of the People's Republic of China, the death rate has been falling and reached 0.65 percent in 1999. This means that the Chinese population is aging. Estimates suggest that elderly (men and women over 65) reached 7% in 2000, up from 5.6% in 1990, while the share of children under 15 had fallen from 28% to 23% (2001). Given that China is a developing country, this is still a small proportion compared to a country like Japan with 15%. The significance of a fertility decline is that the population slowly shifts from children to adults. During the early decades, a fertility decline has a positive effect on the dependency burden of children, i.e. the support needed for growing children. Since China's fertility decline has been more dramatic than many other nations, the dependency rate is also considerably lower than other developing nations. This is a considerable advantage for the nation as a whole in terms of generation of savings available for investment (Ogilvy and Schwartz 2000). However, in the long run, the burden to support China's aging population will be very heavy due to the decreasing number of young people entering the workforce.

The largest part of the Chinese population is Han Chinese, 91.6% of the total. The rest of the population is composed of 54 minorities, which include Zhuang, Uighurs, other Turkic groups, Tibetans, Mongols, etc. The minority population grows quicker than the Han Chinese because some of these minorities are exempted from the one-child policy. Other reasons for their increase are ignorance of the government policies and difficulties for the government to control the birth numbers.

Chinese Religion, Philosophy and Culture

Three important cornerstones of Chinese culture are Taoism, Confucianism, and Buddhism. Only Buddhism can be seen as a religion, whereas Taoism and Confucianism have the character of philosophies. Since these three beliefs deal with different parts of life, it is possible to live by their different teachings at the same time. One does not exclude the other. This is a brief overview of the essentials of these three cornerstones:

Confucianism

Confucianism has its roots in the teaching of Kongzi, or Confucius that lived during the spring and autumn period ca 500 B.C. During the Han dynasty, Confucianism effectively became state "religion" and has since remained the most influential school of thought. It deals with relationships in the society and is based on six values: 1. Moral cultivation, 2.

Importance of interpersonal relationships, 3. Family orientation, 4. Respect for age and hierarchy, 5. Avoidance of conflict and need for harmony, 6. The concept of face.

Taoism

This philosophy is rooted in the teachings of the mythical scholar, Lao Zi. It describes how to live life in harmony with nature and denotes simplicity, contentment, spontaneity, tranquility, weakness, yin yang and most important, Wu Wei. Wu Wei literally means non-action or “doing nothing”. This does not mean Taoists do nothing, but is rather dedicated to life with true passion. Wu Wei nurtures a calmness of mind that empowers one to swallow all confronting forces and then eventually become their master (Fang 1999).

Buddhism

Buddhism is the third cornerstone. It stems from India but has in China developed its own character. It deals with the immortal world and introduces concepts such as reincarnation.

What differentiates Chinese culture from other cultures has been a popular topic in written media. It is, as with any culture, hard to describe it completely. Trompenaars (1998) describes cultures in terms of layers. The outer layers are easy to distinguish, whereas inner layers are more difficult to discern. One way to analyze Chinese culture is according to Gert Hofstede's four different dimensions of culture.

Individualism-Collectivism

This dimension of culture refers to the relative importance of the group vs. the individual. In an individualistic society such as most western societies, the individual is expected to be autonomous, to value privacy, and hold private opinions. People are expected to value self-expression and seek self-defined goals. In a group-oriented society like China, the group is more important than the individual. The individual exists only in the context of the groups to which the individual belongs (Alston 1997).

Uncertainty Avoidance

This measures how comfortable members of a culture are with structured or unstructured situations. Uncertainty avoiding people do not like being surprised or unprepared and prefer following rules even when it leads to inefficiency. Western people often face changes as they appear. This is less the case for Chinese who belong to the uncertainty-avoiding category (Alston 1997). This is reflected by some values that Chinese often adopt in business. These are some of the “Life-Raft” values outlined by John Kao in the Harvard Business Review (Chen 2001): “Thrift ensures survival”, “A high, even irrational, level of savings is desirable”, “Hard work to the point of exhaustion is necessary to ward off the many hazards in an unpredictable world”, “The only people you can trust are family”, etc. All these are means to avoid uncertainty.

Masculinity-Femininity

This dimension measures how people relate to each other. Masculine cultures encourage competition and assertiveness. Success is normally measured in terms of wealth and ownership of things. Things are more valued than people and their feelings. Work is the central part in life and money equals respect, since it is a measure of success. Feminine cultures, on the other hand, encourage interdependence, sympathy with the unfortunate,

equality between the sexes, and quality living. Scandinavian countries score lowest in masculinity and China and the USA fall in the middle region (Alston 1997).

Power Distance

This is a measure of to what degree members of a culture accept inequality. High power distance cultures emphasize large differences between leaders and followers. Generally North Americans, Scandinavians and Britons have low power distance scores, whereas Chinese score higher. By Chinese it is considered important that high-ranking Chinese are met at the same level from their Western counterparts. Otherwise it might be seen as a sign of lacking respect. Informality at an early stage is normally not appreciated. Generally Chinese like being associated with people with status since it improves their face (Alston 1997).

Family Orientation and Business

A Chinese saying states that *when a man gets to the top, all his relatives get there with him, when a man is found guilty, all his relatives go to hell with him*. This reflects the importance of the family in Chinese society. An individual exists mainly in the context of his family. His achievements belong just as much to the people that brought him up and his ancestors as to himself. The Chinese family is the central unit of most organizations. Most of Chinese business is family based. Even the biggest conglomerates in Hong Kong, Singapore, Indonesia, Malaysia, the Philippines and Thailand are in the hands of Chinese families. The different branches are often divided between the different family members with the head of the family having the last say (Chen 2001).

An interesting aspect of the future role of the extended family networks, including uncles and aunts, is the one-child policy. Traditionally the extended family has had an important role for business, economic development and job markets. The impact on these sectors is hard to predict, given that most of the children growing up in China today do not have any brothers and sisters, and their children, on top of not having siblings, will not have any uncles and aunts either (Ogilvy and Schwartz 2000).

The Overseas Chinese

When talking about Chinese as a people, one needs to distinguish between mainland Chinese and overseas Chinese. The "Chinese Diaspora" has throughout history dominantly used the sea as the route out of the country. As a consequence, most overseas Chinese have their ethnic routes in the provinces Hainan, Guangdong, and Fujian, which all border the sea. The first immigrants were Chinese merchants that left during the Song dynasty, 960-1279. These networks now extend all over the world. It is estimated there were 60 million Chinese living overseas in the mid 1990's. These groups form an important force for the future of China in that they provide their mother country with knowledge, a way of moving traditional Chinese values into the modern world, and capital.

Chinese now, although they live as minorities in their host countries, control the larger part of the trade in Southeast Asia. For example, in Indonesia, the Philippines and Thailand, where Chinese constitute 4%, 3% and 3% of the total population respectively, 70%, 70% and 60% of the countries' trade is in Chinese control. It is estimated that overseas Chinese cash holdings by the end of the 1990's exceeded 3 trillion (Ogilvy and Schwartz 2000). Some experts claim

that Chinese investments in mainland China constitutes 70% of total investment inflow. This can be compared with US investment in China which constitutes ca 8.2% and Europe, which stands for 5.2% (Chen 2001).

Generally, the overseas Chinese have mainly been active in traditional types of business, but today even high tech start-ups in Silicon Valley are also owned and managed by Chinese (Chen 2001).

Guanxi

The literal translation of guanxi is “connections”. This translation has a tendency to create misconception, since it has more aspects than just connections. It is important to consider it as connections between people that are based on reciprocity and mutual obligations, trust and shared experience. Generally, the deepest guanxi is found between family members, but does also extend beyond that. A common misconception is that money can buy guanxi. In reality, the personal component is much more important (Chen 2001). Some of the differences between western networks and the Chinese concept of guanxi can be seen in Table 4.

Chinese	Western
Personal relationships have organizational implications, and vice versa	Clear distinction between individual and organizational relationships
Personal and trust-based	Contract-oriented
Symbiotic relationships between networked organizations	High independence of networked organizations
Motivated by economic and social concerns	Motivated mainly by economic concerns
Flexibility and informality	Formality and clearly defined roles

Table 4, Chinese-Western Networking Differences (Chen 2001)

Driving Forces

These are the main driving forces as outlined in China's Futures (Ogilvy and Schwartz 2000) that will be the foundation for the future scenarios used to evaluate the software industry.

The shift to a market economy and the reforms

The reform process initiated by Deng Xiaoping at the end of the 1970's has drastically transformed China. An important factor in the process has been foreign investment that has had a drastic impact on rural areas along the coast line. Yet, the wealth has been unevenly distributed and many peasants today live under hard circumstances, whereas a wealthy middle class is growing in the urban areas. There are a number of problems as the economy races on, such as the risk of recurring inflation, the SOE's and the recently emerging problem with energy supply that now drives the world oil prices to peak levels.

Too much government and not enough

The majority of Chinese people do not necessarily want democracy but definitely choice. The growing middle class and economic reforms enforce this demand. Today Chinese have more choices than before and are allowed to do much of what they like as long as they do not challenge the Communist Party's power monopoly. Since many government officials also have business interests, there is a steady interference with the market forces for political or personal gains. On the other hand, the Chinese government spends around half the amount of GDP of a developed country on government on all levels. In addition, there are many more people on each unit in China than in the US or Europe. So, the government has little means to control what people do or do not do.

The cultural freefall

China has lived through three abrupt breaks with the past; the fall of Qing, the Cultural Revolution, and Deng's break with Mao. The party quite successfully removed Chinese traditional values through the Cultural Revolution. After more than 20 years of reforms and the Tiananmen Square crack down, not many people strongly believe in communist thought. The moral vacuum of what to believe in has been filled by American-influenced capitalism. The main question is whose values will influence China in the future.

The Overseas Chinese

In the mid 1990's 60 million Chinese lived overseas where they have a strong position in overseas business. They can provide knowledge, capital, links to the outside world, and ways of being modernized Chinese that the mainlanders can learn from. As business opportunities open up in China and China gains a stronger role in world politics, they turn their attention to their origin.

The power tension between the regions and the center and the risk of breaking up

The coastal region has been growing more rapidly than the inland. Earlier money was flowing from the regions to the center. Now it is the other way around, partly to make the central and western regions catch up with the coastal regions. There is also the ongoing political struggle between the regions and the center that in many cases have different agendas. Xinjiang and Tibet are also regions where the will to become independent from China is strong. To stem this problem, the party tries to boost the local economies and moves Han Chinese into the areas to gain more influence.

Demographics

The demographics of China are unique in many ways. For example: it is estimated to have a population of 1.4-1.5 billion by 2020; given the baby boom during Mao and now the one-child policy, tomorrow's children will be carrying a heavy burden supporting their parents; there are more boys than girls; future children will not have uncles and aunts, due to the one-child policy, which will have consequences on a society where a lot of networking goes through family relations; since most of the people stemming from China's baby boom are still in working age and Chinese traditionally are risk averse, the saving rates are among the highest in the world with 42% of GDP.

The polluted Chinese environment

With economic development, industrialization, and more and more people that can afford motor vehicles, China's environment is suffering severely. Given the size of China, this could easily become not just a national problem.

The influence of technology

Telecommunications and internet have and will have a considerable impact on China. Information sharing is today much easier in a country where other means of communications are traditionally bad. People can today find out about local injustices in far-off provinces and stage protests against cover ups, which may, for example, promote fairer behavior by the government. Today, Chinese know more about the outside world, and the outside world knows more about what happens in China.

The People's Liberation Army

The PLA is the single largest economic force and does also wield considerable political influence. It incorporates armed forces, an arms industry and also all sorts of other non-military organizations such as golf courses. It is also an important source of weapons exports to the developing world and is in charge of the third largest nuclear weapons arsenal with the ability to deliver these worldwide with its intercontinental ballistic missile systems.

The Communist Party

Today both Mao and Deng are dead. The Party was built on ideology, but today results are more important than at any point before. As long as people's lives are getting better the Party is probably safe in power. Succession and economic crisis are the biggest problems and the biggest challenges. There is no system for political handover, which historically has led to political infighting. Greed has grown after Mao's death and corruption is rampant. This is probably a larger cause for grievance than the lack of democracy. Another challenge after losing its ideological foundation is to provide an identity acceptable to the people in competition with the influence of foreign alternatives.

The "Class of '77"

This is the nickname given to the people first to graduate after Mao's death. They are the people that will take leadership in government, universities, the army and businesses. These people have no memory of a China run by warlords, only painful memories of the turmoil caused by radical politics during the Cultural Revolution. These people have good educational backgrounds, often from overseas universities, and knowledge of the world outside China.

Hong Kong and China

Before Hong Kong became a part of China, it served as a platform for investment to Guangdong regions whose economy consequently boomed. One can say that Hong Kong is in a race to transform China before China transforms it. China is in a difficult situation, since Hong Kong is the first test of the one country two systems idea that is intended for Taiwan. If the democratic movement in Hong Kong is quelled, it will have a negative impact on the prospect of making the idea attractive to Taiwan. Hong Kong therefore carries disproportionate influence on China.

China's relations with its neighbors and the world

Although especially American politicians like to consider China as a regional danger with military ambitions, its armed forces are disproportionately small given the size of its population and the length of its borders that were essentially established during the Tang dynasty (618-907). Since 1949 it has not invaded any country to subjugate it and has peacefully settled border issues with India and established full relations with Indonesia, South Korea and Singapore. China has few interests beyond its border, but it might change if it feels cut off from energy supplies it needs. Given that China is not pushed into a corner, it is unlikely to act offensively.

The United States

The United States considers itself to have a special relationship with China, having been involved in the civil wars before 1949 and having also meddled in the Taiwan conflict. So far there has been a lack of understanding between the two and an inconsistent American policy toward China. Whether or not the United States is able to establish a sustainable policy towards China may have considerable impact on the stability of the region.

Potential risk factors

These potential risk factors could have a negative impact on China becoming a global powerhouse of the 21st century. They stem from China's Futures (Ogilvy and Schwartz 2000).

The burden of the SOE's

The SOE:s are the survivors of the era of the planned economy, when companies served more as a mean to social welfare than profit making. Today, most of them are unprofitable and accounts for a large share of China's assets. They also extract financial resources from the banking system, becoming the basis for the lion share of China's non-performing loans. Trying to solve this problem also creates another problem, unemployment, which might in the worst case lead to social unrest if not dealt with carefully.

The poverty of the rural citizens

The growing gap in incomes between the urban rich and the poor rural citizens creates tension. If the farmers and other low income groups' situation continues to deteriorate, there is the potential for social unrest and new revolutions.

The destruction of the environment

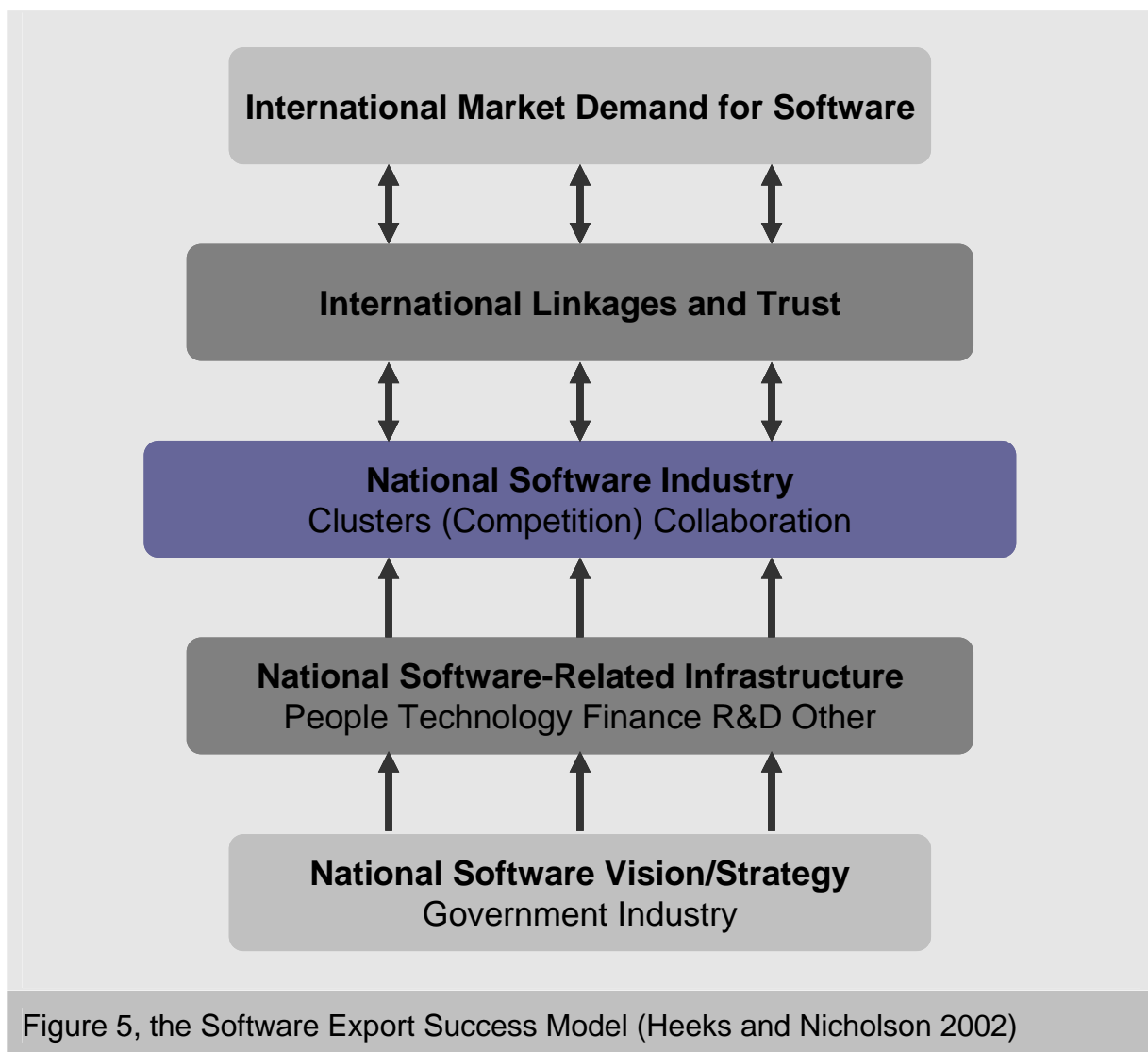
The quality of China's land is declining rapidly because of overpopulation, overdevelopment, deforestation, and pollution. This could lead to an environmental meltdown.

Corruption and the lack of an adequate legal system

These problems are deeply rooted in the way Chinese society works. In a worst-case scenario it will lead to social unrest, inefficient resource allocation and the continuous headache of foreign investors.

Micro Environment

Figure 5 is graphic representation of “the Software Export Success Model” that is based on the success factors referred to in the theory section about “Success Factors for Software Development In DC’s”. Some of these factors have been given greater consideration. One example of a factor that has been given less consideration is investments in telecom infrastructure. The reason for this is that it is that it is not an area of major concern in China. Clusters and collaboration has not been studied in detail either mainly because it is difficult to find useful data about the area and also difficult to determine what kind of impact it has on the development of the industry.



Global Software Outsourcing Situation

India was the first nation that was able to develop into a major global software service provider. Offshore software development has since then developed into more than just providing simple coding services. Today call centers, back offices, or complete business processes are outsourced to low cost countries. Forrester estimated the number of US IT jobs

going offshore would rise from 27,000 in 2000 to a cumulative total of 472,000 by 2015 (Moran 2003). With unfavorable unemployment figures in the United States and elections approaching in autumn 2004, it is not entirely unlikely that either the democrats or the republicans will decide that somehow stemming this flow of jobs going abroad is an efficient manner to attract voters. The following section provides a brief overview of some of the major outsourcing destinations, which stand in the center of this heated debate. Table 5 provides some facts about these countries.

	India	Ireland	Russia	Philippines	China	Poland
Average salary (US\$/Year)	5,880	23,000-34,000	5,000-7,500	6,564	8,952	4,800-8,000
Business Operating Cost (100 is most expensive)	7.7	N/A	21.0	N/A	8.7	13.1
Labor Pool (people 000)	415	23	8	290	200	N/A
Business software piracy (% of all software that is pirated)	70	N/A	87	63	92	N/A
Corruption Perception Index (10 is the best, the lower the worse)	2.7	6.9	2.7	2.6	3.5	4.0
Government Support	H	H	L	H	M	M
Infrastr./communications	L	H	M	H	M	H
Country Risk	H	L	M	M	M	L
Cultural compatibility	M	H	M	H	L	M
English Skills	H	H	L	H	L	L

Table 5, Comparison between outsourcing destinations (Source: see note¹)

India

India was the nation that made offshore software development a global trend. Today, America is the major destination for Indian services. The major Indian software development enterprises have already established overseas sales offices, and can therefore look for customers in a more proactive manner.

¹ This is a short explanation to the comparison table. The measures for average salary, labor pool, government support, infrastructure/communications, cultural compatibility, and English skills all stem from "A Buyer's Guide to Offshore Outsourcing" compiled by CIO Magazine. The measures are from 2002 and include areas such as testing, application development and call center activities. H, M and L implies high, medium and low respectively. Business operating cost, business software piracy, corruption perception index stems from the Economist's Pocket World in Figures 2004.

Advantages (CIO Magazine 2002):

- A large English-speaking and inexpensive software developer pool.
- Quality of service is high. India has more CMM qualified companies than any other country in the world.
- The government has provided strong support for the industry's development with such benefits as 10-year tax holidays for software exporters.

Disadvantages (CIO Magazine 2002):

- India's communication infrastructure is not as developed as one would wish.
- Tensions between India and Afghanistan over Kashmir raises the political risk.

A potential risk that India faces in the future is that its supply of service will not meet demand. A Nasscom-McKinsey from report predicts that the Indian education system will not be able to provide enough IT-professionals by 2008. According to the report, India will require 1.1 m more software workers, but it is only likely to be able to supply 885,000, a potential shortfall of 215,000 (Kobayashi-Hillary 2003). Another problem that India will have to deal with is rising labor costs. One indication of that is the jump in annual IT-salary increase from 12.9 in 2002 to 14.5 in 2003 for professionals, supervisors and technical staff (hindustantimes.com 2003).

Ireland

In the 1970s, Ireland started off with providing US enterprises with localizations and package customization for the European market. This is still their main area, but they have also diversified in application development services (Heeks and Nicholson 2002).

Advantages (CIO Magazine 2002):

- The service offering maintains very high quality.
- Communication is facilitated through limited language barriers and cultural differences.
- Infrastructure is mature and the costs for using it are low.

Disadvantages (CIO Magazine 2002):

- Although the cost level is lower than the average European level it is still very expensive. Due to the high costs, Ireland is quite likely to become a buyer of services from other low cost destinations in the future.

Philippines

The Philippines is by some analysts considered the best option after India in terms of offshore software development. The Philippines have had the benefit of using the infrastructure that the US left. The Philippines does not have a very strong emphasis on software development and provides a wide range of services from call centers to back-office data services operations such as data entry, data processing, digitization and transcription. Due to its link to the US as a previous protectorate, many American firms have also seen the Philippines as a preferred choice (CIO Magazine 2002).

Advantages (CIO Magazine 2002):

- Costs are low.

- Infrastructure and communications are well developed.
- Government support is good and the incentives include three- to six-year income tax breaks, exemptions from all government fees, licenses, dues, export taxes, etc.
- Good English skills and high familiarity with western (American) business culture.
- The labor pool is large.

Disadvantages (CIO Magazine 2002):

- There are not sufficient project managers.
- Instability stemming from local terrorist groups.

Russia

Russia's software industry has benefited from the emphasis on science during the era of the Soviet Union. Russia is the country with the highest number of scientists per capita. This has meant that they have gained an advantage in areas with a large technical or scientific component (Heeks and Nicholson 2002).

Advantages (Heeks and Nicholson 2002):

- Technical skills level is very high.
- Labor costs are very low.

Disadvantages (Heeks and Nicholson 2002):

- Government support is insufficient.
- Business environment carries the legacy of the communist system.
- The level of piracy is high arguably due to an "all property is theft" mentality.
- There is a lack of managerial talent.
- Due to lack of overseas sales offices etc, Russian firms only have a limited understanding of western business mentality.

Given that the business environment improves, the opportunities in Russia may improve drastically.

Poland

The Polish IT market is, as most countries in Eastern Europe, in its early stages of development as a destination for software development services.

Advantages:

- Intellectual capital is high.
- Costs are low.
- Infrastructure is well developed.
- Salaries are currently very low, but might rise with greater integration with the EU

Disadvantages:

- The market is immature and still needs time to grow.

Government Policy

Currently the main difference between the software revenues generated in China and in India is that India more or less only sell services abroad, whereas China's revenues stems from 50% products and 50% services with just a very small portion of services and products being exported. This is displayed in Figure 6. However, since 1999, the central government is strongly supportive towards the development of the local integrated circuit and a more export oriented software industry, which implies that China is striving towards the point "China tomorrow?" in Figure 6.

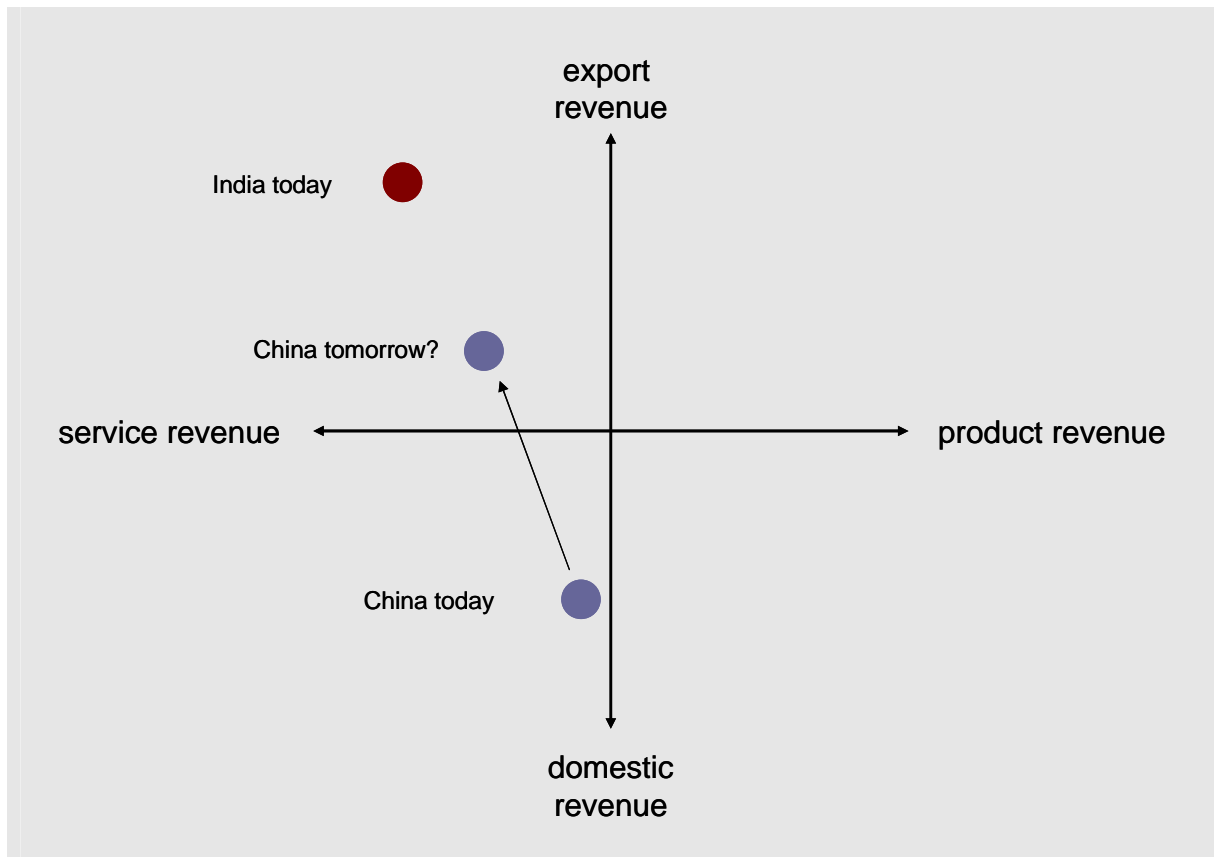


Figure 6, China's software strategy (Model stems from Heeks (1999))

One way to consider government policy in support of China's software development and incentive measures for such enterprises is to divide policy into national policy, policy that relates to the development of the western regions, and local policy.

National Policy for Software Enterprises

In the 10th five-year plan covering 2001-2005, the central government for the first time outlined a policy for the development of the Chinese software industry. This included a growth target of 30% annually, which would lead to sales revenue of \$20 billion in 2005. This target growth rate has so far been maintained. China also aims to build 20 large software companies with revenues exceeding US\$ 120 million, more than 100 "famous software

brands” and software exports of US\$ 1.5-2 billion by 2005. The export goal was reached by 2003 (China Software Industry Association 2003).

On another front the Chinese Ministry of Science & Technology (MOST) in 1995 founded “the Torch Plan” that seeks to fund academic institutions and small new companies to commercialize the products of academic research. They have generally been active for some specific areas of the high tech industry such as photo-electronic, software and biotech. Under “the Torch Plan,” 19 software parks were also established. This led to a further organic development of software parks in all corners of China. To gain control over this development the State Development & Planning Commission, the ministry responsible for long-term macroeconomic policies, announced 10 national software bases that receive central government support. These are the areas: Beijing, Shanghai, Dalian, Chengdu, Xi'an, Jinan, Hangzhou, Guangzhou, Changsha and Nanjing (China Software Industry Association 2003).

State Council Document 18

The state council document 18 that was issued in June 2000 is the basis for the preferential policies aimed at the software and integrated circuit industry development. Although the principal goal of the policies is to spur the development of the domestic industry, there is also a clear role for foreign direct investment and foreign invested enterprises. Most of the promotional measures outlined in the documents relate to taxes, which can be found in further detail in the next section. Another example of preferential policies that does not relate to tax is a “fast track” approval for software firms that want to raise capital in overseas stock markets.

Basic Tax Policy

The tax benefits generally assume the shape of refunds. In order to compare the incentive measures, it is useful to first consider the basic tax policies in brief.

Enterprise Income Tax (EIT)

Foreign entities are taxed at a flat rate of 33%. This incorporates a 30% national tax and 3% local tax. This might seem high in comparison with other countries, but given the number of different incentive packages provided for certain sectors, the real rate may be quite low. For companies established in SEZ's or ETDZ's, the effective tax rate is 15% with the same proportions as above going to the local and central government (The Economist Intelligence Unit 2003).

Value Added Tax

Value added tax is paid at 17% (The Economist Intelligence Unit 2003).

Income Taxes and other costs relating to labor

Income is taxed according to a progressive scale. Exactly how much is to be paid is displayed in Table 6.

There are also a number of items that are tax exempted such as local transportation and accommodation given that is paid by the employer. Other costs that have to be paid are social insurance and pensions provisions. In the normal case these costs will be around 55-60% of the salary. If these costs are not paid by the company, most employees do not pay for them themselves.

Monthly Income Above...(RMB)	...But Below (RMB)	Tax on Lower Amount (RMB)	Rate on Excess
0	500	0	5%
500	2,000	25	10%
2,000	5,000	175	15%
5,000	20,000	625	20%
20,000	40,000	3,625	25%
40,000	60,000	8,625	30%
60,000	80,000	14,625	35%
80,000	100,000	21,625	40%
100,000	-	29,625	45%

Table 6, Personal income tax rates (Source: WMRC Country Report, 2004)

Tax Incentives under State Council Document 18

These are incentive measures that relate to easing of the tax burden for software enterprises under document 18 (China Software Industry Association 2003):

- The preferential policies include a VAT refund to be used for R&D and expanded production. The refund reduces the effective VAT for software companies from 17 percent to 3 percent.
- The policy also includes income tax preferences. Newly established companies, once approved, would pay no EIT for two years and then half EIT for the next three years, beginning with the first year of profitability.
- Certain software companies, designated as "key software enterprises" in the national plan whom do not qualify for the 0 percent EIT, are to be taxed at an EIT rate of 10%.
- Software company's imports of technology and equipment are exempted from tariffs and VAT.

Incentives for Investment in Western China

One of the problems that China is facing currently is the divide between the western and eastern costal regions in terms of development. After opening up the costal regions, the growth rates have been very high. The western regions, on the other hand, have been lagging behind significantly.

In order to lessen the development gap, the government has formulated different measures to encourage investment. One of these measures is to lower the EIT to 15%, effectively providing the same type of incentives for investment as in the eastern special economic zones. FIE's that are designated as export enterprises with exports exceeding 70% of their total output value in the current year are eligible for a further 50% reduction on enterprise income tax in accordance with the tax law. However, the tax rate after the reduction may not be lower than 10%. These incentives apply to Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang, and the municipality of Chongqing. The two regions that are most interesting in terms of software development are Shaanxi and Sichuan (tdctrade.com 2000).

Local Initiatives Promote the Software Industry

The overall tax policy and for specific sectors that one wishes to promote are set on a national level. In the case of EIT more than 90% of the collected revenue goes to the central government and cannot be altered; that leaves the local government with little space in which to maneuver. There are, however, local initiatives to promote the industry (Ge 2004; Zhou 2004):

Liaoning

- Exemptions from urban and town land use tax.

Beijing

- Exemption from individual income tax on government funded award given to a senior software talent.
- Tax refund on one-time investment for purchase of car or accommodation when hiring senior software manager or senior technical personnel. The tax refund may correspond to max 80% of the IIT paid to senior software personnel.

Guangdong – Zhuhai

- Accelerated depreciation of fixed assets after registration with local tax authorities.

Shanghai

- Refund of the local revenue portion derived from (EIT) stemming from earnings reinvested in a software enterprise or invested in the establishment of a new software enterprise in Shanghai. The investment schedule has to span over more than 5 years.

Partly due to the fact that local officials act independently, without interference from the central government, there are also other measures that might be used to encourage establishment, although some of them might not be permitted by the law. Some examples could be: Not requiring the employees of the firm to pay income tax, which means that the SE can pay lower salaries to attract employees. Social insurance and pensions provisions could also be treated the same way. Lower housing costs, rental costs and electricity costs are other examples. In the end it might not be so much of what the official policy says that is important as the deal that one is able to negotiate (Zhao 2004).

WTO and Potential Future Developments of Tax Law

Today it is difficult to say how long these benefits will last. According to the Economist Intelligence Unit, the government has pledged to remove the benefits in the economic zones and in the open cities and create a uniform system for taxation. In 2001 this was predicted to take 2-5 years. Thomas Lagerqvist, working for the legal firm Vinge, also confirms that there are signs that such a proposal might be introduced to the people's congress potentially in the autumn of 2004, which would mean that the law would come into force during 2005.

For those investments that already have taken place in these regions it is likely that the current incentive schemes relating to SEZ's and ETDZ's would be phased out over a period of time. However, it is unlikely that local officials would just give up this manner of attracting investment. One future scenario would be that in order to make investment attractive, the local portion of the income tax would simply not be collected. There are also a large number

of smaller economic zones that have not been approved by the central government. These may potentially be harder control.

In the older economic zones, the lack of tax breaks as a means to attract investment might yet not be detrimental for the zones' future. The knowledge of how to accommodate foreign investors and the advantage in terms of infrastructure might prove just as important. On the other hand, if the benefits schemes were abandoned, it would cause a lot of trouble for the western regions, whose development has been promoted since 1999. They do not possess the advantages of the coastal regions, and one of the few reasons for investment in the west just now is the tax benefits. Yet, in this area the framework of the WTO provided ways to encourage regional development, industrial research, and pro-competitive activities, which would enable incentive schemes to continue to exist in some form. The Chinese government has also stated that it will deal with the tax benefit system on a regional basis, which will most likely mean that the western regions as well as the software industry will also in the future receive special treatment (The Economist Intelligence Unit 2001).

International Linkages and Trust

Links and Synergies

In order to sell export software and then especially sell outsourcing services, the industry needs not only to have the necessary skills but also have sales channels and enjoy their clients' trust. There are potentially two types of intermediaries that could fill these roles: Chinese nationals that are able to act on the international market or non-Chinese nationals that have an understanding of how to operate in China and abroad.

One of China's resources in this area is the ca 60 million overseas Chinese that can be found to a greater or lesser extent all over the world. They have in many cases grown up abroad, but are familiar with Chinese culture. Accordingly, they can create the links to the appropriate markets. A general problem in this area is the lack of trust between mainland Chinese and overseas Chinese or even between Hong Kong Chinese or Taiwanese and mainland Chinese. None of the parties trust the other due to different reasons. The result is also that potential business channels are not utilized (Chen 2001).

Furthermore, many Chinese students go overseas to study. According to estimates, 580,000 Chinese students have during the last 25 years gone overseas to study, but only 150,000 of these have returned to China. Up until recently, this has been a negative trend, but in recent years the number of students that are coming back has been growing at 13% annually. In some of the major cities the return rate is up to 20% (South China Morning Post 2003). In a survey carried out in Silicon Valley among mainland Chinese students, 43% responded that they were intending to return to mainland China. The main reason for returning home was professional opportunities. This could imply that the trend of more and more students returning may continue as long as economic development is beneficial (Dossani 2002).

The survey also showed another interesting detail. A larger proportion of the Chinese had Ph.D. degrees than Indians in Silicon Valley. Conversely, Indian and Taiwanese immigrants had a higher proportion of MBA's than their mainland counter parts. This might be one of the reasons why mainland Chinese in Silicon Valley often do technical work, whereas Taiwanese and Indians are frequently found in management positions (Dossani 2002). If this is true for other parts of the world, then one could expect Chinese students studying overseas mainly bring home technical knowledge and experience of working according to international standards, and not so much of international management experience.

Chinese policymakers have also devoted substantial resources to promoting technical and business exchanges that involve overseas Chinese students. This typically involves events such as conferences, investigation tours, joint research projects, and exhibits. Such activities are designed to involve scientists and researchers, business people, and policy makers in cross-regional exchanges of know-how and information (Saxenian 2003). These initiatives also include measures to encourage students to return home by giving them preferential treatment when starting businesses, etc. (The Economist 2003).

An additional possible sales channel for Chinese outsourcing services is the Indian outsourcing giants and the international IT-service providers that have established themselves on the Chinese market. They have the opportunity to act as intermediaries and sell Chinese

software services overseas. Moreover, these and the many foreign companies operating on the Chinese market and the increased competition that they bring is a source of potential synergies. The industry overview section gives some examples of the companies that have established themselves in China. For many of the top graduates a foreign company is the ideal employer, since they generally provide higher base salaries, opportunities to learn and a stable working environment. However, although the base salaries in local companies are normally lower, benefits and other unofficial cash payments can well be higher, given that the company has a strong position on the local market. Some of the skills gained by locals working for foreign companies will hence most likely spill back into the domestic industry. International competitors competing with the local industry will provide an environment where the local enterprises can learn from their international competitors.

Intellectual Property Rights

The general opinion about Chinese copyright and intellectual property right legislation is that it is good enough, but that enforcement is unsatisfactory. Today 92% of all business software sold in China is pirated (The Economist 2004). A case that received a lot of media attention is the one between Huawei and Cisco. Huawei allegedly copied parts, code, manuals and user interface from its competitor, Cisco. This was settled outside court by Huawei agreeing to adjust its product not to incorporate copyrighted material from Cisco (Summer 2004).

Two underlying reasons for the high rate of piracy in China today are embedded in Chinese society. The traditional Chinese conception of intellectual creation and protection differs significantly from what modern western intellectual property laws provide. Knowledge, according to Confucian thoughts, cannot be owned or controlled. It also cannot be used as a means for profit. Knowledge must be made public and duplicated as much as possible. The purpose of enacting laws was not to protect creativity in order to promote economic interests, but to maintain social order. In imperial China, law was enacted to control how and what kind of knowledge should be disseminated to the society. Protection of the purity of knowledge, rather than the author or the author's rights for profits, was the primary concern (Ho 2003).

The second reason relates to China's communist history. Marxist-Leninist theory assumes that private capital is a means to exploitation. Therefore granting intellectual property rights undermines communist thought. Due to this reason, there was little in terms of laws to support copyright during the pre-reform years (Ho 2003).

There are also other problems relating to the Chinese legal system that need to be considered before an end can be seen to the piracy problem. These are some examples (Ho 2003):

Decrease the influence of local politics on the legal system

One difference between Chinese courts and their western counterparts is that the legal system is not independent. This in many cases means that the judges in China have to adjust themselves to the local political conditions, which may lead to biased rulings.

Insufficient deterrents

So far the punishment for breaking copyright laws is not strong enough to deter from breaches. The damage payments gained generally does not motivate anyone even to proceed to court to solve the issue.

Lack of standardization

Currently, judicial decisions are published in the government publication, Gazette. However, due to the way the content is selected, it does little to provide guidelines for lower court reasoning. This means that the judges at these levels have to trust their own interpretation and experience. This means the way that law is applied can vary between different courts. The knowledge about IPR legislation also varies. In the important cities like Shanghai and Beijing legal professionals are trained in these types of matters. In the smaller, more far-off regions on the other hand, no such training is available.

Lack of Legal Professionals

The Chinese government has identified a need of 600,000 legal professionals. However, the current education system is not able to provide more than 700 lawyers a year.

There are also areas that need to be considered. The pricing of foreign movies and software today does not make it possible to afford anything else than pirated goods. For example, a Microsoft Office 2003 package is today priced the same way as it is abroad, i.e. above 2500 RMB. Given that the average salary in a Chinese city is around 2000, it is hard to motivate the buying of the real product when it is possible to get the pirated version for something like 8 RMB. If it did not cost 2500, more people would also more likely start buying legal copies.

In October 2001 amendments to the copyright law were approved to bring the legislation into line with WTO norms and international agreements on intellectual property, including TRIPS (Trade-Related aspects of Intellectual Property Rights). These amendments are based on the copyright law from 1990 (World Market Research Centre 2003).

In the area of consumer products it is unlikely that there will be any drastic changes in terms of piracy. But in the area concerning foreign companies setting up development centers in China, there are positive signs. One of the milestones was when the Chinese government issued "Zhong Guan Cun autonomy regulations" in 2000. These are rules regarding the structure of limited corporations, individual investment protection, and individual or organization engagement in any economic activity that is not prohibited by law. The regulations allow a wide range of economic activities with less government influence and control. These are the model regulations for setting up economic zones in China. This project has great potential if it achieves the following major objectives: (1) decrease government influence, (2) establish a rule-based economic environment to guarantee fair competition, and (3) provide strong financing mechanisms for start-ups (Ho 2003).

Trends

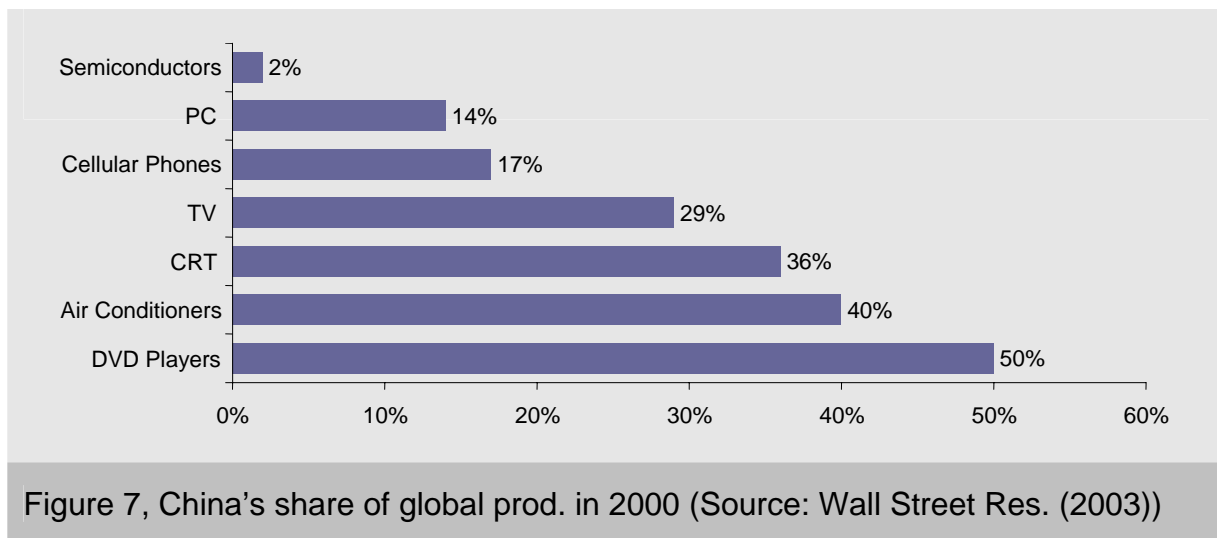
These are some of the recent developments.

- **More and more overseas Chinese students are returning home:** The main attraction is the increased business opportunities in China.
- **Improving enforcement of IPR:** This is likely to come with an overhaul of the Chinese legal system and the potential separation of legal structure from the political structure.

Software Industry Characteristics

Background

China has developed into something of a manufacturing backyard for the rest of the world. As the scientific and technical infrastructure improves, China also gains in the area of consumer electronics as depicted in Figure 7.



The background of the Chinese software industry is intertwined with that of the IT industry, especially the hardware industry. The earliest and most well-known IT companies have their origins in a variety of sources, with the more technology-intensive ones stemming from various government research institutes, universities and greenfield start-ups. These are important modes of firm formations identified by earlier research (Tschang and Xue 2003).

1. The model of spin-offs from the government-funded research institutes in the Chinese Academy of Sciences.
2. The model of university-researched technologies being commercialized by private enterprises which were funded partly by the university and partly by other agents.
3. The model of spin-offs from a state-run firm.
4. The model of greenfield start-up.

The issue of software and hardware is related, since many of the initial IT firms developed technologies that involved some amount of software, often embedded in hardware. Another common model is firms that initially developed hardware and provided integration service that then led into software development. In all of these, the government has played an important role in its provision of intellectual capital, training and incentives and it could therefore be useful to consider these linkages in further detail (Tschang and Xue 2003).

Government Influence

The government has had an important facilitating role for the Chinese IT industry. These are some of the ways that government has influenced its development (Tschang and Xue 2003):

- Served as incubator for IT companies before they could be privatized.
- Funded research in technologies considered essential for the national computer industry such as the 863 research program. A more recent example is the “Golden” projects that promoted the country’s e-commerce capabilities and other sectoral capabilities such as e-government.
- Funded research and development in several dozen research institutes of the Chinese Academy of Sciences (CAS) that later generated spin-offs.
- Promoted the IT industry by procurement policies on regional and municipal government levels.

The Influence of Universities and Scientific Research

A few well-known Chinese hardware firms had an earlier start as spin-offs from universities, usually as a result of some combination of software and hardware technology. These in turn have given rise to software divisions, or even software spin-offs. Both Founder and Lenovo have their roots in these kinds of projects. The former originates from research at Peking University and the latter stems from research at CAS.

One can say that the research institutes served not only as a nurturing ground for technology, but also as a holding area for scientific and engineering talent, keeping them engaged until the right time and private sector opportunity emerged. Otherwise much of the scientific talent would have been involved in other diversions. However, although the companies often originated in government research giving them a competitive edge, these companies were created and made successful by the combination of “private” efforts (e.g. university entrepreneurs and private investments) and public financing of research. Some of the earliest and most well-known PC makers were based on some kind of technology related to software (Tschang and Xue 2003).

Different Roots than the Indian Software Industry

The aspects of linkages between the formation of the product companies and university, government sponsored research and research institutes illustrate a major difference between the Chinese software firms’ and Indian software firms’ origins. Although many Indian firms did arise out of the defense industry (HCL), from the hardware industry (Wipro) many more recent Indian companies started immediately as export service companies (Infosys). A number of Indian companies originated from personnel leaving multinationals, or by those leaving the first generation of companies like Wipro and TCS (Tschang and Xue 2003).

Given that Indian software firms from an early point were gaining resources and contracts from MNC’s, they have been forced to adjust to international standards and develop their competence accordingly. The Chinese industry, on the other hand, has depended on contracts and resources from government-linked institutions and local universities. Arguably, this has lead to a flatter learning curve.

Growth, Size and Structure

As can be seen in Figure 8, currently the software products and services stand for about equal shares of the sales revenue for software.

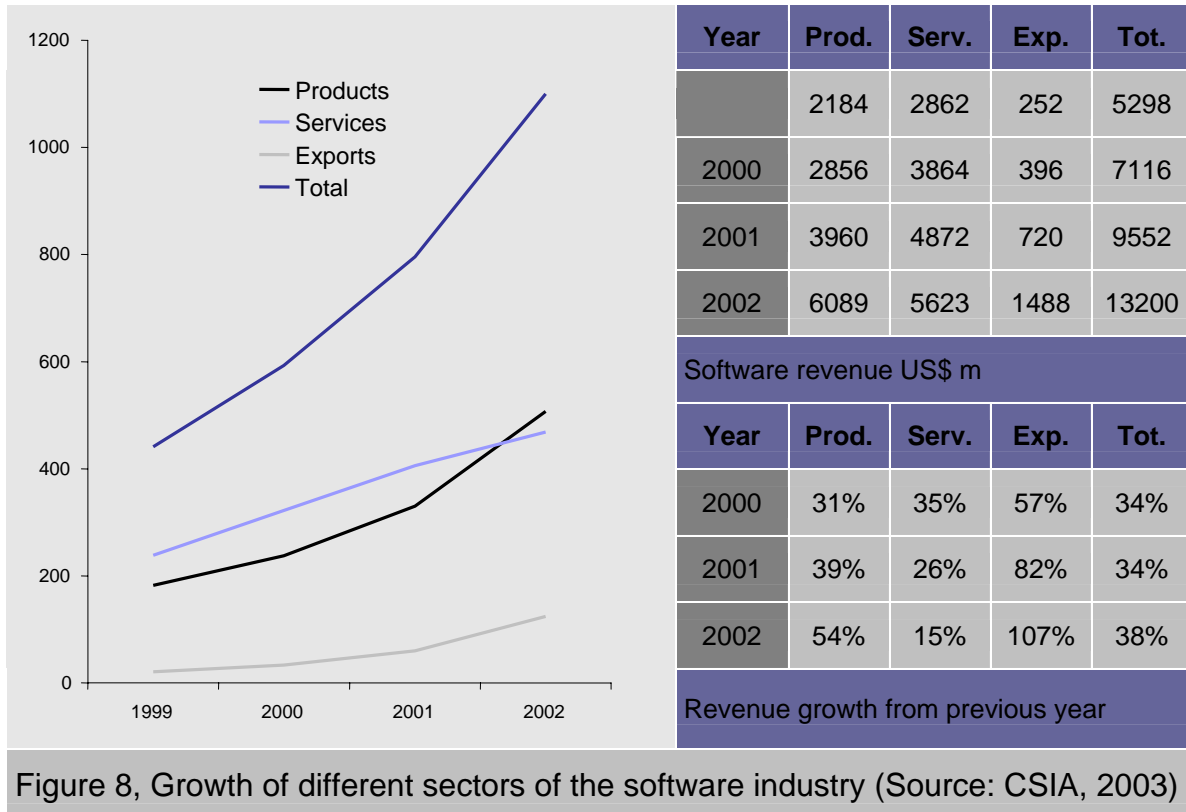


Figure 8, Growth of different sectors of the software industry (Source: CSIA, 2003)

The share of exports of total revenue is still small but experiencing strong growth. From 2001 to 2002 software exports more than doubled. Figure 9 depicts in which regions the software revenue is generated.

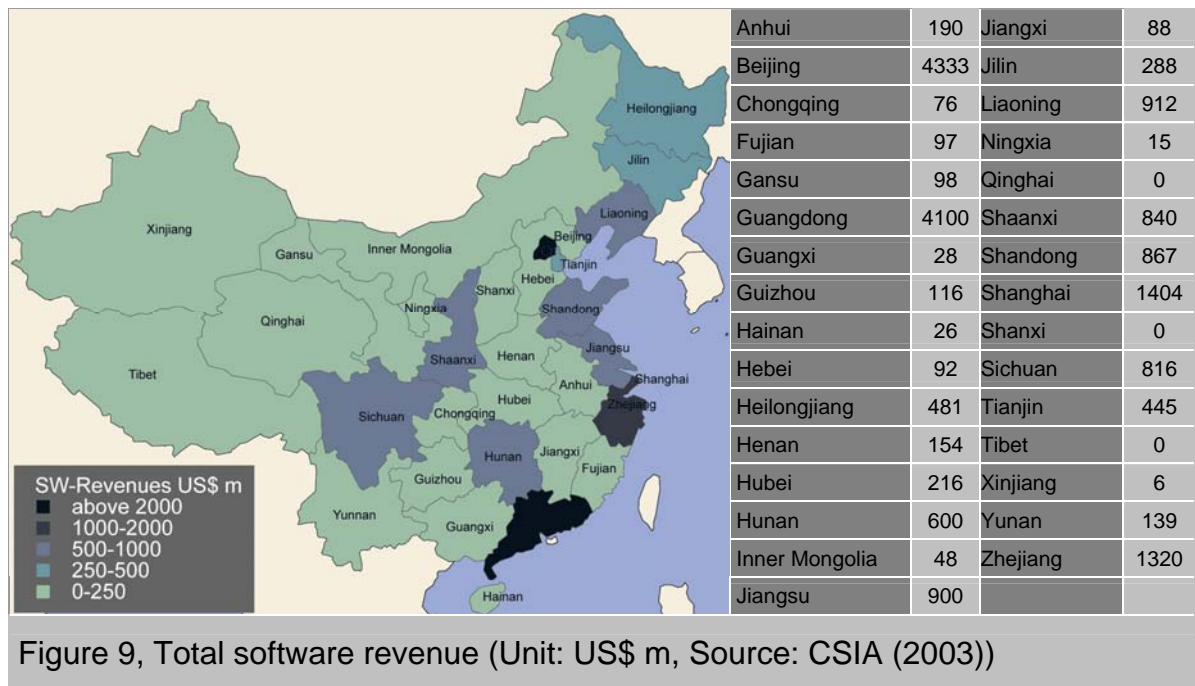
The coastal region is most dominant followed by Shaanxi, Sichuan and Hunan in the central western region.

The top 10 Chinese software enterprises in terms of revenue are Huawei, ZTE Corp., Putian, Digital China, Beijing Ericsson, Founder, Microsoft, Neusoft, CSS Group, and Datang Communications. Among these companies there is a strong emphasis on telecom and network related software, since they also produce corresponding hardware. A couple of these also export their software products mainly to Japan but also to the US. Still, the share of export-derived revenue is low overall. For more information about these companies, see appendix 1.

Firm Size

The general view of the Chinese software industry is that it consists of too many small companies. The conventional belief also suggests that many smaller firms are weak and not making much money. According to CSIA, most of these firms are operated on a workshop

basis with limited ability to take on more complex projects. In part, this small size may be due to the recentness of the industry's development.



To cure this problem of size, the central government has been encouraging the development of larger firms to strengthen the industry. The potential problem with this method is that although the companies may grow large, they may not develop technical capabilities. So what it might lead to is keeping large companies alive that would not otherwise have survived the competition and blocking the way for other companies that could have taken their place. This might have been the case in Shanghai (Tschang and Xue 2003). According to previous research based on data from 2000, almost half of the firms with revenues above 100 million RMB in Shanghai and Beijing are system integrators with limited capabilities, which contradicts the big and strong image. The research also showed that a lot of the firms developing products are medium sized. Some of small firms also showed high growth rates (Tschang and Xue 2003), although lack of resources and skills probably limits the growth of a large number of small firms.

In short, there may be small firms that are growing well, although it is likely that a large number may be suffering from deficiencies in terms of skills and resources. Being small also limits the size of the contracts that these actors are able to handle, which might serve as a factor limiting growth. There are also a number of large firms with sufficient capabilities in terms of services and products, but potentially also a number of large relatively weak firms. This is especially true about government-supported firms.

Quality Standards

Quality is an often mentioned problem with the Chinese software industry. One common measure for process maturity level and quality is SEI CMM, an assessment criteria designed by Carnegie Mellon. In terms of CMM certifications India lies far ahead of China. As of

March 2003 there were only four firms in China that had reached CMM 5 (SIECC 2004). Two of these certifications were archived by different Motorola branches. This can be compared with 64 firms in India that have reached this level (Nasscom 2004). Still, one positive sign in this area is the recent increase in certifications. In June 2002, China had only six firms with CMM level 3 and above (Qu and Brocklehurst 2003). At the end of 2003, there were 22 (SIECC 2004). One reason for the increase is the promotional activities aimed at more certifications carried out by the local governments in Shanghai, Beijing, Yunnan, etc. One problem that has surfaced is unscrupulous assessors that would rather see the enterprise pass the assessment than miss out on business. Two reasons why there are few CMM rated companies are: local firms find it difficult to afford certification, and some firms also consider it not as necessary since they are mainly developing products and selling less service. Some product oriented firms might still be interested in implementing the CMM framework, but then just as long as it makes commercial sense for the quality of their product.

Product Market

The market for application software is dominated by low-end applications, since the use of computers is still relatively immature. For example, only 10% of Chinese companies have implemented ERP systems and 6% supply chain management systems (U.S. Department of Commerce 2003). The following are the major software products areas.

Business Applications

At the lower end of accounting and financial management systems, the competition is fierce, with domestic companies holding a 90% market share. There are a large number of applications that fall into the category of management information system, predecessors of ERP, which are developed on a one-time basis by a large number of small companies. In terms of packaged solutions, the Chinese software firms, UFSOft and Kingdee, have the largest market share, but there are also foreign brands on the market. SAP has the third largest market share and Oracle ranks sixth (China Software Industry Association 2003). Although the foreign brands are superior in terms of functionality, the Chinese market does in most cases not yet require that kind of functionality. This makes it possible for Chinese firms to offer better value. The Chinese firms also have an advantage in terms of market knowledge since China's financial system requires considerable localization (Tschang and Xue 2003).

Security Software

Security software is a major emerging sector in China, in part because of the Chinese government's concerns with protecting its systems and data. This has led a number of companies to emerge in this, making it very competitive. However, the technology in this sector can range from the simple (e.g. desktop security like virus checkers) to the complex (e.g. network security based on university research). Thus, the degree of competitiveness depends on the quantity of R&D (Tschang and Xue 2003).

Telecom

Infrastructure and other large projects (e.g. telecommunications) have become an important area in which Chinese software firms have been able to grow big relatively quickly. The Chinese telecom is characterized by a large number of different protocols, which makes development complex. Some of the major hardware developers in this sector are Huawei, ZTE and Digital China that also develop software accompanying their hardware products.

Huawei has been successful on the international market by targeting developing countries with network and telecom equipment.

Education

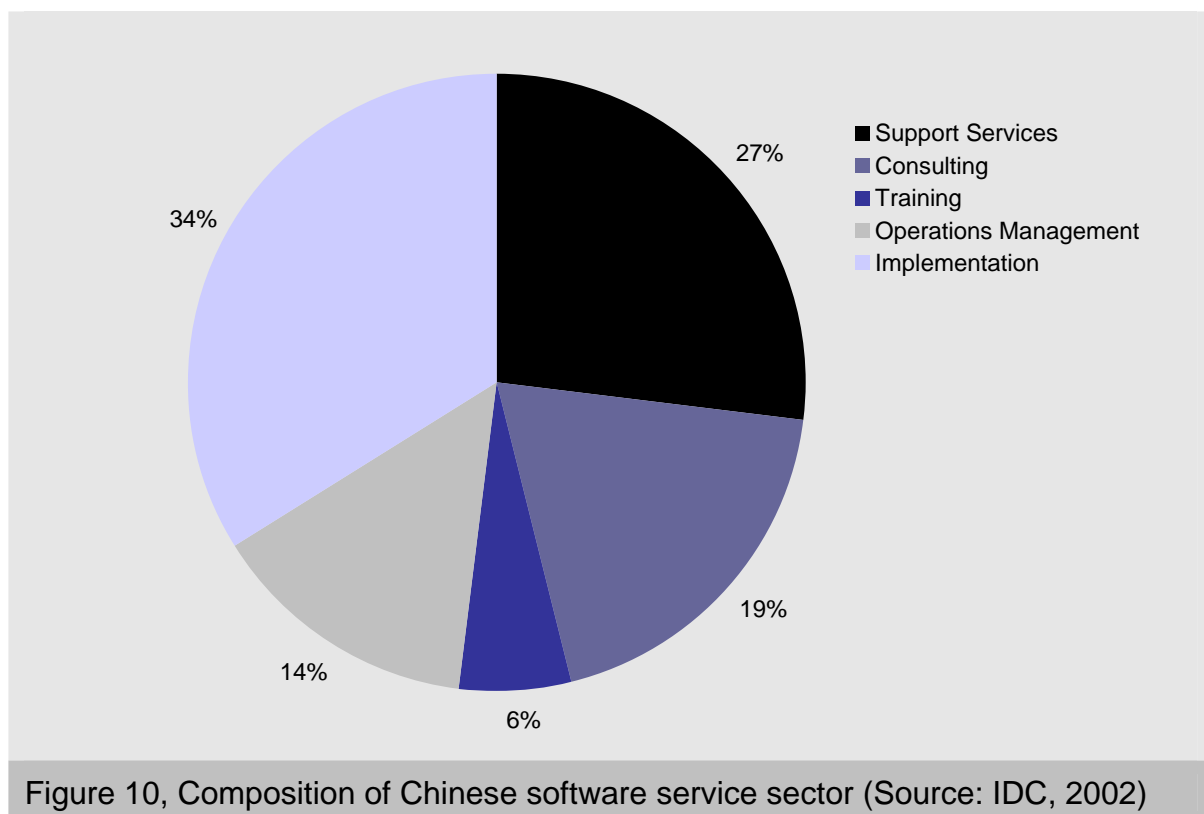
The education sector is experiencing strong growth due to the competitive school system and the increased PC sales. In the major urban centers, around 50% of the software sold is education software, although overall sales account for only 10-15% (U.S. Department of Commerce 2003).

Others

China has also developed competence niche areas such as character recognition.

Service Market

The Chinese software service sector is dominated by a large share of simple services such as implementation work, commonly referred to as system integration. This can be seen in Figure 10. System integration is at its simplest the connecting together of “off-the-shelf” hardware and software into information systems.



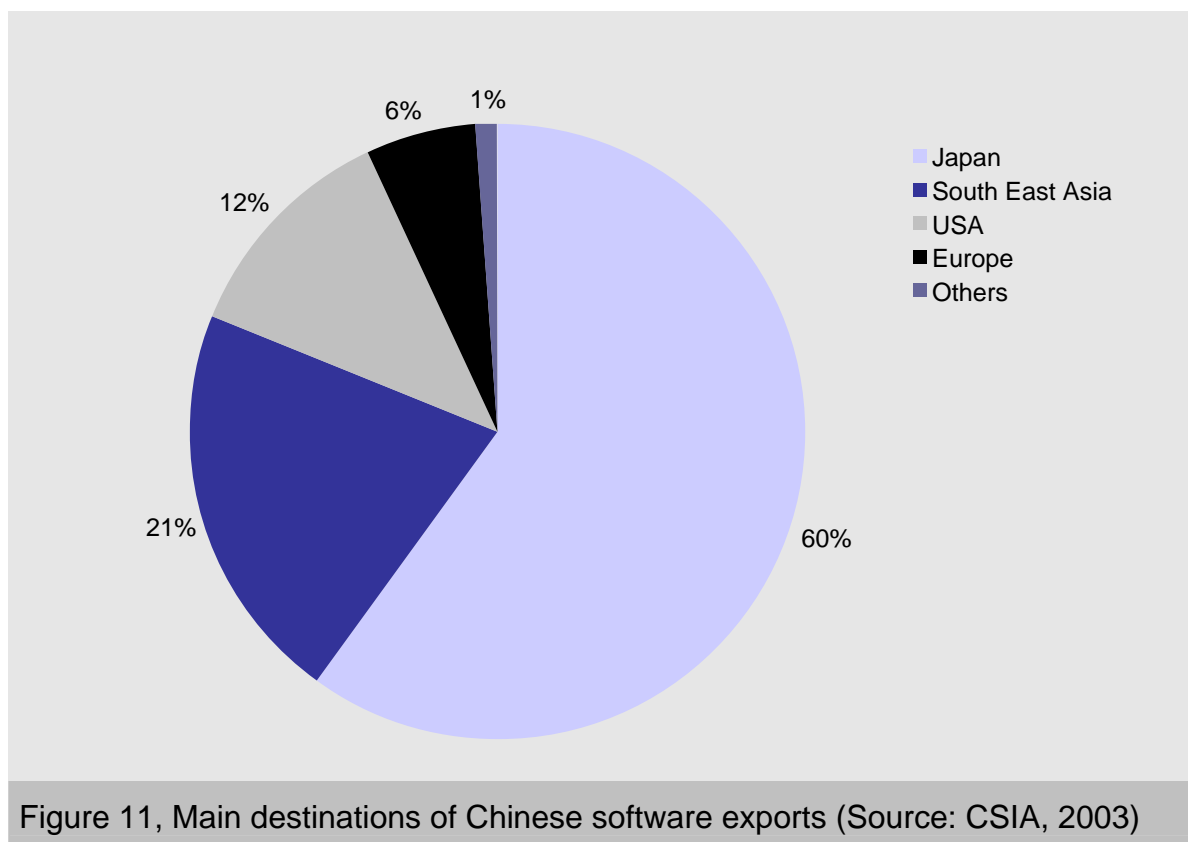
The grey areas between services and products can complicate the process of classifying firms. Furthermore, there are important relationships between services and products. One such relationship is that many firms combine or package their software product with customer service or a systems integration “solution” so as to help add value to somewhat less sophisticated customers. Customers in China do not have enough internal information systems expertise, so they rely on the software or systems integration vendors to help them. At the

higher end, consulting can also help these less sophisticated customers to deal with systems implementation of services by integrating the software solutions with their business processes. According to IDC, consultancy services will be the strongest growing sector up until 2006 (Citi Group 2003). This can be a sign of an increase in the sophistication level of the service offering.

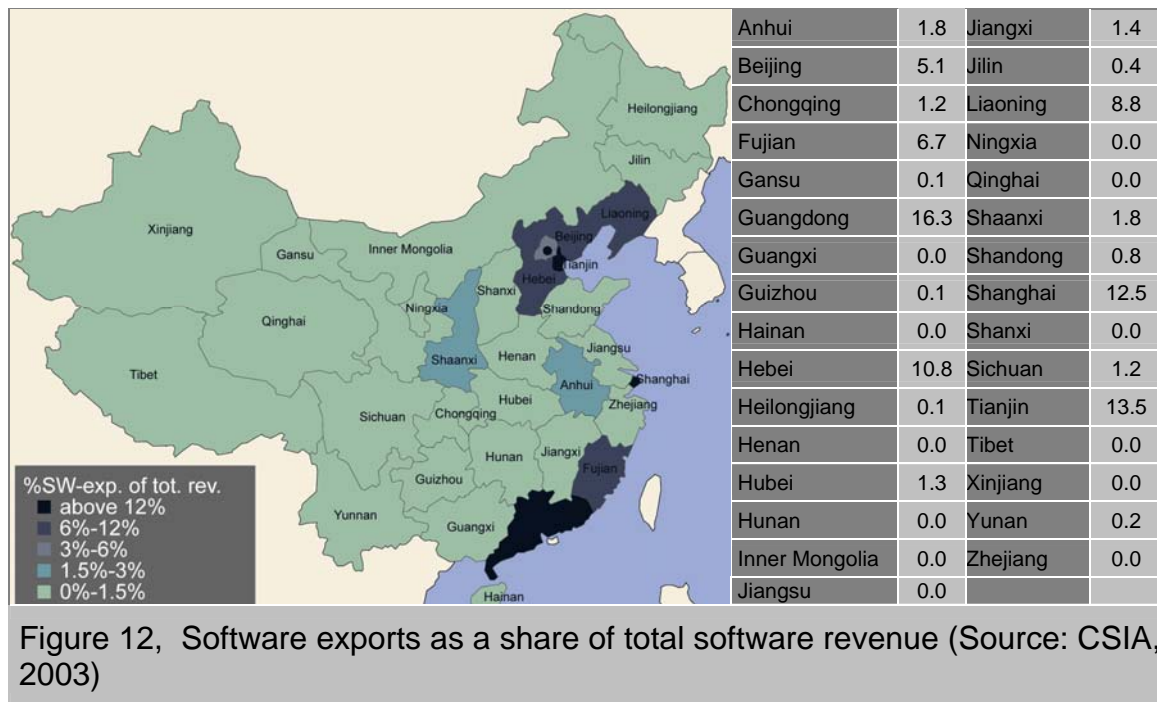
Software Exports

China's software exports can be divided into three different categories: software products, embedded systems that are integrated into electronic equipment, and outsourcing services. According to the Chinese Software Industry Association, the major part of software exports today fall into the third category, with a lot of the work carried out being simple low-end work such as coding. The products being exported today are mainly middleware solutions and virus software. The major market for these products is Japan.

The main destinations of Chinese software exports can be seen in Figure 11. Currently most of the exports are destined for Japan. Yet, according to Chinese Software Industry Association (China Software Industry Association 2003) the focus on the American market is increasing. The main problem to achieve this is the inability to reach the US market, since it often requires overseas sales channels and good language skills. These kinds of market tactics are not widely used in China today and a lot of the software is either sold through personal contacts of employees or through other acquaintances (Yan 2001).



Chinese software exports are today concentrated to Beijing, Shanghai, Shenzhen, Dalian and a couple of other areas. In Figure 12, one can see which areas depend more on software exports.



These are the characteristics of the main areas (China Software Industry Association 2003).

Beijing

Beijing is characterized by a large number of multinationals engaging themselves in software development. According to statistics from 2002, there were 38 of them. Most of the exports from Beijing are destined for Japan.

Shanghai

22% of China's foreign-owned software enterprises are located in Shanghai. They stand for more than 60% of Shanghai's total software exports. In 2002 the major Indian Software enterprises, Infosys, Satyam, TCS (Tata Consultancy Services), Zenstar, and Pentasoft entered the Chinese market. All of them chose Shanghai as their primary location.

Shenzhen

An important component of Shenzhen's software exports is embedded software. The most important players on this market are Huawei and ZTE. One of the advantages with Shenzhen as a location is its proximity to Hong Kong. Due to its past, people from Hong Kong possess a good understanding of western business and can therefore serve as a link to the west. Furthermore, the legal system is similar to the western legal system, and its funding framework is developed. This strengthens its potential as a base for exports to Europe or America. Shenzhen and Hong Kong also entered a cooperative agreement for this reason in 2002.

Dalian

Dalian is characterized by a large share of exports to Japan. Japan is one of China's most important trading partners and the trade links between Dalian and Japan have traditionally been very strong. These links facilitate software outsourcing business between Japan and China. Around 50% of Dalian's foreign investment stems from Japan as well. This has led to the establishment of a number of companies in Dalian that specialize in exports to Japan.

Major Local Exporters

Most of the top 10 software exporters are either involved in outsourcing activities with Japan or export software solutions related to the telecom or network products that they develop (Table 7). Few of these outsourcing providers have overseas sales offices, whereas their Indian counterparts have reached far in that aspect with well developed international sales networks. There are also a number of other software enterprises that are still in their early stages of growth and which might become influential in the outsourcing market in a couple of years.

Rank	Name	Export destinations	Export m USD	Areas of specialization
1	Huawei	40 + countries	115.6	Telecom equipment, networking equipment, optical transmission
2	Founder	USA	39.3	Chinese language publishing equipment, computers
3	Tiancai Co. Ltd	USA, Italy	27.3	Financial system, education, food and beverage, entertainment solutions and middleware
4	Neusoft	Japan	14.5	Outsourcing, security software, internet software, e-learning system integration, medical digitalization equipment
5	DHC Co., Ltd.	Japan	12.0	Outsourcing, integration, support, training, etc.
6	NEC System Integration China	Japan	11.7	Outsourcing, support services, e-commerce, consultancy services, system integration, training
7	Hangzhou Silan Electronics Company	Korea, Japan	9.4	Integrated circuits, embedded software
8	CSS Group	USA, Japan	7.0	System Integration, outsourcing, ERP, Middleware, E-government products, translation software, information security
9	NEC-CAS Co., Ltd.	Japan	6.9	General applications and middleware, internet applications
10	Shanghai Changxiang Computer Co., Ltd.	Japan	6.4	Outsourcing, intelligence traffic systems, systems for intelligence houses, application software, GIS

Table 7, Top 10 software exporters (Source: CSIA, 2003)

Global Software Service Providers

Another force on the Chinese service market is global service. Their large international networks could be used to utilize Chinese software development resources on a global scale. These are the main global software service providers in China today.

IBM

IBM has over 1800 people in its greater China service group. IBM Japan is reported to be planning to establish a 4000-person development center in Dalian. This would be the biggest in China of this kind.

Microsoft

Microsoft has a 300-person development center in Beijing. Their Shanghai call center has over 300 staff and provides customer support for Microsoft globally.

HP

HP generated US\$1.1bn from its hardware business in China in 2001. HP Consulting currently employs approx. 170 consultants.

Accenture

They are reported to be planning for a 1000-person development center in Dalian.

EDS

EDS China, founded in 1972, employs ca. 80 people in Beijing, Shanghai, Chengdu and Guangzhou.

CSC

CSCPRC has over 260 engineers with 60 of them based in China.

Bearing Point

Plans to build a development center in Shanghai. Their long-term goal is to reach 5000 employees in mainland China.

Indian Outsourcing Providers on the Chinese Market

India's perception of China was initially as competitor. This has now changed into considering it a "land of opportunity". Some of the reasons are (Citi Group 2003):

- Easier to find developers with Japanese and Korean language skills and it can serve as a bridge to the growing Japanese outsourcing market.
- Decreased dependence on the US revenues (currently 68% of India's outsourcing revenues stems from the US)
- Large potential customer base; MNC's in China and domestic market
- The 2008 Olympics, the World Expo in 2010 in Shanghai, E-government initiatives and the banking reforms create business opportunities
- Booming IT-training market

These are the main Indian software service providers that have entered China so far.

Satyam

Satyam was the first Indian software service vendor to open a development center in China in 2002. Their center was located in Shanghai Putong Software Park as a wholly owned foreign enterprise. According to original plans, their staff number should have reached 80 by the end of 2003. In the future, they are looking at expanding to cities like Dalian and Chengdu, where there are cost advantages (rediff.com 2003).

Zensar

Zensar entered into a joint venture with Hong Kong-based ALT (Asia Logistic Technologies) in August 2003. Their head office is located in Zhuhai. They plan to provide consulting services and software support to local companies with emphasis on CMM-related advisory. There are today no plans of establishing an offshore development center (The Hindu Business Line 2003).

Infosys

In January 2003, Infosys opened its first Chinese branch in Shanghai. This was planned for an earlier date but was delayed by the SARS outbreak and difficulties in getting the right permits. Their development center is expected to employ 200 people and service MNC's and domestic companies (Reuters 2004).

Tata Consultancy Services

Tata Consultancy Services (TCS) framework in China consists of three parts: Tata Information Technology Co. Ltd.'s Shanghai branch will be their headquarters. The Beijing office deals with marketing, PR, and support to the northeastern and northwestern regions and a development center will be established in Hangzhou that will provide services in coordination with their development centers in India. TSC's goal is to use China as a base for services to Japan, Korea and the Chinese-speaking regions in Asia (TCS - Press release 2002; rediff.com 2003).

Apart from these Indian outsourcing providers, the Indian training providers Aptech and NIIT have also established themselves on the Chinese market. Gartner is very optimistic about the Indian vendors' role in China and predicts that by 2006, 40% of China's software export revenues will stem from Indian operations in China (Citi Group 2003). According to Gartner the Chinese outsourcing industry in 2002 was 7 years behind the Indian outsourcing industry; basically, in the stage as when the Indian industry was about to take off. Dion Wiggins, the director of the China India study, argues that there is a gap of opportunity of a couple years from 2002 onwards that will determine Indian vendors' role in China (CSDN 2002).

Linux

The central policy behind China's Linux movement is policy 893, which strives to promote the development of software based on Linux. In 2001, the first year of the policy, 1.4 billion RMB was spent on the first projects called "raise the sails" and "set sails". As a part of this framework, common standards were developed. These included document standards, interface requirements, platform requirements and Chinese input standards. This was followed by the development of a Chinese Linux desktop which served as a basis for two Linux releases from the two co-developing companies, Red Flag Linux and China Soft Linux. Red Flag Linux also developed two different office suites. The most popular of these suits sold a bit more than

4000 copies. So even if these projects were designed to set an example for Linux use and purchase, especially in the government sector. Still, it is questionable how successful it has been so far. However, the market for Linux-based products grew by 66% in 2002. The total market size was estimated at 580 million RMB. The dynamics in the market for Linux-based products is not really what one would hope for with well established brand names such as Red Flag, China Soft and Turbo Linux dominating the market (China Software Industry Association 2003).

The adoption of Linux by the industry grew 30% in 2002. Still, the absolute number of users is estimated to be low. Government areas have so far been the main areas of implementation. Linux is now being used in the Department of Education, the Ministry of Disease Control, the State Postal Bureau, the Ministry of Foreign Trade and Economic Co-operation, China Central Television, and China Netcom (China Software Industry Association 2003).

There are a number of reasons why the Chinese government wants to promote the use of Linux. Some examples are: the lower cost of commercial software, the independence from foreign software manufacturers, better insight into the code, a way to solve the copyright disputes over the WTO entry and also to cost-efficiently promote IT use in the western regions.

One new strategy from the Chinese government is the deal made in November 2003 with an external supplier, Sun. As part of this deal, Sun shall deliver at least 200 million of its desktop versions of Linux to the China Standard Software Group that is formed by a number of state-owned companies (Reuters 2003). Another sign of the northeast Asian commitment to Linux is an agreement made in September 2003 by South Korea, Japan and China to jointly develop an alternative to Windows (Reuters 2003).

One of the main reasons for not adopting Linux has been the lack of enterprise applications and the lack of competent Linux manufacturers on the market providing these kinds of products. Another barrier is the lack of skilled professionals that are able to take on projects. Although there are known companies that provide Linux training, the scale of their operations is still not large enough. One of the signs that there is potential movement in this area is the formation of a union in Hong Kong to popularize Linux. In a survey in 2002, 65% of China's programmers said they were intending to look at Linux-related programming in 2003. 44 % already have some experience with Linux development work. This can be compared with 50% in North America.

If the government is successful in making Linux a national standard, the manpower demand with Linux experience will be immense. These demands will be especially difficult to satisfy in the south western regions. To solve this problem, the current problem of insufficient training and certification systems and organizations has to be solved. So even if the industry has gained strength both in terms of use and spread, it is still immature (China Software Industry Association 2003).

Embedded Software

Embedded software is one of the more promising sectors of the Chinese software industry. It is also outlined as a key development area in the Chinese government's policies 863 and 973.

Figure 13 shows which regions depend more on revenue from embedded software. The southern regions are dominant in terms of hardware manufacturing and the share of embedded software is therefore also higher. Guangdong is where most embedded software is made. There, 31% of the software revenue stems from embedded software. In Shenzhen this is up to 42%. A lot of these revenues originate from telecom and network equipment companies such as Huawei and ZTE that are located in the region. The market size for embedded software in 2002 was 11.9 billion RMB, which corresponds to a little more than 10% of the total market (China Software Industry Association 2003).



Figure 13, Embedded software revenue as a part of total software revenue (%) (Source: CSIA, 2002)

For the local market the most well known operating system for embedded applications is Hopen, developed and sold by Hopen Software Engineering Co. Ltd with customers such as Lenovo, etc. The advantage of this system is its small size, which has enabled it to compete with other more well known brands.

In the area of embedded Linux, some measures were taken in 2002. One of them was the formation of a Linux Union incorporating the main software and hardware manufacturers. Within this framework, work on standardization was carried out. Some of the main computer manufacturers were also encouraged to increase research related to Linux (China Software Industry Association 2003).

The two main representatives for embedded Linux are Chinasoft Linux and Red Flag Linux. The Chinasoft embedded Linux version has mainly been used in applications that have had special requirements in terms of speed and memory management. It is also closely compatible to the mainstream Linux editions. The Red Flag embedded Linux provides a lightweight user management support system, support of external drives, as well as a development tool. Both manufacturers provide support for a number of hardware platforms. On the Chinese market the mobile database Sybase is the dominant leader in the telecom sector with a 65% market share. The embedded database Xiaojinling from Basesoft Information Technology is a local

alternative for PDA's, mobile phones, etc. Another local alternative is Openbase mini (China Software Industry Association 2003).

An important driving force for the embedded software market is the booming market for computers, telecom and consumer electronics. For example, mobile phone sales grew by more than 40% in 2002 and the market for digital cameras grew by 127%. China today also stands for a considerable share of the world's electronic manufacturing. Another factor contributing to the growth is China's aspiration in chip-making technology. Shanghai, for example, aims at becoming one the leading locations in the world for IC-chip design by 2015 (China Software Industry Association 2003).

Humans Resources

Size of Software Workforce

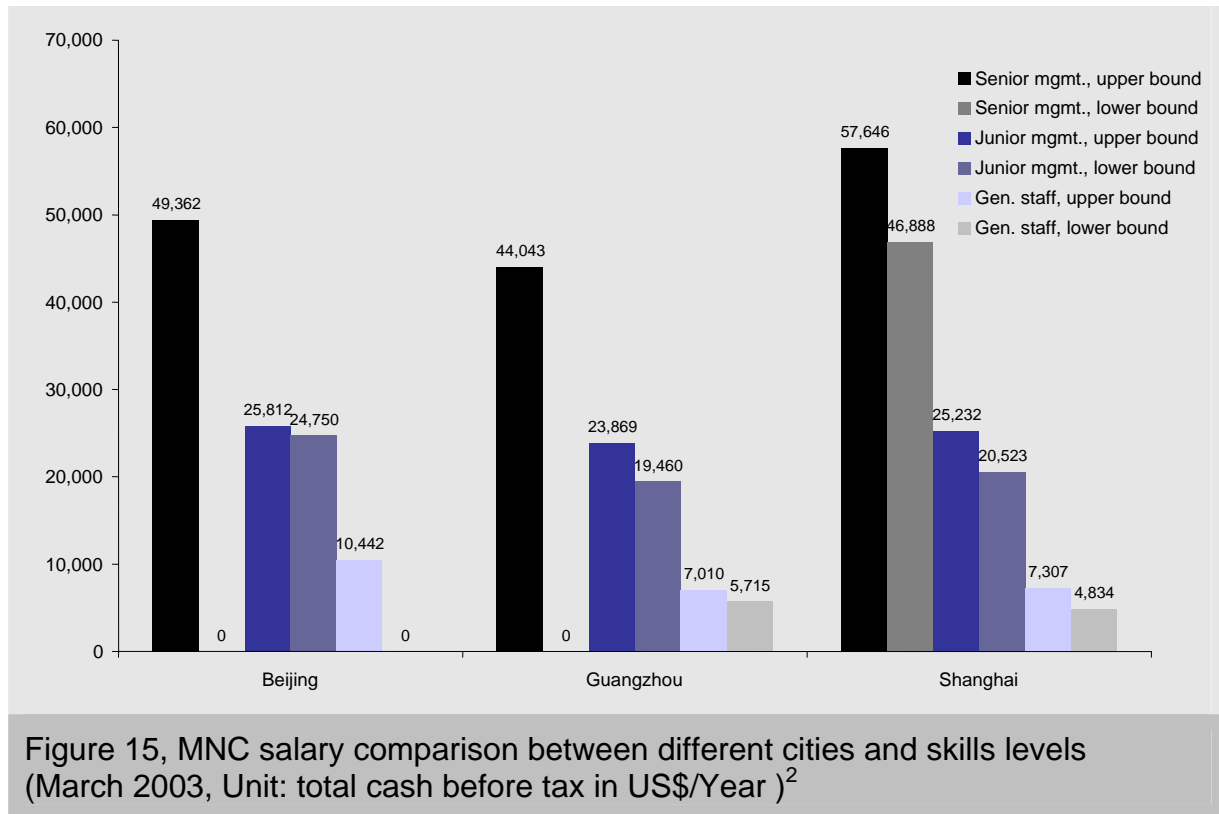
One of the greatest sources of potential with China is its large low-cost labor pool. According to research from the CSIA, China's 4500 largest software enterprises employ 520,000 people, of which around 260,000 carry out software development (China Software Industry Association 2003). Figure 14 displays in which regions these software developers can be found. One can from this picture determine that the largest numbers of working software developers can be found in Guangdong, Beijing, Shanghai, Shandong, Zhejiang and Shaanxi.



Figure 14, Software Workers in Different Regions (Unit 1000s, 2002, Source: CSIA (2003))

Salaries for Software Workers

Salaries for software workers in China vary significantly, depending on location, technical skills level, English or other language skills, management experience, etc. Average salary levels for software workers in China are quite low for unskilled labor. However, a MNC in China, in the process of recruiting, would in most cases pay a premium to attract more than average competent staff with language skills, etc. Figure 15 illustrates the differences in salary levels between Beijing, Guangzhou and Shanghai for different skill levels. There was no data available for Shenzhen that is more known for its IT industry than Guangzhou. One could expect that the salary levels in Shenzhen would be somewhat higher. Some of the categories of data that were not available are indicated by a zero. The data originates from Watson Wyatt, 2003 Compensation and Benefits Report as presented in the China Business Review (2004).



What this diagram reveals is that senior management skills are most expensive in Shanghai, followed by Beijing and Guangzhou. On the other hand, Beijing is the most expensive location for junior management and general staff. Guangzhou is the cheapest for junior management. The costs for general staff are more or less the same in Shanghai and Guangzhou.

Statistics generally show that foreign companies pay their staff more. One of the reasons for this is that the payments from MNC's generally go through official channels. This is not always the case with local companies, where one portion of the salary might be paid "under the table". This might mean that a local company in a strong position pays their employees more than a foreign company would do, and more than the statistics indicate.

The cities listed in Figure 15 are the most developed areas of China. The level of living standard and salaries are consequently the highest in the country. The data in Figure 16 are derived from a web survey carried out by ChinaHR.com (ChinaHR.com 2000; 2003). These are broad averages of salaries from a large number of different cities. Since these figures incorporate low level IT-services and a bigger component of employees working in local companies, the averages may be lower than what a MNC would pay in that city.

The significance of these figures is that there is a vast potential for cost savings if one locates somewhere other than in Beijing, Guangzhou, Shanghai or Shenzhen. Some attractive locations are Chengdu, Hangzhou, Nanjing, Dalian, Xi'an, etc., since these cities also have

² The data in the table is based on a range of different skills levels, where for example a senior manager would into skills level 13-15. 15 is in that case the upper bound and 13 the lower. In the case where there is no data indicated by a zero, there was not enough data to give a correct indication of the category in question.

strong universities that carry out education and research in computer science and software development.

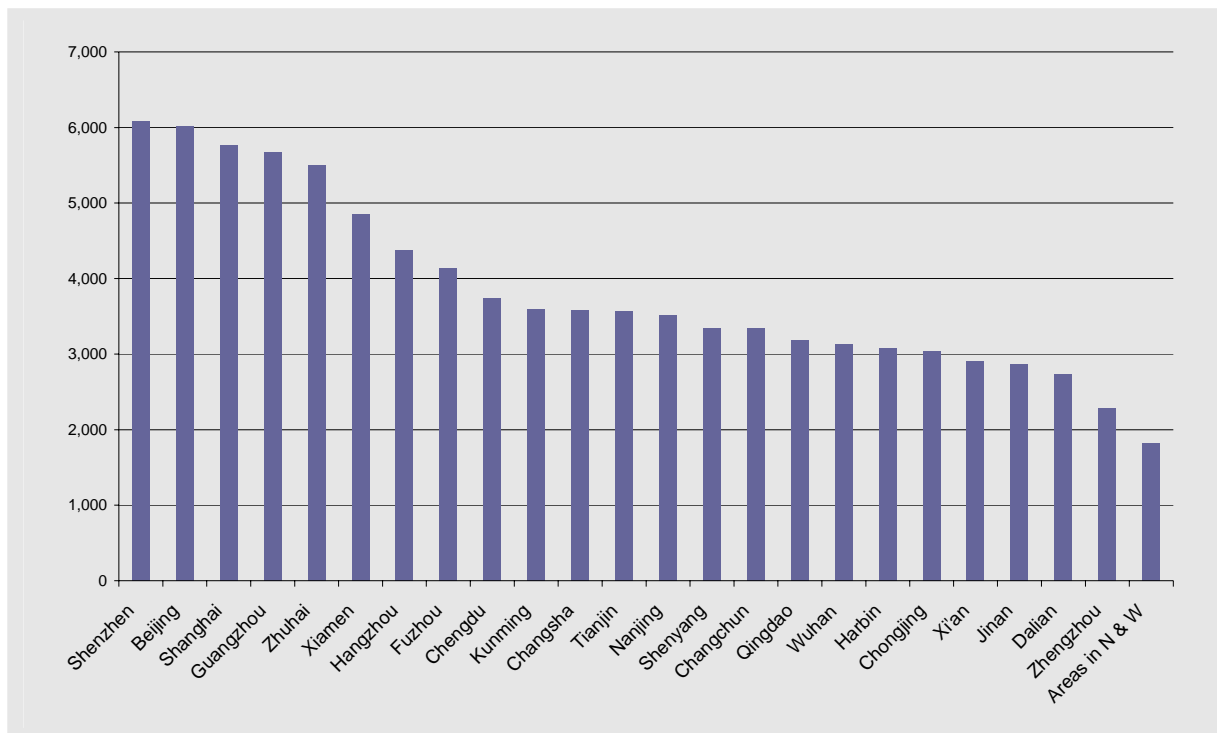


Figure 16, Average salary levels for different cities in China (2000, Unit: US\$/Year)

One factor that speak for China in a comparison with India is that wage inflation in China is about half of the 13% found in India 2003. This can be attributed to the development level of the Indian software industry (Yamamoto 2004).

Language Skills

The interest for English in China has been steadily increasing since the country started to open up to the outside world in 1978. Initially, Beijing, Shanghai, Guangzhou and Xi'an were the cities where foreign language training was concentrated. Since a couple of years ago, all Chinese students are taught English from first grade, and all students have to pass certain English tests in order to graduate from universities. Consequently, most Chinese students know how to read and write English to some extent, even though the level of spoken English is generally quite low. China hosting the Olympics in 2008, the WTO entry and the men's soccer team qualifying for the world cup has recently spurred an increasing interest in English (Li 2002). Currently, it is almost something of a requirement to know English to find satisfactory employment and the market for English learning material is booming.

In terms of the Japanese language, China has a definite advantage. Japanese language uses three different alphabets for writing, Hiragana, Katakana and Kanji. Kanji is in essence the same as the traditional character set that is used in Hong Kong and Taiwan, and it is also closely related to the simplified Chinese characters used in mainland China. The meanings of the characters have changed slightly over time, but in most cases the basic meaning is the

same, which makes it easier for Chinese to learn written Japanese. Furthermore, China and especially the region of Liaoning and the city of Dalian have strong trade relations with Japan. These links has been the foundation for an outsourcing sector around Dalian, focusing on the Japanese market. Korean speakers are also reasonably easy to find, since China experienced an influx of North Korean refugees during the Korea War. This group of people are now accepted as one of China's 55 minorities.

Structure of the Workforce

In order to satisfy the demands of China's expanding software industry, the Chinese government has adopted a model similar to India's for creating and developing a software workforce. The goal is to create a pyramid-shaped skills structure with the following three skills levels.

High-level Skills, Management, Analysis and Design Skills

Sources: graduates from universities and research institutes with work experience, returning graduates from overseas, foreign talent.

Mid-level skills, Backbone Software Development Skills

Sources: non academic training organizations, inexperienced university graduates and on-the-job training.

Low-level skills, Technology Workers

Sources: specialized technical secondary schools and training centers. This type of training is intended to have a very practical orientation.

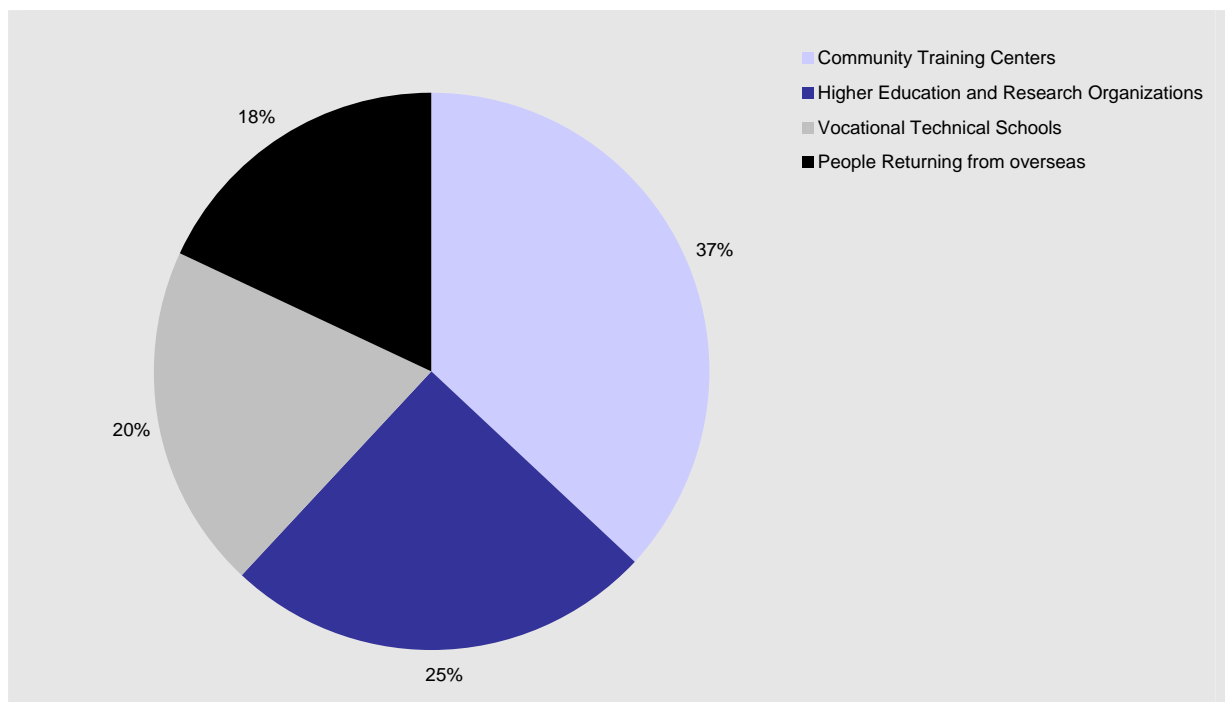
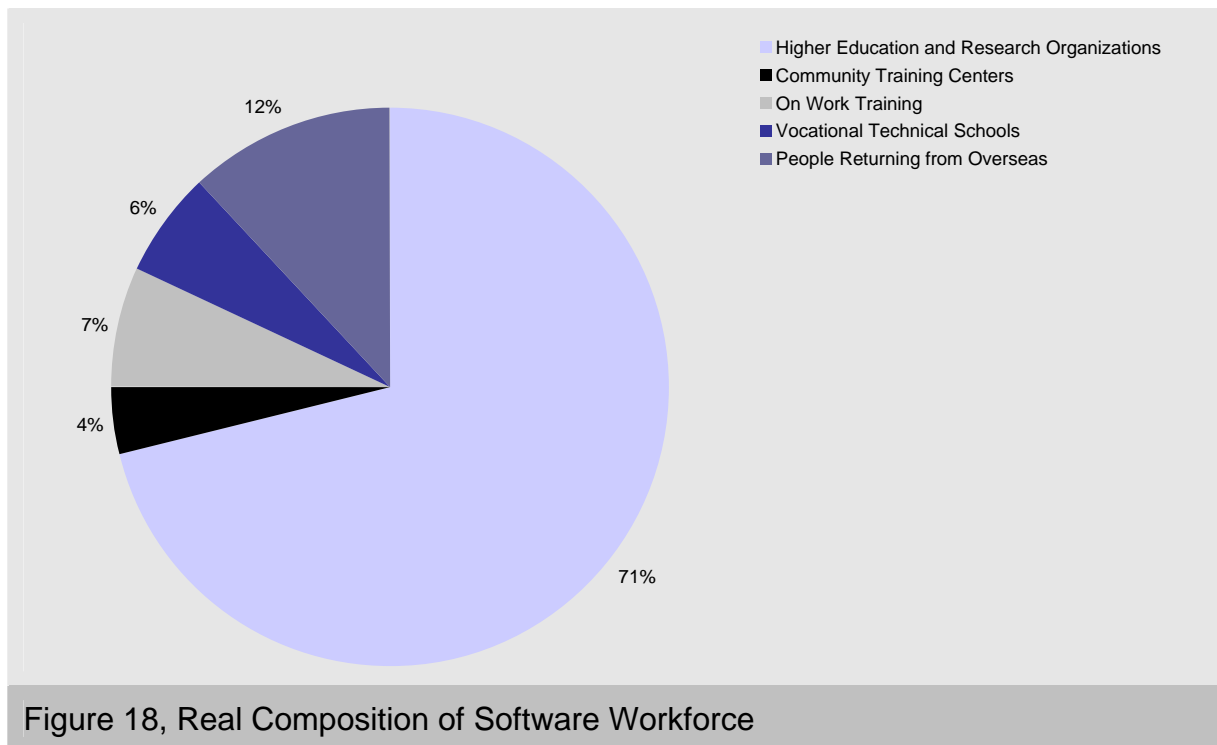


Figure 17, Ideal Composition of Software Workforce

The ideal structure of the workforce according to the Chinese Software Association can be seen in Figure 17.

However, the real composition differs drastically from the ideal picture as can be seen in Figure 18. As of today this skills structure has the shape of an olive with too many people with mid-level skills and too little people with high-level managerial skills and low cost software workers.



The dominant group is students with Bachelor's degrees in Computer Science. The high dependence on higher education makes it difficult to expand the workforce rapidly and to standardize work roles. The BA graduates that carry out most of the work today are badly suited for high-level management or design roles due to their lack of experience. On the other hand, they are overqualified and cost too much for simple coding.

As of 2002 China was estimated to have 520,000 people working in companies developing software. Within these companies, 250,000 were involved in the software development process. From these 520,000, employees with a university degree amounted to 380,000. 50,000 of them had Master's degrees. Figure 19 shows the concentration of software workers with an education level above a Master's for different regions. The conclusion one can draw from it is that the highest educated workforce can be found along the costal regions and in Sichuan and Shaanxi.

The data is based on the 4500 largest software enterprises in China and reflects the education level of the developers and people working with non-development work in these companies. No data was available for Qinghai and Tibet.

Overview of Chinese Software Education

The number of people going to Chinese universities is increasing. The percentage of the Chinese population that attends university rose from 2% in 1980 to 12% today. Still, China is lagging behind developing countries in terms of education spending. Today China ranks in the 13th worst place in terms of education spending as a percentage of GDP with 2.1%. This can be compared to India that spends 4.1% of GDP on education (The Economist 2004).



Figure 19, Proportion of workforce in software companies above Masters degree (%) (Source: CSIA(2003))

Universities and Research Institutions

Totally China has 475 schools that have undergraduate courses in computer science. At these schools there are around 560,000 computer science students with 60-80,000 graduating every year. This can be compared with India, which produces around 40,000 graduates every year. In 2002 there were around 550,000 students attending courses specializing in or relating to computer science. This produced 70,000 graduates in 2002.

However, there are a number of problems related to traditional computer science education in China (China Software Industry Association 2003):

There is a gap between software training and real practice

The training provided at universities has traditionally not been very well adjusted to the market's demands. Emphasis has been put on theory, which means that graduates from related disciplines rarely have practical experience or knowledge of international standards.

Teaching material has not stayed up to date with the pace of change in the IT industry.

The use of outdated teaching material and strong emphasis on theory has forced the companies that want to hire a fresh graduate to train him for 6-12 months before he can be put to work.

The workload at the universities has been too high.

This limits the students' spare time and opportunities to develop on their own.

There is a lack of differentiation and suitable structure.

Teaching material and methods are also more or less the same from Qinghua University and Peking University down to the common universities around the country. There is little differentiation between the different universities and little differentiation in teaching suitable for fostering different work roles (China Software Industry Association 2003).

Location	Total	Model Schools	No of Top 50	No of Top 100
Beijing	10	7	5	8
Shanghai	6	4	6	6
Nanjing	6	2	4	5
Xi'an	3	3	1	2
Guangzhou	3	2	2	3
Jinan	2	1	1	1
Wuhan	2	2	2	2
Tianjin	2	2	2	2
Changsha	2	1	2	2
Chengdu	2	2	1	2
Harbin	2	2	1	1
Hangzhou	2	2	1	1
Chongqing	1	1	1	1
Dalian	1	1	1	1
Fuzhou	1	0	0	1
Jilin	1	1	1	1
Zhengzhou	1	0	0	0
Kunming	1	1	0	1
Shenyang	1	1	1	1
Suzhou	1	0	1	1
Hefei	1	1	1	1

Table 8, Number universities with computer science/software engineering courses

In order to find a solution to these problems, the government established 35 model schools for software engineering in 2002 (for list of the names see appendix 2). These schools recruited on average 800 undergraduate, double major and Master's students each. At these institutions new teaching material is used as well as new teaching methods. Most of the teaching material stems from the corporate world and many of the teachers also have a background in the industry. Teaching is also partly carried out in English by foreign experts. The goal with these schools is within 2-5 years to reform training and management methods, and provide high level software development talent with a practical emphasis that satisfies international standards. They could then serve as a model for the education system in this field (China Software Industry Association 2003).

Chinese universities providing courses in computer science and software engineering can be found throughout the country. The best opportunities to find graduates from these fields are in Beijing, Shanghai and Nanjing. The total column signifies total universities with computer science or software engineering courses. Model schools indicates these schools are part of the new “model school” program. Top 50 and 100 columns indicates the number of universities in the top 50 and top 100 lists of universities provided by the Chinese government. The top lists are general top lists and not a top list for software engineering schools, since there is no such official list. The universities are those that have been recognized by the Ministry of Education. The complete list with names of the institutions can be found in appendix 2.

Community-Based and Private Training

Today around 100,000 IT-workers graduate each year from training centers and non-university training educational institutions. This can be compared to India, where the corresponding figure is 300,000. This forms an important cornerstone for the Indian software industry (China Software Industry Association 2003).

As a foundation for the future professional education in China, the government in September 2002 issued a document with the title “Vigorously Moving Ahead with Reform and Development of Professional Education”. This document addresses how to extend the scope of professional training. One part of this policy aims at promoting foreign organizations and private entrepreneurs to start training institutions (China Software Industry Association 2003).

Traditionally, there have been a number of community-based training organizations. The problem with these has been that most of them focus on how to use software and little about how to develop it. This means that these kinds of organizations provide less than 25% of the total software workforce. People with this kind of background mainly work in sales or other types of support activities. Nevertheless, these organizations are slowly becoming aware of what the industry demands and are adjusting accordingly. Recently, this awareness has led to fierce competition, strong market growth and more foreign players entering the market to establish their brand names. Since this market is still immature, the quality of training is varying (China Software Industry Association 2003).

India's largest training company, NIIT, and third biggest, Aptech, have also established themselves in China. NIIT has a 100% subsidiary that operates about 50 training centers and plans to establish 500 centers by the end of 2007. NIIT has entered a partnership model with 6 universities such as Qinghua University, Peking University and Shanghai Jiaotong University. Aptech has established its first JV center, co-invested with the Chinese Ministry of Science and Technology in Beijing University in 2000. Their goal was to reach 200 training centers by the end of 2003. In 2003, Aptech had 30,000 students enrolled in their training courses. The country's largest training organization for Microsoft certifications is the web-based Milkyway Education Center (China Software Industry Association 2003).

Professional On-the-Job Training

In the area of professional work training there are a number of cooperative agreements between higher educational institutions and local and foreign companies. Some examples of companies engaged in these kinds of activities are Microsoft, IBM, Sybase and Oracle. The

main advantage to these kinds of activities is that the curriculum suits industry demand. According to estimates, within the next three years 1 million people will pass through this type of training (China Software Industry Association 2003).

Vocational Schools Specializing in Technical Subjects and Technical Secondary Schools

These forms of education are some of the most common forms of education in China today. The intention is to encourage these schools to provide more education relating to software development to become the main source of software blue collar workers. The scope of training given at these schools is limited to simple coding and compilation (China Software Industry Association 2003).

Others

People that have gone through university or college-led self-study or training at work

This kind of teaching has a 20-year history in China and around 1,200,000 people have passed these kinds of IT courses (China Software Industry Association 2003).

Chinese Returning Home

This group receives special attention from companies because of their rich experience and knowledge of international standards. Still, the number of returnees is still quite small, but with the increasing living standard in China and also global economic downturn, one could expect that this flow might grow more important (China Software Industry Association 2003).

Lack of Certain Skills

There are a number of problems that need to be resolved and skills that need to be developed for the Chinese software products and services to become internationally competitive. These are the main skills that are lacking today (China Software Industry Association 2003):

Project Management Skills

As mentioned earlier, the Chinese software industry currently operates on a workshop basis, where the scale of projects is small. In order to develop into an industry, managers need to attain project management skills to take on bigger projects.

Design Skills

Especially to develop software products, there is a need for people with design skills.

People with International Experience

The Chinese software industry has limited international reach. This in turn depends on the lack of a sales force with international experience and personnel with knowledge of international standards. So far, the outsourcing contracts that local companies have been able to attain have either been gained through contacts or through foreign companies that already are located in China. Without reaching out to the international market to compete, it is also very difficult to develop the industry.

People with “Multiple Talents”

In order to develop products or provide services that suit the industry's need, there has to be an understanding of how the industry works and what particular needs this industry has. To create this link, people with knowledge of the industry as well as knowledge of how to develop software are needed. This is something that the education system does not provide enough of today.

Software “Blue Collar Workers”

One of the areas of urgent need is for cheap software workers that would be able to lower the cost of development, and enable university students to carry out work for which they would be more suited. Just as an example, during one period of time, there was a lack of 40-50,000 blue collar workers in Beijing.

High Turnover Rates

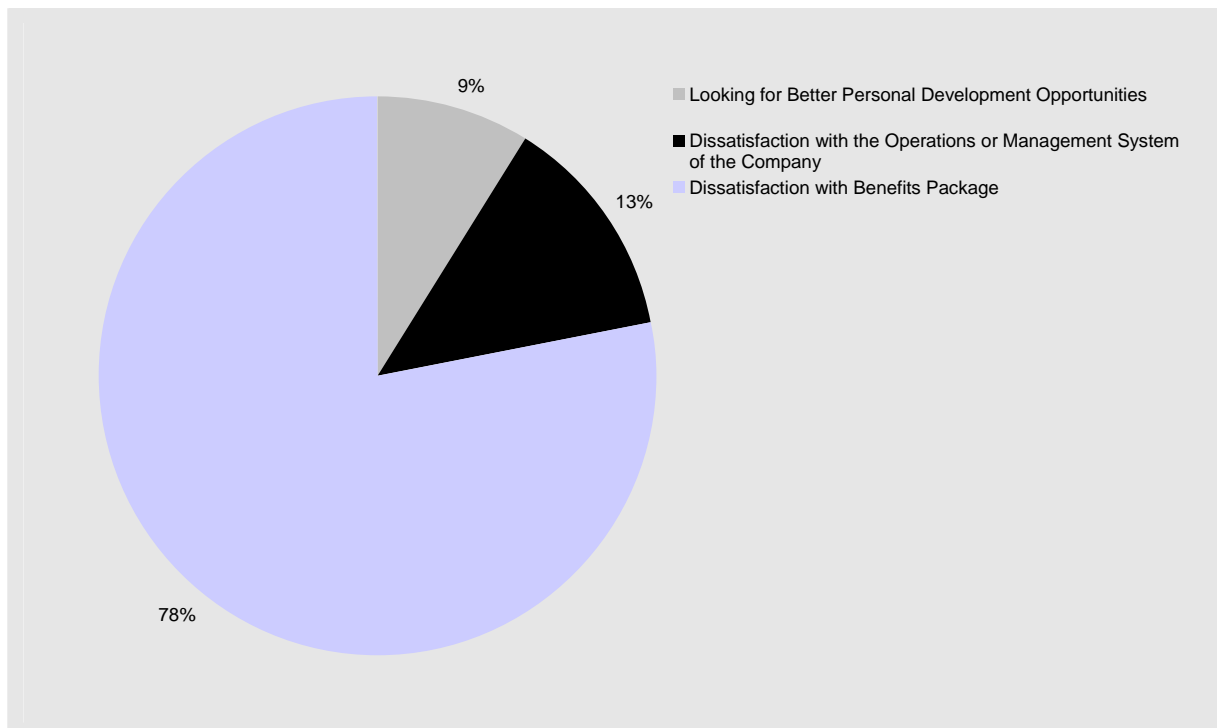


Figure 20, Reasons for leaving the company (source: CSIA (2003))

The Chinese software industry also has a problem with high turnover rate. As mentioned, there are a number of areas where the Chinese software industry does not have enough suitable talent. In developed countries, managers and people with software design skills are relatively abundant. This kind of manpower generally remains relatively stable. In China's case, the lack of these talents and the high turnover rates for people holding these kinds of skills makes developing the industry difficult. Often the ability of one company to attract talent means that another firm will be losing manpower. 45% of the software developers that leave local companies find new employment at foreign companies and ca 20% go abroad to continue higher education. The main reasons for high turnover is dissatisfaction with the management system, dissatisfaction with the benefits package, or the search for better career

development opportunities. How these reasons are ranked is depicted in Figure 20. One of the reasons why salary is seen as important is that it is considered to be a just measure of your capability (China Software Industry Association 2003).

Since salary level plays an important role here, local companies find it difficult to compete with MNC's that can provide higher salaries. Another factor that contributes to this trend is a number of MNCs' strategy to localize the workforce, which also attracts the best of talents. To help local companies, the government supports companies that are expanding and looking for special technical management skills by sponsoring car purchases or provision of housing. By taking these measures, they are able to match the kind of benefits a MNC could provide.

There is also a general problem of people leaving certain regions to go to the bigger cities. In a province such as Jiangxi, 2,057 people officially work in the software industry. Of these, only 150 have an education level of a master's and higher. In reality, Jiangxi province's higher education system produces quite a reasonable number of skilled software talents, but close to 100% of them leaves the region. In a survey carried out by CSDN, China's largest developers' community, software developers were asked to vote for where they would like to work. The results can be seen in Table 9. This data highlights the fact that one is most likely to find highly skilled software developers in the three major cities.

Region	Percentage
Shanghai	34.6%
Beijing	24.8%
Shenzhen	22.0%
Guangzhou	9.0%
East Region	3.7%
Southern Region	2.1%
South-western Region	1.2%
Northeast	0.9%
Northern Region	0.9%
North-western Region	0.8%

Table 9, The most attractive work locations for software developers (CSDN 2004)

Major Destinations for University Graduates

One major problem for the local software industry is that they are unable to attract the best graduates. Around 40% of the students at China's top universities, Peking University, Qinghua University, etc., wish to go to a foreign company to work after graduation. The situation in Shanghai is similar, where half of the computer science graduates go to foreign companies or abroad. Over the last 10 years, 400,000 students have left the country; of these, only 100,000 have come back (China Software Industry Association 2003).

Future Targets for Software-Related Education

China currently aims to have 800,000 software developers by 2005. Today's workforce numbers around 270,000 developers. Given the outflow of people, China's education system needs to provide ca 200,000 software developers each year. To realize this goal, the Ministry of Information Industry will in the next two to three years establish 100 software education bases to provide practical IT training. The recently established 35 software model schools will also have a positive effect on this and is estimated to contribute with 200,000 software engineers by 2005. Specialized polytechnic schools are planned to contribute with a further 300,000 software blue collar workers within the same time period (China Software Industry Association 2003).

Yet, there are a number of problems facing the Chinese government before reaching these goals of expanding the software workforce. For example, assume one wants to educate 15,000 more Master's students in software engineering. If each supervisor can supervise five students, one would need 3000 highly qualified supervisors with industry experience and very thorough knowledge of the subject. These kinds of skills are hard to find in great quantities in China. There are a number of reasons why this is the case (China Software Industry Association 2003).

- It is not possible to develop these kinds of skills quickly on a grand scale.
- The high speed of change in the IT-industry creates quickly changing demands and traditionally trained academics have difficulties in rapidly adjusting to the new requirements.
- There is no common platform for exchange between the academic world and the industry.

One model that India used to try to develop the educators was "3T", which basically means "Train the Teachers". Since the academic resource pools poorly satisfies the new criteria, one needs to turn to the industry. This increases the importance of professional education and on-the-job training. There are today no such large scale initiatives, although Microsoft and other companies have been involved in these kinds of activities on a smaller scale. Another resource is Chinese students returning from overseas or foreign software professionals that come to China to teach. However, the number of these kinds of trainers will be far from able to satisfy the demand. Therefore, the local resources will be the most important (China Software Industry Association 2003).

Sources of Finance for Local Firms

The immaturity of the Chinese financial system reinforces the advantages of state and collectively owned companies in the software industry and limits the growth of their private counterparts. A 1999 survey conducted by the World Bank's International Finance Corporation reports that 80% of Chinese private sector companies believe the lack of access to financing has constrained their growth (IFC, 2000). This has meant that start-ups often rely on private finance. Since SOE's have better links to the state-owned banks, they are prioritized in terms of allocation of funds. According to Central Bank data, in 1999 less than 1% of all working capital loans went to private companies, and these were likely not given to local private firms but rather to joint ventures with foreign private companies (Studwell, 2002.). As an illustration of the problems, China ranked fourth from the bottom in a global comparison carried out by the World Bank considering financing constraints for private firms (Huang 2004).

Software enterprises, like the university spin-offs Neusoft, Lenovo and Founder, with close government ties, have had little trouble finding finance. Consequently, although they may lack technical capabilities or commercial track records, state-owned or collectively owned enterprises have become one of the important sources of funding for software start-ups in China because of their privileged access to capital either through venture capital arms (e.g. Legend Capital and Neusoft Venture Capital) or through the financing of subsidiaries or spin-offs (Saxenian 2003).

Company	% of venture capital investment
Sino-Foreign Venture Capital Company	35%
Local Venture Capital Company	15%
Foreign Venture Capital Company	55%

Table 10, Sources of venture capital investment (Source: CSIA, 2002)

For software companies in the start-up phase, there is still an immature venture capital market that can in some cases be a source of finance. In 2002, USD 87 m was invested in software

Country	Venture Capital Investment USD million
USA	3428
Singapore	1109
Hong Kong	540
Japan	460
Holland	200

Table 11, National analysis of foreign venture capital investment (Source: CSIA, 2002)

enterprises. That is an increase of 82% more than the previous year and constitutes 37% of total venture capital that year. This can be compared with the hardware sector that received 3%, or the second biggest sector, telecom, that received 17% of the total (China Software

Industry Association 2003). This indicates a clear focus on the software sector. A large part of the venture capital funds stemmed from abroad as could be seen in Table 10 and Table 11.

Yet, on a comparative level, the venture capital investments made in China are relatively small, only 35% of what is spent on venture capital in the US. Moreover, most of the investment is made in the later phases of growth. Given that most small enterprise owners are not familiar with the venture capital, the small and medium enterprises with the greatest need in most cases do not have access to the funds.

Different Corporate Forms in China

Since this report deals with setting up a development center somewhere in China, it is useful to consider different forms of establishing a business entity. Therefore, this section provides some detail about the different corporate forms and what speaks for and against them.

Equity Joint Venture (EJV)

The most common entry mode for MNC's on the Chinese market is the EJV. To set up an EJV each partner contributes cash, facilities, equipment, materials, intellectual property rights, labor, or land-use rights. According to the EJV law, a foreign investor's share must be at least 25% of total equity. There is no limit upwards in terms of the software industry. Still, in practice, foreign majority shares are less likely to gain approval. According to the law there is no maximum term of operation. In most cases a 50-year period is granted, but these arrangements can be extended and the authorities normally encourage these extensions. The government generally favors this mode since it involves significant technology transfer to the local partner (Luo 2000).

Advantages (Luo 2000; Citi Group 2003):

- Link to local market, which is especially important if one pursues SOE or government contracts.
- Access to local resources, such as staff, facilities, equipment and business networks. The business network can be especially important since business in China is carried out through networks.

Disadvantages (Luo 2000; Citi Group 2003):

- The risk of IPR issues, due to the high level of technology transfer, is higher. Requirement of access to state of the art technology is often a requirement during negotiations.
- Relationships are hard to maintain. Even in Europe and the US, JV's are hard to sustain. The vast difference in structures, culture and traditions between China and the West contributes to the difficulties.
- Every Chinese company operates under some combination of local, provincial, and central government. Hence, there are a lot of agendas and conflicting interpretations of rules and regulations that might interfere with business. Furthermore, if one sells locally and wants to extend the business scope outside the region, it is easy to run into difficulties with local authorities.
- Negotiations over the joint venture contract might require extensive time and resources. This is especially true for western business people with little experience of Chinese negotiation style.

Wholly Foreign Owned Enterprises (WFOE)

According to Chinese law, a WFOE is a foreign company using its own capital, technology, and management while operating in China. The enterprise manages its operations independently and is responsible for all gains, risks and losses (Luo 2000). This kind of corporate form is likely to be approved if the development of the Chinese economy is likely to gain something from it (World Market Research Centre 2003).

Advantages (Luo 2000):

- It is possible to expand quickly without considering local partners.
- The risk of IPR issues and risk of transfer of sources to competitive advantage is less.
- They are quicker to establish since the local authorities are required to respond to the initial proposal within 30 days.

Disadvantages (Luo 2000):

- There is no initial access to guanxi networks, which might mean that these need to be established in a costly manner or the firm has to depend on agents that have the necessary contacts.
- Since there is no local partner involved, the requirements for investment approvals by the government is normally higher.
- Greater emphasis on PR management is required, since Chinese naturally do not like the idea of companies that take advantage of their country. WFOE's are therefore more likely to be criticized than EJV's.

Contractual (Cooperative) Joint Ventures (CJV)

In contrast to an EJV, where distributions and management depend on the proportions of invested capital, the CJV is an investment vehicle in which profits and responsibilities are determined in the joint venture contract, not necessarily according to invested capital. A CJV is a business partnership where each party cooperates as a separate legal entity and bears its own liabilities. The CJV is allowed to adopt a non-legal person status, which implies unlimited liability. This differs from the EJV mode, in which the legal person status is automatic (Luo 2000).

Advantages (Luo 2000; Citi Group 2003):

- In this mode, there is no minimum capital requirement, but in practice a foreign investor is expected to contribute at least 25% to a CJV with non-legal person status.
- CJV's enjoy high strategic flexibility with no limitations to the duration of the contract, and high flexibility in terms of asset structure, process and management. This means that management can be transferred to a third party after government approval. It is also easy to dissolve.
- Links to market, resources and guanxi networks.

Disadvantages(Luo 2000):

- The disadvantages of the EJV also apply to the CJV.

Acquisitions

Before 1990, the market for mergers and acquisitions in China was nonexistent. Since then the number of deals and complexity has been increasing. China now allows foreign companies to buy all or part of a Chinese company. Generally, China lacks resources to support industries that are not prioritized. There are two ways of acquiring a Chinese firm. One is where the target is converted into a foreign-invested enterprise (FIE). The other approach is to buy the shares of a company listed on the stock exchange. Some companies are also listed on the Singapore stock exchange (S-shares), Hong Kong stock exchange (H-

shares), or on the stock exchanges in Shenzhen or Shanghai (A,B-shares, only B-shares can be bought by international investors). Some firms are also traded on the New York stock exchange. Still, acquisition by share purchase is limited to a minority stake either by law or by practice (Luo 2000). In April 2003, a new law was filed that was supposed to bring China in line with international standards in terms of acquisitions. Instead, the new legislation has been criticized for a lack of clarity in a number of areas (World Market Research Centre 2003).

Advantages (Luo 2000):

- Potential to acquire resources currently managed unprofitably and make them profitable.
- The choice to participate in the firm's management, but does not have to do so, whereas this is necessary in WFOE's and EJV's.
- It is a quick way to enter after having been approved.

Disadvantages (Luo 2000):

- The process of getting government approval for transfer of ownership is troublesome.
- Information about the company, especially its liabilities, may not be readily available.
- As a minority shareholder, the foreign owner does not have any say on the board of directors in China.

Branch

One of the newest options for expanding investment is the establishment of a branch. This is allowed by law, but there have only been a few companies that have been able to open branches, since it is subject to heavy restrictions. With a branch office, liability is with the foreign entity owning it. To shield the parent company, it is common to assign an offshore company as a parent. (Luo 2000) One example of a company that tried to establish a branch is Infosys. They tried to overcome these hurdles for a long period of time but eventually gave up.

Summary of software industry

The following section provides a summary of the main points from the micro-environment. Current trends for each region are also listed. In the cases where there are no references, the trends stems from previous sections.

Government Policy

The policy measures that are relevant for the software industry can be divided into national policy, policy to develop the western regions and local policy. On a national level, the policy includes ambitious growth targets for software revenues and exports, investment in R&D to support the development of the IT-industry, the creation of software parks and specific software regions as well as provision of different tax-benefits. Another of China's recent goals is to develop the western regions to bridge the development gap between the inland and the coastal regions. This also means that software enterprises that establish themselves in the western regions of China enjoy the same type of tax benefits that they would have enjoyed in one of the special economic zones in the eastern regions. Apart from these measures local government also implement different types of incentives. However, since most of the tax goes to the central government, local governments are left with little to maneuver with. There is also a discussion of standardization of tax policy throughout the country to bring the power back to the center and better comply with WTO. The regulations under WTO would most likely leave some room to promote the software industry and the western regions.

Trends

- **Strong government support measures for the development of the software industry:** Parts of these measures may however be altered in form due to WTO requirements.
- **Preferential tax incentives in the western regions.**
- **WTO may force China to change incentive measures and taxation policy.**

Demand

There is a strong growth trend for offshore software development services. Today India is the dominant provider for the western world, but there are uncertainties to whether it will be able to satisfy demand in the future and how much price inflation will affect the cost effectiveness of its services. India's annual salary inflation increase reached 14% in 2003. This is two times as much as in China. China, Russia, Mexico, Brazil, the Philippines and a number of countries in Eastern Europe might be able to fill the demand gap and compete with India in the future. Indian software giants are also starting to spread their development and sales networks globally. Particularly interesting is their establishment in China to potentially take advantage of the cost effectiveness and special skills of the local development resources. Global service providers such as IBM, HP, Accenture, EDS, etc have also pursued a similar strategy and established development centers in China and other parts of Asia as well as in Eastern Europe. So far most offshore services have been sold in Eastern Europe and America, but a potential future market is in Japan.

Demand for outsourcing services in China is still reasonably low. Since the overall software industry is still quite immature, this kind of business model has not gained widespread use yet. Conversely, the growing number of MNC's creates a potential market base.

Trends

- **Supply of offshore development services grows.**
- **Demand for overseas development services grows in Japan:** The long Japanese economic downturn has forced the Japanese industry to cost savings. This has led to an increase in use of offshore software development vendors (Citi Group 2003).
- **Demand for offshore development services grows:** There is however a risk of return to protectionism as more and more jobs move from developed countries to developing countries. This could limit the current growth.
- **Global service providers engage Indian software giants:** Firms such as IBM, HP, Accenture, EDS establish themselves for example in India, China and Eastern Europe. They are therefore able to under price Indian providers through their global sales networks. However, since they generally provide a higher onshore component than their Indian competitors, the total cost may still be higher (Moore 2003).
- **Growing role for intermediaries:** Consultants that provide vendor evaluation, selection and management and contract negotiation skills are becoming more active in the offshore sector. This adds additional price pressure on the offshore vendors (Moore 2003).
- **Salary inflation in India increase:** Currently salary inflation in India has reached around 14%. This is around 2 times as much as in China.

Sales Channels, International Linkages, IPR and Trust

In order to sell China's offshore software development services overseas, sales channels need to exist and there should be mutual trust between buyer and seller. Today most of China's software services are sold through friends and/or previous business relations mostly on the local market or to Japan. Due to different cultures and languages, the ability to build trust between Chinese firms and western firms has been weaker than between Indian firms and American or European firms. Indian outsourcing providers have established elaborate global sales network with local sales facilities in most corners of the world. Most of these links originally stem from Indians working overseas for foreign companies.

Two of the barriers for the build up of Chinese trust are IPR and the reputation of low quality. The general problem with IPR is not that laws are lacking but that enforcement is substandard. Given that a license for Microsoft Office 2003 corresponds to the average monthly salary in the cities, it is unlikely that very many people would afford software at all even if IPR protection was working. China is therefore aiming to introduce Linux as a national standard, but so far the progress has been slow. Nonetheless, the central government has introduced stricter enforcement around the major software parks with special agencies that deal with breaches. One method to deal with the image of low quality is the adoption of international standards. CMM rating is often considered a proxy for process maturity. On this front China is lagging considerably behind India with 4 CMM 5 rated enterprises compared to 64 in India. However, progress is being made.

One of the forces that could help the creation of trust between the target markets and China is the large overseas Chinese community and the growing number of Chinese students that go overseas to study. These individuals could become a link between the different markets. The central government also creates incentives for Chinese that have gone abroad to return and start business. Yet, there are also problems on this front. In the Chinese context, the further away from the inner circle of friends and family, the weaker the trust. This means that there is a low level of trust between people from Shanghai and Beijing, from the mainland and Hong

Kong and even lower trust between overseas Chinese and mainland Chinese. As a result, the potentially fruitful links to Hong Kong and Taiwan, who both have more experience with foreign markets, have not been utilized to its full potential. This also opens the market for actors with already established sales networks such as Indian outsourcing giants, global service providers, brokers and agents.

Trends

- **More and more overseas Chinese students are returning home:** The main attraction is the increased business opportunities in China.
- **Improving enforcement of IPR:** This is likely to come with an overhaul of the Chinese legal system and the potential separation of legal structure from the political structure.

Software Industry Characteristics

The Chinese software industry is interlinked with the development of the more successful hardware industry and has also been strongly influence by University research and organizations such as the Chinese Academy of Science. This makes its origins quite different from that of the Indian software industry that is more export orientated and has a stronger foreign influence. The foreign influence has therefore contributed to a quicker adoption of international standards as opposed to China. The industry is today concentrated around Liaoning, Beijing, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang, Guangdong, Sichuan and Shanxi, where most of the revenue is generated. Most of the top 10 software enterprises are involved in development relating to telecom or network equipment. For most of these firms outsourcing and exports has been considered low priority. Apart from telecom, simple ERP solutions, security software, education software, and special areas such as character recognition have been prevailing in the product market. The service sector is dominated by simple services such support and implementation, where competition is hard. High-level services such as consultancy are considered strong growth areas.

The size of the average Chinese firm is a topic that concerns the government. There are more SE's in China than in India and they are also smaller which allegedly has made it more difficult for Chinese enterprises to market themselves abroad and take on larger projects. To deal with this problem the government has provided support to grow for enterprises that they considered potential winners. This has in some cases created weak giants that may not have survived under normal competition. This kind of system integrators, are quite common around Beijing and Shanghai. However, there are also promising small and large SE's that are able to survive on their own.

Chinese software exports in 2003 were a 10th of those of India. Most of the software exports today are low-end outsourcing services. In 2002, 81% of the exports were destined to other Asian countries with Japan receiving 60%. The most vital export bases are Beijing, Shanghai, Guangdong, Liaoning and Tianjin. Dalian, Beijing and Shanghai are those that exports most to Japan. Around 50% of Dalian's foreign investment originates in Japan. Shanghai is where some of India's offshore service providers have established themselves. Shenzhen is dominated by exports of embedded software from the telecom sector, but also have the potential to attract western business when cooperating with Hong Kong. Hong Kong could serve as a bridge due to its familiarity with western markets. Apart from Indian SE's being attracted by the China related business opportunities, global service providers such as IBM, EDS, Accenture etc have also established development centers on the mainland.

Linux is an area where China has received a lot of attention after it declared its plans to make it a national standard. The reason for this enthusiasm is among other things the opportunity to solve the IPR issues. Promising work has been carried to create standards and also desktop versions of the system. There are also plans for North East Asian co-operation in the area of joint development. Furthermore, China is planning large scale purchasing of desktop software systems from Sun. Yet, adoption is slow and mainly seen in the government sector. Some of the barriers to its adoption are the lack of people with Linux development skills and also the lack of enterprise software solutions based on Linux.

Embedded software is one of the most promising sectors primarily because of the flourishing hardware industry. China's coastal and especially southern regions are those that depend most on embedded software revenue linked to hardware manufacturing. Guangdong is the most important area of revenue generation.

Trends

- **The growth of China's hardware industry contributes to the embedded software sector:** The main areas are telecom equipment, consumer electronics and computers.
- **Chinese SE's are slowly evolving from scattered workshops to an Industry:** This also contributes to the overall capability of the industry.
- **More and more CMM appraisals:** Initially, this was driven by government incentive measures, but these campaigns have now concluded at least in Beijing and Shanghai.
- **A growing foreign interest in offshore development in China:** The new entrants are represented by Indian SE's and global IT-service providers.
- **The Chinese government shows interest in solving the IPR issue through Linux.**

Human resources

China's main advantage for software development is its large inexpensive labor pool. The Chinese software industry was estimated to have 260, 000 software developers at the end of 2003. Some further facts about some of the major software regions can be found in the "Analysis of regions" section.

One of the problems that China faces when competing with countries like the Philippines and India about outsourcing contracts from Europe and America is the low level of English skills and differences in culture. However, there is a great interest in American culture and English language that over time will make communication more efficient. In a different region, like Japan, the problem turns into an advantage since the Chinese and the Japanese have a large share of the written language in common. Both are also strongly influenced by Confucianism, which means the natives of the two countries have a lot of basic values in common. Since the Japanese outsourcing market is expected to grow, this is a considerable advantage. There are also schools that combine Japanese language training with software engineering courses.

China shares a common problem with other developing countries. China's software workforce has too big share of recent university graduates, too little of cheap software labor and also a lack of people with management and design skills. This oversupply of university students with bachelor degrees causes them to do everything from coding to management, none of which they are well suited for. There is however initiatives that will most likely correct this imbalance over time. For example, Indian training organizations are very active in China

today and will have a positive impact to the supply of low cost software workers. Another problem that faces the local software industry is that the best students tend to go to multinationals or overseas for further studies.

The main problem with the software related education provided by universities is that it is too theoretical and does not satisfy industry demands. In order to deal with this problem, 35 “model institutes” for software related education were established in 2002. These provide more practical training that suits the industry. Furthermore, the Chinese government has set a target of having 800 000 software developers by 2005. To achieve this, the higher education system is estimated to contribute with 200 000 new developers. Specialized technical secondary schools are estimated to contribute with 300 000 “blue collar workers” within the same time period. One of the problems that has to be dealt with is to find enough educators that provide the kind of education that the industry is looking for. This is expected to be a problem especially for master’s courses and above.

Trends

- **Increased number of students returning from abroad and MNC:** According to the China Software Industry Association the number of students returning from abroad and from positions in MNCs has increased drastically. They expect the number of returning students will increase by 20% annually. The main reasons why people start to come back from abroad are the promotional measures that the software industry has carried out, and the relatively good opportunities on the Chinese software market compared to the foreign markets.
- **The increasingly positive effect of the new software schools:** The opening of new software schools has already attracted other universities to take similar measure and establish software institutes.
- **Increased international interest for the local training market along with increased competition:** Especially influential on this market are the India players. By 2003, NIIT would have established more than hundred training centers around the country. Aptech is another Indian company that through a Joint Venture has established a presence in around 80 different locations (figures from 2002). Currently most of these companies enter the market through joint ventures or co-operation with institutions of higher education, but there is an increasing number that enter the market on their own.
- **More Foreign software personnel join Chinese Companies:** According to statistics, during recent years a number of foreign specialists have joined companies in ‘Zhongguancun’. In most of the cases it is the Chinese enterprises that recruit management and technical talent. Foreign personnel are also recruited for international sales. This trend is also expected to pick up pace.
- **High turnover rates of software developers:** Since there is an undersupply of software developers, the ability of one vendor to attract suitable talent means the loss of talent for another vendor.
- **Different measures are carried out to balance the composition of the software workforce:** For example, 35 new more industry oriented software institutes are projected to reform and revitalize software education in China.

Financing for local firms

One of the problems is that the local firms are faced with is financing. The venture capital market and stock market is still immature. Bank lending is also mainly available to government linked companies since they have better relationships with state owned banks. Most of the firms on the stock market are also previous SOE's that are now controlled by government through a majority share. These limitations make it difficult to get access to external working capital or funds, and a lot of enterprises depend on private capital from partners and friends for growth. This also limits the size of the projects that the SE's can take on.

On a positive note, international agencies involvement in the venture capital market is growing which will have a positive impact on the ongoing reform process of the financial markets.

Trends

- **The flow of foreign venture capital to China is growing:** Currently USA is the biggest investor followed by Singapore.

Analysis of Regions

The following sections will consider where the best location in China would be to develop software for a foreign company. This means that less attention will be dedicated to current and future software vendors in different regions. Instead more focus will be given to determining the different regions standing in respect to the following areas:

- Human resources in terms of
 - Labor cost
 - Size of overall labor pool
 - Competition for labor
- Education system and Universities
- Government support mainly in terms of tax benefits
- Country risk
- General development level
- IPR
- English language skills and cultural adaptability to western markets

The choice of factors to evaluate is based on “Offshore Services Supplier Selection Criteria” and the factors used in A.T. Kearney’s model from the theory section. The problem with the “Offshore Services Supplier Criteria” is that it focuses on Service Suppliers which makes some of the criteria less suitable for a region. The A.T. Kearney model on the other hand is more suitable for the task, although it is not specifically designed for software development. The choice of criteria also reflects the views from a discussion with Siemens about what they consider important in order to determine the quality of a certain region. Some of these areas, such as IPR protection, language skills and cultural adaptability, are very difficult to measure on regional level. However, using the scenarios as tool it is possible to some extent identify in which manner they might develop in the future. Language skills and cultural adaptability has been turned into one point with a focus on western markets and English language. The reason for this choice is that China already has an advantage in terms of Japanese language skills and also has good understanding of Asian markets.

The information used in this analysis originates from the previous background sections about the micro and macro environment. If this is not the case a reference is provided.

Current Regional Situation

Labor Pool and Labor Costs per Region

Table 12 provides an overview of the wage levels and the characteristics of the labor pool for different regions. The choice of regions to study broadly corresponds to the regions that the government has chosen to focus on for software development. As the table shows there are considerable differences in wage levels. The figures for wages for software workers are from 2000 and show that the cheapest locations are Xi'an, Dalian, and Nanjing. According to ChinaHR, Dalian's overall salary levels have gone up with around 30% since then, whereas Nanjing's and Xi'an's has risen by around 20%. The salary level for top management in Shanghai is higher than both Beijing and Guangdong. For mid management and software workers Beijing is most expensive. The cities with most relevant universities are Beijing, Shanghai and Nanjing. The biggest software industries in terms of developers and revenues are the coastal provinces of Beijing, Shanghai and Guangdong. The most skilled work force, measured by the percentage of people working in the software industry with an education level of at least a master's degree is found in the regions of Guangdong, Beijing, Jiangsu, Sichuan and Shaanxi.

	Province → City →	Beijing Beijing	Shanghai Shanghai	Guangdong Guangzhou	Tianjin Tianjin	Liaoning Dalian	Jiangsu Nanjing	Zhejiang Hangzhou	Sichuan Chengdu	Shaanxi Xi'an
HR costs	Salary top manager ³	49,362- N/A	57,646- 46,888	44,043-N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Salary mid manager ³	25,812- 24,750	25,232- 20523	23,869-19460	N/A	N/A	N/A	N/A	N/A	N/A
	Wages software workers USD ³	6,011	5,773	5,675	3,561	2,733	3,514	4,378	3,741	2,905
Labor pool	No. of developers ⁴	49,000	23,000	56,000	5,000	11,000	9,000	18,000	8,000	18,000
	% Software staff with above MSC education level ⁴	14%	9%	16%	2%	4%	11%	7%	10%	10%

Table 12, Labor cost and labor pool characteristics (Source: ChinaHR.com(2000), CSIA(2003), Watson Wyatt (2003))

³ Measured per city

⁴ Measured per region

Education System and Development

Table 13 provides an overview of the current education situation as well as some data on the general development level in China's regions. The first column signifies how many universities each city has that provides education relating to computer science and software engineering, the number in clauses is the number of "model schools" that the government has set up as models to reform software related education. There are also figures on the overall number of universities. In that context, comprehensive universities simply mean universities that provide a number of fields that can include engineering as well. Most of these regions have quite a number of universities. The reason for including technical secondary schools is that this is one of the future sources for "blue collar" software workers. The level of education spending reveals one of China's problems, the difference in education level between the inland and the coast. The inland regions of Shaanxi and Sichuan receives the smallest amounts of education funding, which also corresponds to the low level of GDP per capita, which is shown in the development section. The development level in terms of GDP per capita can also be seen as one of the drivers of wage inflation. The reason for including the cumulative foreign investment is that it gives an idea of the level of foreign establishment in the region. This could also be seen as a proxy for the level of foreign competition for the best talent.

	Region → City →	Beijing Beijing	Shanghai Shanghai	Guangdong Guangzhou	Tianjin Tianjin	Liaoning Dalian	Jiangsu Nanjing	Zhejiang Hangzhou	Sichuan Chengdu	Shaanxi Xi'an
Education	No of universities with software rel. courses ("model sw-schools") ⁵	10 (7)	6 (4)	3 (3)	2 (2)	1 (1)	6 (2)	2 (2)	2 (2)	3 (3)
	Science and engineering universities ⁶	18	12	4	6	17	18	8	13	14
	Comprehensive universities ⁶	5	2	15	1	4	8	2	4	5
	Technical secondary schools (engineering field) ⁶	25	37	53	21	46	65	18	31	27
	Education spending per capita (RMB) ⁶	2,243	1,428	536	853	405	457	609	234	369
	% of population currently attending universities ⁶	2.78%	2.04%	0.63%	1.96%	1.07%	0.95%	0.88%	0.48%	1.12%
Development	Computers/100 urban homes ⁶	45,3	38	35	21	10	13	20	11	9
	GDP per capita ⁶	2,695	4,146	1,546	2,159	1,347	1,413	1,615	574	546
	Acc. Foreign invest. 1994-2002 ⁶	14,917	31,760	109,817	15,959	18,409	55,838	14,905	4,441	3,059

Table 13, Education and development level (Source: China Statistical Yearbook (1994-2003), CSIA(2003))

⁵ Measured per city

⁶ Measured per region

Overview of regions

This section outlines some of the advantages and disadvantages for the different regions.

Tianjin and Hangzhou

Advantages

- **Close to Beijing and Shanghai respectively:** This could considerably facilitate customer contact or government sales in the case of Beijing.
- **Cost advantage over Beijing and Shanghai:** There are however cheaper options in the western regions of the country.
- **More international interaction:** Both Shanghai and Beijing function as trade hubs with a large number of foreign enterprises. This can have a positive spillover effect on the local workforce. It may also contribute to the adoption of international standards and a steeper development curve.
- **Potential Japanese outsourcing business:** This is especially true for Tianjin, that already has some companies that provide services for Japan. The fourth company to reach a CMM 5 assessment in China is located in Tianjin and they focus on Japan.

Disadvantages

- **In both cases, very limited number of Universities:** These two cities have the smallest number of universities providing software related education of the regions being considered. However, if one considers the overall number of universities, the situation looks somewhat better.
- **Potential Brain drain:** These two cities are located in the shadow of what many developers would classify as the exciting options of Beijing and Shanghai. Given the proximity, the most skilled people are likely to leave for the more exciting life in Beijing and Shanghai. This can potentially be reflected in the low percentage of people in the software workforce with master's degrees and above. Tianjin displays the lowest figure in the sample with around 2%. This could potentially contribute to the difficulties to find management talent etc. This situation is unlikely to Change under any scenario.
- **Potential over development and high wage inflation:** There is a risk that a quick rise in living standards may force wage inflation to a considerable higher level than in the inland.

Xi'an and Chengdu

Advantages

- **Historically strong Science and Technology infrastructure**
- **A reasonable number of Universities**
- **Easier to hire best talent:** Hangzhou, Nanjing, Tianjin, and Dalian are now attracting large amounts of foreign investment. Jiangsu for example, where Nanjing is located, is today attracting more foreign investment than any other region in China except Guangdong. Conversely, Chengdu and Xi'an have only received less than a tenth of the cumulative foreign investments received by Nanjing in the period of 1994 to 2002. Since there are less foreign enterprises active in the region and one does not need to compete with more export orientated industry along the coast, it should be easier to attract the best developers and managers.
- **Low wage costs:** The wage cost in Xi'an is approximately half of that of Beijing.

- **Less suitable for traditional export industry:** Both these regions are further away from the coast and could develop a strong focus on software development since the transportation costs would matter less in that case.
- **Tax breaks for development of western China:** Currently both of these regions enjoy the same tax benefits as in the special ETDZ's along the coast.

Disadvantages

- **Potentially less developed infrastructure:** Since the development level signified by GDP per capita is low in these regions, the facilities for software development is likely to be worse than in the costal regions.
- **Potential brain drain:** Given that these areas do not have the same attraction power as Shanghai and Beijing, they are likely to suffer from some migration of talent to the costal regions.
- **Lower education levels:** Overall the education level is lower in the inland.
- **Higher risk for IPR issues:** In a case of a relatively small government such as that of today and most likely that of the future, people further away from Beijing will act on their own initiative and law enforcement will be less stringent.

Dalian

Advantages

- **Strong trade links with Japan.**
- **Strong outsourcing industry aimed at Japan:** Since this industry is already well developed, it is probably easier to find the right type of skills.
- **High living standard and good infrastructure**
- **Low wages**

Disadvantages

- **A relative small number of Universities specializing in software related education:** Liaoning has the third largest number of universities focusing on engineering after Beijing and Jiangsu.
- **Potentially relatively strong competition for talent:** Given that the outsourcing industry is already well developed, it will most likely be harder to attract the best talent.
- **Wage inflation:** Dalian today already enjoys a high living standard and is also a recipient of quite a lot of foreign investment.

Nanjing

Advantages

- **The third highest number of Universities:** Only Beijing and Shanghai has more universities in the field of computer science and software engineering than Nanjing. In terms of overall number of universities, Jiangsu is the region with the highest number of universities in the sample. The largest number of specialized secondary schools in the field of engineering is also found in Liaoning.
- **High living standard and good infrastructure**
- **Low wages**
- **Near to Shanghai**
- **Potential wage inflation:** Given Nanjing's attractiveness and a very high inflow of foreign investment, there is a risk of rises in costs.

Disadvantages

- **Potentially strong competition for talent:** Nanjing is one of the regions in China that receives most foreign investment and has a large number of foreign enterprises in the region. One will also be competing with the more export orientated industry for skilled staff.

Beijing and Shanghai

Advantages

- **The largest number of Universities in the Country focusing on software development**
- **The countries best position in Research and Development**
- **The best talent is found here**
- **High living standard and good infrastructure**
- **Better protection for IPR:** Given Beijing's and Shanghai's status in the country, they serve as an example for copyright protection. So far protection is not what one would wish for, although software parks have special offices that deal with this problem. Yet, the day the government decides to deal seriously with the problem, Beijing and Shanghai will be the first places where you will see the results.
- **Linux in Beijing:** Due to government research and the fact that Linux in China is a government initiated project, Beijing is the area where most Linux development is carried out.
- **Business opportunities with MNC's and Government:** For government business Beijing is the most appealing. Shanghai has a large number of commercial interests that could serve as a considerable customer base.
- **Good international links.**

Disadvantages

- **Wage costs:** There are considerable cost savings to be realized by moving away from Beijing and Shanghai.
- **Further Wage inflation:** Since Beijing and Shanghai are the most advanced cities in most areas in China and the pace of development is immense, salaries and wages will undoubtedly rise in the long run. In the short run they might however fall since there has been undersupply of low skilled software workers especially in Beijing. When the software education reform is completed, the workforce will be more suited to satisfy the industries demand and the undersupply will be solved.

Guangdong

Advantages

- **The longest experience of dealing with foreign business in China:** Shenzhen was the first Economic and Technological Development Zone in China.
- **A very large software industry**
- **Attracts people from other areas of China:** Shenzhen ranks the third most popular area for developers to work in.
- **High living standard and good infrastructure**
- **Quite a number of universities and a high number of technical secondary schools:** The number of universities specializing in software related education is however low.

- **Close to Hong Kong:** It is easier to find people with western business experience in Hong Kong. The legal framework is also better suited there for foreign business.

Disadvantages

- **Over development:** Since Shenzhen was the first Economic and Technological Development Zone in China and has experienced continuous development, costs are now starting to rise and new businesses rather establish where the costs are lower.
- **High wages:** Development has also brought high labor costs.

To sum up, if one today seeks the most skilled work force, one should find vendors or set up a development center in either Shanghai or Beijing, since they do not only have a large number of universities but also attract some of the best talent from other regions. If one is intending to sell software or software services to the government, Beijing is especially interesting with its high concentration of government departments. Although, Beijing has a large share of foreign business, Shanghai is often what is considered China's commercial center with an even larger concentration of foreign enterprises. However, sourcing from these regions carries high costs, since the salary levels are the highest in the country. If cost is an issue and good education infrastructure is important, Nanjing is the best option with a large number of universities and salary levels around 60% of that of Beijing. Hangzhou is also an option if a short distance to customers in Shanghai is of importance. The salary level in Hangzhou is however higher than in Nanjing and there are also less universities. If low cost is the primary option in the sourcing strategy, the best options are Xi'an and Dalian. Conversely, Dalian has experienced relatively strong wage inflation the last 3-4 years, so it might have passed the salary level of Xi'an. If one pursues special skills such as embedded software knowledge, Guangdong is probably one of the best choices since it is strong in hardware manufacturing and large share of its revenue stems from embedded software. For Linux development, Beijing is most interesting since most of the government research in this area is carried out here. So far Linux is much of a policy driven project with the government supporting research. Most companies dealing with Linux are therefore also found around Beijing. For those pursuing the growing Japanese outsourcing market Shanghai, Beijing and Dalian seem to be the center of activity.

Scenarios

The scenarios presented here are based on the scenarios presented in China's futures (Ogilvy and Schwartz 2000). The main difference between these scenarios and the scenarios presented in the book is that the timeframe is different. The scenarios in the book points at 2022, whereas these scenarios end at 2015. The scenarios are in their original form of a general character. To create the link between these general scenarios and the software industry, a section that connects the two has been added along with the relating assumptions.

The third scenario can be seen as nightmare scenario for how China could turn out. The first and second scenarios, which can be considered successful development paths rests on five common fundamentals.

- The government is able to stay in control and provide the people with a better living.
- Corruption is limited.
- The army remain in the hands of the government.
- There is a transformation from rule of man to rule of law.
- Reforms are carried out in particular to the SOE's.

Scenario One: China Web

China has built a massively decentralized village based economy founded on wireless communication and efficient transport initiated by the "move west" plan from 1999. China has skipped the industrial revolution and is heading for the information age. As a surprise to everyone, China has after a couple of severe environmental incidents around 2010 succeeded to cut down on its coal and oil reliance and is able to provide just enough steel and railways to tie together its network of townships and village enterprises. The greatest resource of these enterprises is the previous farming population that in 2015 provides the bulk of labor for this network of the new century. The wealth and power that once concentrated to a few wealthy families are now spread down to local level. The government's main role today is national defense and directing investment. Corruption still exists, but only on local level and less severe than before. The higher officials are much better paid now and punished harshly if acting in their own interest. The government is satisfying its people and there is little to complain about. It is still not accepted to criticize the government, but no one worries too much about that.

China has resisted foreign influences and developed their own way of Chinese modernization. In 2015s China, the market provides profits and goods to those who need it. Still it has little to do with the American system based on democracy, human rights and a strong legal system. All of this are things that the Chinese has managed to survive without. China has found a way to modernize without westernizing and industrializing. Instead of traditional industrial giants that depend on economies of scales, China has created a giant network of enterprises that has the shape of supply lines that end in the costal regions, where the products are assembled from the parts made in the inland regions and shipped overseas.

Fundamentals of this Scenario

This is essentially what did not happen to post-colonial Africa.

- There are enough highways and railroads to transport raw materials to the countryside and the goods to the market.
- The government invests in education and healthcare.
- Proper bankruptcy laws are implemented that limit insensible investments.
- Corruption and fraud are dealt with.
- The agricultural sector is modernized.
- Rule of law is enforced.
- Companies can hire outsiders, fire employees at will and declare bankruptcy.
- Power is delegated downwards and local government and people in general are left to do what they see fit.
- There is no ideal corporate model that everyone has to copy, as was the case during the great leap forward.

The Software Industry

The software industry in 2015 has spread over the whole country but the cutting edge of software development is still found in the cities. However, a large number of companies have also adopted the kind of distributed development model that is often found in Linux communities. After the reform of the education system for software development, undersupply of labor is not a real problem anymore. There are both plenty of low cost developers and high level management and design talent. This has meant that the salary levels have stabilized and even fallen for low skilled software workers. The main market for outsourcing services is Japan, but the Korean market is also growing. In both these areas, the Chinese has a language advantage over India and The Philippines, who are the strongest players on the European and American market. China has more or less given up on the western markets since it is easier to make money in East Asia on outsourcing. The banking system has been working well the last five years and is frequently used by local SE's to finance expansions.

Assumptions

- Chinese outsourcing vendors are unable to penetrate western markets.
- Finance is provided by the banking system and financial markets.
- The software education reform has been successful.

	Cause		Effect	Beijing	Shanghai	Guangzhou	Tianjin	Dalian	Nanjing	Hangzhou	Chengdu	Xi'an
Tax	WTO would most likely tolerate tax breaks for regional development.	→	Lower operating cost is found in the western regions.	0	0	0	0	0	0	0	3+	3+
Dev.	Development is focused on the central and western regions.	→	Improved infrastructure in west, but the coastal regions still stay ahead	2+	2+	2+	2+	2+	2+	2+	3+	3+
Edu.	Development is focused on the central and western regions.	→	Gap in education between east and west decreases.	2+	2+	2+	2+	2+	2+	2+	3+	3+
HR	The best universities and most research spending are found in the big cities.	→	The best skills, talents and facilities are found in the attractive big cities.	3+	3+	2+	0	0	2+	0	0	0
	The software education reform is successful.	→	Lower wages especially where there has been a lack of low skill software workers	3+	3+	3+	2+	2+	2+	2+	2+	2+
	Living standard rises somewhat quicker along the coast	→	Wage inflation is somewhat higher along the coast.	2-	2-	2-	-	-	-	-	0	0
	Foreign investment rises.	→	Foreign establishment creates competition for talent.	2-	2-	2-	-	-	2-	-	-	-
Pol. risk	People are satisfied with the development of the country.	→	Low political risk.	2+	2+	2+	2+	2+	2+	2+	2+	2+
IPR	A well working legal system is developed.	→	Sufficient IPR enforcement is likely at least in bigger cities.	3+	3+	3+	3+	3+	3+	3+	?	?
Lang & cult.	People continue to learn English and interact with foreigners.	→	Impact is likely to bigger in larger cities with more international exchange.	2+	2+	2+	2+	2+	2+	2+	+	+

Table 14, Regional impact diagram scenario: "China Web" ⁷

⁷ 0 implies an unchanged situation from today, +,2+,3+ means different degrees of positive impact, -,2-,3- means different degrees of negative impact, ? implies an uncertain impact

Comments

See Table 14.

Tax and incentives

The main beneficiary of the tax breaks under region development plans is the Xi'an and Chengdu since they are located in western China where the living standards are poorer.

Development level

The western regions are likely to lessen the gap to the coastal regions in terms of development, but not overtake them. This would mean better infrastructure and higher living standard as well.

Education

The focus on developing the western regions will most likely lead to a higher education level in the inland.

Human resources

The development gap between inland and coast is too big to bridge and the western regions are still attractive for exporters since they are nearer to the coast and will therefore most likely still attract more foreign investment than the interior. In the coastal areas, the salary levels and competition against other foreign companies about the best talent will intensify. These problems will most likely be less severe for the inland, although they may still have a role in the supply chain of exports.

Political risk

Although there is no democracy people are more and more satisfied with counties development. Political risk is therefore likely to be low.

IPR

IPR is well enforced throughout the country. If enforcement is not perfect, problems are more likely far away from the center in the poorer regions.

English language and personal skills

People with language skills and understanding of other cultures are more likely to be found in the cities since exchange with foreigners and language education is likely to be better.

Scenario Two: The New Mandarins

This scenario is also built around the network idea. However, the network in this case is composed of families, clans, villages and language groupings. There are perhaps 50 large familial networks that stretch throughout South East Asia and into Europe and the United States. The government provides a strong legal framework that is needed for the developing economy, but has abandoned interfering with people's ideas and thoughts. The ca 50 "tribes" include language grouping from the south east, military regions and districts of the PLA, the family relations of the party leadership (the so called princes and princesses) and the "class of 77". The government is in 2015 business only and does not concern itself with social control. These "tribes" become what Japan's business families, Honda, Mitsubishi, is for Japan by employing capital built up in the overseas Chinese communities. Rule of law is implemented that creates an impression of fairness. The control however rests with the 50 "tribes". Capital is also distributed through this business networks. The communist party becomes controlled by the "tribes" and those that join the party do it mainly as a way to earn money get access to a large guanxi network. The party is however able to put up a facade of ideological leadership. These paternalistic and hierarchical networks strongly influenced by Chinese traditional values are the true powers of China that are slowly becoming an important force on the global stage.

Fundamentals of this Scenario

- Rule of law is implemented.
- Corruption and fraud is dealt with to some extent.
- The government provides a vision that extends beyond earning money.
- The PLA remains in the control of the communist party.
- The government is able enforce taxation and authority.
- The SOE's are effectively dealt with.
- Development focuses on the costal regions.

The Software Industry

More and more overseas Chinese can now be seen on the mainland. These new inhabitants have also invested heavily in software enterprises. Normally, the overseas Chinese acts as bridges to the market, whereas the mainland Chinese are responsible for the local operations. Since most of the overseas Chinese communities stems from Fujian and Guangdong in the south, the southern region of China has specialized in providing western markets with outsourcing services. This kind of enterprises can however also be found in Shanghai and Beijing, but less further west in the country or in the smaller cities up north. The more northern areas specialize on selling services to Japan. The software education reform was carried out successfully and has brought overall stable wages and more fitted workforce for the outsourcing industry. However, the living expenses in Beijing and Shanghai are in 2015 approaching European levels, and the same applies to salary levels. On the positive side, the same cities have also gained a global position in terms of specific areas of research. There are large scale migrations from the inland regions to the costal regions. The project of developing the western regions has lost pace and transportation out to the regions is not all that well developed, so development focuses mainly on the coast.

Assumptions

- Chinese outsourcing services are to penetrate western markets with the help of outside forces such as overseas Chinese. Indian software vendors and global service providers such as IBM and Accenture also play their part.
- Finance is provided mainly through traditional Chinese credit clubs.
- The software education reform was successful.

	Cause	→	Effect	Beijing	Shanghai	Guangzhou	Tianjin	Dalian	Nanjing	Hangzhou	Chengdu	Xi'an
Tax	WTO would most likely tolerate tax breaks for regional development.	→	Lower operating cost in western region.	0	0	0	0	0	0	0	3+	3+
Dev.	Development is focused on the costal area.	→	Infrastructure and telecommunications develop quicker along the coast.	3+	3+	3+	2+	2+	2+	2+	0	0
Edu.	Focused development in the costal regions.	→	Gap in education between east and west increases.	3+	3+	3+	2+	2+	2+	2+	0	0
HR	The best universities and most research spending are found in the big cities.	→	The best skills, talents and facilities are found in the attractive big cities.	3+	3+	2+	0	0	2+	0	0	0
	The software education reform is successful.	→	Lower wages especially where there has been a lack of low skill workers.	3+	3+	3+	2+	2+	2+	2+	2+	2+
	Skilled people move from smaller cities.	→	Local brain drain in small cities and larger cities gain on it.	2+	2+	2+	2-	0	0	2-	2-	2-
	Foreign investment rises especially along the coast.	→	Foreign establishment creates competition for talent.	2-	2-	2-	-	-	2-	-	0	0
	Living standard along the coast races ahead of the western regions.	→	Wage inflation is significantly higher along the coast.	3-	3-	3-	2-	2-	2-	2-	0	0
Pol. risk	People are satisfied with the development of the country	→	Political risk is low.	2+	2+	2+	2+	2+	2+	2+	2+	2+
IPR	A well working legal system is developed.	→	Sufficient IPR enforcement is likely at least in bigger cities.	3+	3+	3+	3+	3+	3+	3+	?	?
Lang & cult.	People continue to learn English and interact with foreigners.	→	Impact is likely to be bigger in larger cities with more international exchange.	3+	3+	3+	2+	2+	2+	2+	+	+

Table 15, Regional impact diagram scenario: "The New Mandarins"⁸

⁸ 0 implies an unchanged situation from today, +,2+,3+ means different degrees of positive impact, -,2-,3- means different degrees of negative impact, ? implies an uncertain impact

Comments

See Table 15.

Tax and incentives

The main beneficiary of the tax breaks under region development plans is Xi'an and Chengdu since they are located in western China where the living standard is lower. Although, focus is on the coastal region, it is not unlikely that there would still be attempts to make the western areas more attractive.

Development level

The western regions are lagging behind the coastal regions in terms of development mainly because there is a greater business interest in the coastal regions.

Education

Low education spending and low level of development will lead to stagnating educational levels in the inland, whereas the coastal regions race ahead.

Human resources

The two main differences in this scenario are the focus on the coastal region and more international interaction through overseas Chinese networks. This means that the western regions will most likely suffer both from brain drain since people flee to the coast. On the positive side wage inflation will probably be lower than in the coastal regions where development races ahead. It will also be much less competition for talent in cities like Xi'an and Chengdu. The coastal regions will be thriving due to foreign influence and high levels of investment and development. The learning curve will be steep due to the more international interaction and support from overseas.

Political risk

Although there is no democracy, people are more and more satisfied with their lives. Political risk is therefore likely to be low.

IPR

IPR is well enforced throughout the country. If enforcement is not perfect, problems are more likely to be found further away from the center in the poorer regions.

English language and personal skills

People with language skills and understanding of other cultures are more likely to be found in the cities since exchange with foreigners and language education is likely to be better.

Scenario Three: The Thief of Beijing

In this scenario, China collapses into a quagmire of decadence, corruption and greed. As hordes of gangsters raze the country in a hunt for wealth, China's environment is on a steady course towards a meltdown. The leftovers of traditional values that survived communism are consumed in the struggle for power, status and money. The elite of billionaires, gangsters, government ministers, party officials start to fear a complete breakdown. Foreign investment has long shored up. Even the people that expressed open opposition to communism start missing the safety that the old system provided. A former PLA general gains power under these conditions. Order is restored in a very harsh manner, where thousands of criminals and corrupt politicians are executed. In 2015, China is now in the hands of a military dictator that whips up anti-foreign sentiment around the country.

Fundamentals of this Scenario

- No legal reforms are initiated and China remains under the rule of man.
- Corruption and fraud is rampant.
- The government is unable to provide a vision.
- The PLA takes over control.
- The government is unable to enforce taxation and authority.
- The SOE's leaves millions unemployed.

The Software Industry

The reform of the software related education was never completed and has left the Chinese software industry approximately in the same place as where it was in 2005. China has once again closed its doors to the outside world. Most of the foreign enterprises had left the country before 2010, because it seemed too risky to stay. However, there are still some foreign enterprises left in the big cities that operate there under hard restrictions. The new dictator does not want to let the people know too much of the outside world, and for locals it is virtually impossible to get a passport to leave the country.

Assumption

- The software education reform has been interrupted
- Chinese are not allowed to leave the country
- National anti-foreign sentiment rages.

	Cause		Effect	Beijing	Shanghai	Guangzhou	Tianjin	Dalian	Nanjing	Hangzhou	Chengdu	Xi'an
Tax	Under these kind of circumstances, policy is hard to predict.	→	?	?	?	?	?	?	?	?	?	?
Dev.	Development is at a standstill until the new leader takes over.	→	Infrastructure and telecommunications are marginally improved in the bigger cities.	+	+	+	0	0	0	0	0	0
Edu.	Development is at a standstill until the new leader takes over.	→	The education level is more or less the same as in 2005.	0	0	0	0	0	0	0	0	0
HR	The best universities and most research spending is carried out in the big cities.	→	The skills, talents and facilities are found in the big cities with many universities.	+	+	+	0	0	+	0	0	0
	The software education reform was never carried out.	→	The skills structure is approximately the same as 10 years ago with lack of management and cheap labor.	0	0	0	0	0	0	0	0	0
	There is little foreign business interaction.	→	There are no synergy effects of working with foreign companies and skills develop little.	0	0	0	0	0	0	0	0	0
Pol. risk	China is safe but foreign businesses operate under severe restrictions.	→	Repatriation of profits, contacts with the outside and cooperation with domestic partners may be very difficult.	2 -	2 -	2 -	2 -	2 -	2 -	2 -	2 -	2 -
IPR	China is unlikely to bow to foreign pressure in terms of IPR.	→	It is hard to say how enforcement will be.	?	?	?	?	?	?	?	?	?
Lang & cult.	The government restricts common peoples' contact with the outside world.	→	This may have a negative impact on language learning.	-	-	-	-	-	-	-	-	-

Table 16, Regional impact diagram, scenario: "The Thief of Beijing"⁹

⁹ 0 implies an unchanged situation from today, +,2+,3+ means different degrees of positive impact, -,2-,3- means different degrees of negative impact, ? implies an uncertain impact

Comment

See Table 16.

Under the circumstances mentioned above, the attraction with China as a sourcing location for software development is most likely gone.

Implications

The most important question for the strength and weakness of certain regions is whether the central government's development plan for the central and western regions will succeed or not. In the case of the "China Web" scenario, the strategy is successful, whereas in "The New Mandarins" and "The Thief of Beijing" scenarios, the regional development policy fails. Due to the importance of the success or failure of Western China development plan, the implications of the scenarios are considered from a general perspective that applies to more or less to all regions, from the perspective of the coastal regions and from the perspective of the inland regions. Currently, the coastal regions are where the best skills, research and facilities are found and will most likely be in the future as well. On the other hand, the western regions are where the best cost efficiency can be attained. This will not likely change in the future either.

Relevant for Coastal Regions

The best representatives of China's developed regions are Beijing, Shanghai, Guangdong, Nanjing, Dalian, Tianjin and Hangzhou. All of them have good universities, highly skilled labor and the best infrastructure in China. The main disadvantage with the three former representatives is the high costs. Nanjing on the other hand is a little bit further back in the development cycle and has therefore been able to maintain a low cost level. This makes Nanjing the best choice in China today if one prioritizes a balance between highly skilled labor, some of the countries best universities, and low costs.

Potential positive aspects of the future

A positive development path for the costal regions would be represented by either "China Web" or "The New Mandarins" would mean that that the regions continue to develop in a stable manner. The difference between the two scenarios is the pace of development, where the "China Web" scenario would represent the lower pace. The implications of future development would be:

- Improved communications and infrastructure
- Large labor pool
- Good education system
- The best skills are found along the coast
- People with good language skills are most likely easier to find in areas like Beijing, Shanghai and Guangdong.

Potential risks

The major risks associated with continued development of the costal regions are potential side-effects such as overheating. Another factor that might have negative side-effects is a quick increase in living standard. The most relevant scenario for these kind of problems is in "The New Mandarins" scenario, where focus is on costal development. This is what it could lead to:

- Harder and harder competition for the best talent as foreign establishment increases and more and more local Chinese companies offers attractive employment.

- High wage inflation attributed to a raise in living standards. This could mean that Beijing, Shanghai and Guangdong start approaching western salary levels, and a city like Nanjing, which is the focus of foreign investment currently, may experience similar cost levels that can be seen in Guangdong today.

Relevant for the Inland Regions

The representatives of the inland regions are Xi'an and Chengdu. These regions represent a low cost alternative with similar or better higher education capabilities than Hangzhou, Dalian and Tianjin. However, they are not able to match Shanghai, Beijing, Guangdong, or Nanjing in terms of education system or infrastructure. The level of development in these regions is today the lowest signified by the lowest GDP per capita level out of the nine regions being compared. Xi'an and Chengdu are likely to maintain their cost advantage in the future as well. To what extent the inland regions will be able to bridge the development gap to the coastal regions depends on the success of Western China development project.

Potential positive aspects of the future

The most positive scenario for the inland regions is the “China Web” scenario where the living standard is raised and the inland is integrated into the supply chain of export hubs in the coastal regions. That would mean more development of China. The inland regions are however unlikely to overtake the coastal regions in terms of development, which would sustain their cost advantage. Xi'an and Chengdu would also have a good opportunity to focus on developing their IT-industry and especially software industries since both of them have strong technical research facilities and education system. The implications of such development path would be:

- A smaller gap in development level between the coast and the inland, leading to better basic education, better communications and infrastructure.
- Potential tax benefits in the inland. Tax holidays are most likely found in the inland regions if there would be any alterations to the current tax policy.
- Wages would be lower than along the coast.

Potential risks

The main risks of the inland regions are associated with “The New Mandarins”, where the coastal regions develop significantly quicker than the inland regions. This kind of scenario is associated with a failed Western China development plan and would have the following implications:

- Communications and infrastructure does not improve significantly in the inland.
- Basic education level remains low in the inland.
- Language skills are likely to be lower than the coastal areas.
- Large numbers of people leave the inland to seek better jobs along the coastal regions.

General Risks: Applies to All Regions

The major general risk for the future development of China is that the country evolves as “The Thief of Beijing” scenario. A scenario would have similar implications to all regions.

The way to reach a similar scenario to this would be to fail to satisfy all or some of the following fundamentals.

- The government is able to stay in control and provide the people with a better way of living.
- Corruption is limited.
- The army remains in the hands of the government.
- There is a transformation from rule of man to rule of law.
- Reforms are carried out in particular to the SOE's.

If these are not catered for it could create a very negative business environment that would motivate a strategy of limiting losses and leaving. These are some of the potential implications for the software industry:

- IPR-protection is non-existent.
- Infrastructure and communications are generally bad.
- It is difficult to find skilled people.
- Political risk is high.
- Corruption is rampant.

Reflections

The main objective of this study has been to determine which factors will affect the future Chinese software industry and determine which regions will be most suitable for the establishment of a software development center.

One can consider the region for potential establishment of development center as two blocks: inland regions and coastal regions. Unless China experiences a scenario like “The Thief of Beijing”, where China fails to develop in a positive manner, the major force that will affect the attractiveness of these two blocks is the success or failure of the Western China development plan and other plans to provide more even development over the whole country. This plan and other similar future measure will affect the pace of development in coastal regions relative to the inland regions. Different paces of development will have positive and negative effects. Some factors are however unlikely to change. If the primary criterion for the sourcing strategy now and in the future is the best of what China has to offer, Shanghai and Beijing are the best options. If one is pursuing a more low cost strategy but still want a good pool of talent and universities, Nanjing is likely to be the best option. Xi'an and Chengdu are however the regions most likely to provide low costs in the long run. These facts are unlikely to change quickly.

Without Heeks' framework for the development of national software industries, structuring the analysis of the Chinese software and determining its future prospects would have been extremely complicated. Conversely, it does not provide much guidance to what extent different factors have an impact on the development path. This is most likely easier to determine after the event than before. However, by combining the use of scenarios with this theory one might be able to get closer to determining different factors importance before the event. The main advantage of using the scenario technique is that it provides a systemic picture that highlights how the driving forces affects the development paths of local software industries. The use of the scenario technique has given an indication of which attributes of the different regions are prone to change and which remain fairly constant. The vividness of the picture also triggers the reader to think beyond previous theories and frameworks and is potentially useful to form new theories and raise new questions. It also serves as a powerful learning tool, which definitely has helped me to understand China better. However, one problem that scenario technique suffers from is legitimacy. Since it form a new for of research tool, researchers and people in general may have more difficult to accept its findings than the findings of more traditional research methods. Whether or not these traditional methods provide more useful answers is another question.

A study like this one leads to a number of new questions. For example, how do the foreign enterprises engaged in software development affect the local software industry in cities such as Beijing, Shanghai and Nanjing? Will the reforms of software industry related education have a different impact in different regions or what impact will returning overseas students have on the industry? These are just a few questions that would be useful to have answer to in order to provide a more accurate answer about the future of China's software industry.

Appendix 1

Rank	Company	Revenue US\$ m	% exports	% Sys. Integ.	Destination of exports	Business area
1	Huawei	725	15.9%	0.0%	40+ countries	telecom equipment, networking equipment, optical transmission
2	ZTE Corp.	454	0.0%	6.3%		telecom equipment, networking equipment, mobile phones
3	Putian	292	13.5%	0.0%	US	mobile phones, telecom equipment
4	Digital China	279	0.0%	77.4%		system integration, supply chain management solutions, network products
5	Beijing Ericsson	251	0.0%	0.0%		telecom equipment, networking equipment, mobile phones
6	Founder	187	1.2%	0.0%	Jap	Chinese language publishing equipment, computers
7	Microsoft China	176	0.0%	0.0%		office software, operating systems
8	Neusoft	171	8.5%	54.0%	Jap	outsourcing, security software, internet software, e-learning system integration, medical digitalization equipment
9	CSS Group	160	4.4%	36.9%	Jap, US	system integration, outsourcing, ERP, middleware, e-government products, translation software, information security
10	Datang com.	154	0.0%	92.0%		telecom equipment, network equipment, mobile phones

Top 10 software enterprises in China (Source: ChinaByte.com (2003), various company websites)

Appendix 2

Chinese name	English name	Location	Model School	Ranking on top 100 list
北京航空航天大学	Beihang University	Beijing	confirmed	23
北京邮电大学	Beijing University of Posts and Telecommunications	Beijing	confirmed	100
中国科学院研究生院	The Post Graduate Campus of the Chinese Academy of Science	Beijing		
北京交通大学	Beijing Jiaotong University	Beijing	in progress	67
北京科技大学	University of Science and Technology Beijing	Beijing		40
北京大学	Peking University	Beijing	confirmed	2
北京工业大学	Beijing University of Technology	Beijing	confirmed	64
清华大学	Tsinghua University	Beijing	confirmed	1
北京理工大学	Beijing Institute of Technology	Beijing	confirmed	36
解放军装备指挥技术学院	The People Liberations Army's Technical College of Equipment Command	Beijing		
中南大学	Central South University	Changsha		17
湖南大学	Hunan University	Changsha	confirmed	43
四川大学	Sichuan University	Chengdu	confirmed	10
电子科技大学	University of Electronic Science and Technology of China	Chengdu	confirmed	56
重庆大学	Chongqing University	Chongqing	confirmed	31
大连理工大学	Dalian University of Technology	Dalian	confirmed	26
福州大学	Fuzhou University	Fuzhou		77
华南理工大学	South China University of Technology	Guangzhou	confirmed	24
中山大学	Sun Yat-Sen University	Guangzhou	confirmed	11
广东工业大学	Guangdong University of Technology	Guangzhou		87
浙江大学	Zhejiang University	Hangzhou	confirmed	3
杭州电子工业学院	Hangzhou Institute of Electronics Engineering	Hangzhou	confirmed	

哈尔滨工业大学	Harbin Institute of Technology	Harbin	confirmed	13
国防科技大学	National University of Defense Technology	Harbin	confirmed	
中国科技大学	University of Science and Technology of China	Hefei	confirmed	15
吉林大学	Jinlin Univerisity	Jilin	confirmed	8
山东大学	Shandong University	Jinan	confirmed	14
山东科技大学	Shandong University of Science and Technology	Jinan		
云南大学	Yunnan University	Kunming	confirmed	69
南京大学	Nanjing University	Nanjing	confirmed	6
河海大学	Hohai University	Nanjing		70
南京航空航天大学	Nanjing University of Aeronautics and Astronautics	Nanjing		47
南京邮电大学	Nanjing University of Posts and Telecommunications	Nanjing		
南京理工大学	Nanjing University of Science and Technology	Nanjing		46
东南大学	Southeast University	Nanjing	confirmed	20
华东师范大学	East China Normal University	Shanghai	confirmed	34
复旦大学	Fudan University	Shanghai	confirmed	4
上海交通大学	Shanghai Jiaotong University	Shanghai	confirmed	9
上海大学	Shanghai University	Shanghai		45
同济大学	Tongji University	Shanghai	confirmed	21
华东理工大学	East China University of Science and Technology	Shanghai		35
东北大学	Northeastern University	Shenyang	confirmed	27
苏州大学	Soochow University	Suzhou		39
南开大学	Nankai University	Tianjin	confirmed	19
天津大学	Tianjin University	Tianjin	confirmed	16
武汉大学	Wuhan University	Wuhan	confirmed	7
华中科技大学	Huazhong University of Science & Technology	Wuhan	confirmed	5
西安科技大学	Xi'an University of Science and Technology	Xi'an	confirmed	
西安电子科技大学	Xidian University	Xi'an	confirmed	55
西安交通大学	Xi'an Jiaotong University	Xi'an	confirmed	12

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