



INTERNATIONAL FINANCE CORPORATION
A Member of the World Bank Group

**The ICT Landscape in the PRC
Market Trends and Investment Opportunities**

FINAL REPORT

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Preface

Information and Communications Technologies (ICT) are increasingly an important tool for supporting sustainable development and economic growth in developing markets. By embracing communications at unprecedented rates, people around the world have demonstrated their appreciation for the contribution of ICT to the betterment of their lives. It took 113 years from its invention for the fixed telephone to reach ten percent global penetration. It took 15 years from its invention for the mobile telephone to reach the same penetration, and ten percent of the World's population are now Internet users less than twelve years after the birth of the World Wide Web.

China's growth story, for ICT companies specifically, has been astonishing. China, often referred to as the "factory of the world" has traditionally had a strong manufacturing base, including a core focus on the electronics industry. In addition, in the past 10 years, we have seen an explosion of the mobile phone population to over 300 million subscribers, larger than any other country in the world. Further, the country's total number of Internet users has surpassed 90 million subscribers. Historically, sectors such as electronics manufacturing and mobile communications applications have enjoyed the benefit of growth, while we can already see new nascent sectors come up including media driven business, broadband applications and cutting-edge IC design houses.

While much of the growth in the ICT sector has been funded by foreign investments, mainly through the private and public equity markets, it is anticipated that many sectors require substantial and ongoing funding. It is anticipated that such funding by international investors will continue to outpace domestic funding sources

The International Finance Corporation (IFC) is committed to maintain and increase support to private sector businesses in China, in the ICT space. While in the past 15 years IFC has committed to over US\$1.8 billion of investments in China, we envisage an increased participation in the domestic ICT sector, by providing a full array of financial products and services along with technical assistance regarding such matters as corporate governance.

This study is sponsored and funded by the Swedish International Development Corporation Agency (SIDA). IFC would like to express its sincerest gratitude and appreciation to SIDA for its important contribution and support. The study represents an important tool and roadmap for private investors in supporting the ICT industry in China. Another key consideration is IFC's role in mobilizing funds by working with domestic and international financial and strategic partners.



Mohsen A. Khalil
Director
Global Information and
Communications Technologies

Javed Hamid
Director
East Asia and Pacific

The International Finance Corporation



PRODUCED FOR IFC BY SPINTRACK AB AND BDA CHINA LTD:

BJORN SODERBERG	TED DEAN
SPINTRACK AB	BDA CHINA LTD
bjorn.soderberg@spintrack.com	ted.dean@bdachina.com

JOHANNA BJORKSTROM	XIA WEI
SPINTRACK AB	BDA CHINA LTD
johanna.bjorkstrom@spintrack.com	wei.xia@bdachina.com

LIU BIN	FANG MEIQIN
BDA CHINA LTD	BDA CHINA LTD
bin.liu@bdachina.com	meiqin.fang@bdachina.com

SPINTRACK AB

DROTTNINGGATAN 99, 7 TR., SE-113 60 STOCKHOLM, SWEDEN
PHONE: +46-8-528 00 310 FAX: +46-8-528 00 315
WWW.SPINTRACK.COM INFO@SPINTRACK.COM

BDA (China) Ltd.
#2908 North Tower, Kerry Center, 1 Guanghua Road, Beijing, 100020, China
PHONE: +86-10-8529-6164 FAX: +86-10-8529-6163
www.bdachina.com contactus@bdachina.com

Executive Summary

The following report is the public deliverable of an IFC project which was funded by the Swedish International Development Cooperation Agency (Sida). The project was carried out, and the reports produced by Spintrack AB in close collaboration with and with significant contributions by BDA China Ltd.

General Market Conditions in China

Growing consumer demand coupled with continued growth in the export-led manufacturing sector has fuelled growth in China's gross domestic product (GDP). Continued growth in imports and exports tells a similar story of robust economic growth.

Despite this growth, private companies (particularly smaller IT companies) in China have traditionally had limited choices when it comes to raising capital domestically. Instead, Chinese IT companies have turned to foreign investors to fill the void. Foreign investors have responded aggressively. In recent years, the initial public offerings of a growing number of Chinese companies and the sale of still more companies to foreign IT companies has proven to investors that they can exit from their investments in China. As a result, the pace of investment has accelerated.

In 2004, venture capitalists invested USD 1.269 billion in 253 Mainland China or Mainland-related companies according to the research firm Zero2IPO. The number of deals was up 43% from 2003, and the funds invested increased 28% from the previous year.

As the pace of investment has increased, valuations in some sectors have shot up, and there has been speculation that some sectors are becoming overcapitalized. But with the domestic venture capital industry still in its infancy and most foreign investors being new to China, investment flows have tended to be concentrated in a few "hot" sectors. Other sectors, where the regulatory risks are greater or the development cycle is slower are still starved for capital.

The State of the IT and Telecom Sectors

Uncertainty over how the government will address issues such as 3G licenses, potential restructuring of the state-owned telecom operators, development of Chinese technology standards, opening of the market to foreign telecom operators, development of a system for a Universal Service Obligation, and the control and censorship of content and applications offered over fixed-line and mobile telecom networks, remains a consistent concern of industry players, complicating their business planning and ability to raise capital. **Ongoing reform** is however gradually leading to a more transparent regulatory environment. As part of these changes, China's regulatory agencies are shifting away from an economic planning function to act as more independent regulators.

The mobile subscriber base has now surpassed the fixed subscriber base, with fixed-line penetration of 25% (including PHS) and mobile penetration of 26% mobile (GSM and CDMA). The number of **Internet users** reached 94 million at year-end 2004. China's Internet access market is in the midst of a migration from narrowband to broadband access. Total broadband users in China reached 26 million in 2004, compared with the 1.9 million in 2001.

The timing of **3G license** issuance, which operators will receive licenses, and the selection of technology standards remains uncertain. China Mobile is certain to receive a license for W-CDMA, and Unicom is expected to upgrade its CDMA network to EVDO, but whether both fixed-line operators will receive licenses and what technology they might deploy is still undecided with China's TD-SCDMA standard representing the biggest wild card. The possible break-up of China Unicom is another complicating factor. It is widely believed that the government will delay the issuance of 3G licenses until the second half of 2005 at the earliest.

IT Sub-Sectors Covered in the Report

The report cover the following sub-sectors:

- Infrastructure and Software
 - Telecom Equipment
 - The Chinese IC Industry and Fabless Chip Design
 - The Chinese Software Industry
 - Security Services
- Applications
 - Mobile Data
 - Online Gaming
 - E-commerce
 - Digital Media Applications
- Outsourcing
 - Software outsourcing and IT Services
 - Handset Design in China

Telecom Equipment

Foreign IT and telecom equipment vendors are well established in China. In fact, foreign firms in these sectors are among the largest foreign investors in China and the largest exporters from China.

Domestic IT and telecom equipment vendors have emerged from the shadow of foreign market leaders and won significant market share in important market segments. In mobile handsets, domestic vendors have won close to 50% share in a market that was once completely dominated by foreign vendors. In ADSL, Huawei alone holds 44% of the

market, while two other domestic vendors, ZTE and Harbour Networks, hold an additional 16% and 9% share respectively. Thanks to improved R&D, domestic vendors are also expected to take a larger share of China's 3G market, once licenses are issued. Huawei and ZTE in particular have mature 3G products and are likely to win a significant slice of operators' capital investment in 3G networks.

Increasingly, leading domestic vendors have global ambitions for their business. Lenovo's recent purchase of IBM's PC business for USD 1.25 billion in cash and stock is the most significant example of a Chinese company expanding overseas, but Lenovo is not alone. In fact, the Lenovo-IBM deal is part of a continuing trend of Chinese firms striking deals to expand their business overseas.

The Chinese IC Industry and Fabless Chip Design

Due to the growing domestic demand of electronic products and the development of foundries, the growth of the Chinese IC design market is set to continue. Nevertheless, despite the growth in demand and manufacturing capacity, China still trails other markets in terms of domestic design capability. In order to succeed, the Chinese IC industry will need to identify or create new applications (i.e. DTV) or market opportunities. Human resources continues to be a bottleneck with experienced IC designers and professionals with experience in managing the design process in short supply. Highly educated overseas Chinese are returning to mainland China, but not in sufficient numbers to fill the industry shortfall.

The Chinese Software Industry

The Chinese Software Industry has grown rapidly in the last few years, reaching RMB 163.3 billion (USD 19.67) in 2003. The annual growth for 2004 was expected to reach 29%. Private and foreign software companies dominate the market while many Chinese companies are attempting to qualify for international standards with an eye on the international markets. Currently, Japan is the biggest market for Chinese software exports, followed by the US. Government investment in software represents a major market for software companies, and an increasing demand from small and medium-sized enterprises is helping to drive the enterprise software market.

Security Services

The security market is signified by a split between corporate and government markets with the domestic (and government backed) companies focusing on government projects, and private and foreign companies focusing on the fast growing corporate market. Government projects are gradually opening to private domestic firms, but foreign firms are unlikely to be able to win government projects.

The corporate market makes up the majority of the Chinese security market. This sector is growing rapidly as security threats escalate and dependency on IT systems grows for both multinational and domestic enterprises.

The Chinese government tightly controls the security products market requiring vendors to obtain official approval to sell security-related products. Some security technology and products are restricted to only state-owned companies that are appointed by the government.

Mobile Data

The Chinese mobile market is the largest subscriber market in the world. With a number of mobile data companies already listed, there is a proven pathway to an exit in the sector, either through an IPO or a sale to one of the already listed companies. New opportunities are likely to only exist in new applications where technology transitions open up new markets. The dependency on mobile operators constitutes a significant risk for all companies in the sector. While the pathway to an exit in the sector is clear, the market may be over invested and reaching the end of the current investment cycle as the sector consolidates around already listed players.

2.5G services have become the new driver of the mobile data sector as the 2G market, primarily SMS-based services, is saturated, and the growth is stagnant. China Mobile and China Unicom will strategically support the 2.5G wireless data market to maintain overall growth. The uptake of WAP and MMS accelerated in 2004 because of increased penetration of 2.5G handsets and aggressive promotional activities by the operators. However, Java and BREW-based services are unlikely to realize growth similar to the explosion in SMS traffic because the penetration of Java-enabled or BREW-enabled handsets is still much lower.

In 2.5G services, technology market entry barriers have increased, and operators have limited the number of service providers for these new services. Content acquisition and partner management has become a key success factor for 2.5G service providers.

Online Gaming

Like the movie industry, the Chinese online gaming industry revolves around blockbusters. As a result, it is a risky business forcing investors to bet on whether companies will be able to continue to churn out blockbuster titles. The intense competition, between both foreign and domestic companies, is likely to lead to a wave of consolidation during 2005, and to put greater pressure on margins especially as game licensing fees and marketing costs increase. Despite these challenges, the market is expected to continue to grow strongly as PC and broadband penetration increases and more gamers come online. Investing in established leaders with proven R&D abilities, or a large user and established channels may help to minimize risks.

e-Commerce

The China B2C market will maintain rapid development in the future. However, the increasing trade quantity may not ensure the profitability of leading B2C websites.

Margins are limited due to the high cost of operation and intense price competition. Furthermore, logistics, distribution and payment system are still issues. The reach of logistics and payment system limits the market to higher end cities. Since leading players have already raised capital, with one company purchased by eBay and another invested by Amazon, the market is likely to consolidate around these top players. Some smaller players may survive in particular market niches.

Digital Media Applications

The *digital TV (DTV) market* is at a very early stage, with less than 1% of the total 120 million cable subscribers accessing DTV programs. The limited market demand can be attributed to a lack of compelling new DTV content, the availability of pirated content, and the high-cost of set-top boxes (STBs). STB costs are not expected to come down dramatically in the short term because so many cable operators still demand customized units, especially for conditional access (CA), which makes large scale production impossible. Given slow growth in service revenues, the lack of a business model to support STB subsidies will likely trump a political push by the State Administration of Radio, Film and Television (SARFT) to force subsidies on the industry.

Cable networks are highly fragmented, which is likely to delay the industry's growth. SARFT has made an effort to integrate city networks within one province into single provincial network but progress has been still slow. Despite these challenges, a focus on moving the DTV market forward ahead of the Beijing Olympic Games in 2008 may give the industry the extra push it needs to take off.

The Internet *video-on-demand (VOD) market* is still small, but growth is expected to be strong, more than doubling from 2004 to 2005. One problem is that users are unwilling to spend on VOD services, resulting in low revenue. Research shows that one VOD user spends only RMB 4 (USD 0.48) per year on average. Domestic TV stations and movie producers are struggling to create attractive programs under government controls. Imported foreign content is strictly censored. Pirated DVD/VCDs are widely available in China for less than USD 1, posing a serious challenge to any VOD business case. The only opportunity for Internet VOD may exist in new business models that cut through piracy issues, such as interactive applications like healthcare, education, and gaming.

Software Outsourcing & IT Services

There is every reason to believe that the growth of China's software outsourcing market will continue thanks to continued government support, investment from foreign companies, and strong demand from Japan. Moreover, the entry of more western and now Indian companies should serve to accelerate the industry's growth. Given the small size of China's pure-play outsourcers today, it may take years for a company comparable to leading Indian outsourcing firms to develop. However, in the meantime, China's software exports are likely to continue their explosive growth and China will play an increasingly large role in software development globally.

China's software outsourcing market will probably develop along different lines than its Indian counterparts as domestic demand will play a larger role. Some Chinese outsourcing firms are already seeing opportunities in this area.

Handset Design in China

The global handset value chain has become increasingly fragmented over the past few years. The disintegration of the handset value chain has opened up opportunities for Chinese domestic handset manufacturers to compete more effectively with foreign vendors and challenge the primacy of Motorola and Nokia in China. Consolidation in the crowded design house sector is inevitable as manufacturers push upstream and chipmakers move downstream in the handset value chain. Low costs, strong R&D and stable customer relationships will be key factors for company survival. Operators play an increasingly important role in handset distribution, a trend that is likely to have a positive effect on design houses. Although the 3G market will initially account for a small share of the overall handset market in China, it is likely to offer the highest margins. However, demand for 3G handsets will take time to develop. The outsourcing trend is likely to continue among domestic vendors, driven in part by shortened product life cycles.

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1 Introduction

The ambition of this report is to provide a macro perspective of the key features and dynamics of the IT sector in the PRC as well as an overview of some of the issues facing investors, the private sector, and the public.

The facts and figures presented in the report were derived from a combination of first-hand information collected through interviews and studies of secondary sources. The interviews were conducted with over 80 organizations including companies in each sub-sector, government regulators, industry associations, and venture capitalists throughout the fall of 2004.

Most of the secondary information used in this study came in the form of previous reports, studies, news articles, and presentations. Most of this information dates from 2003 and 2004, though some of it goes back as far as 2001. The identities of the interviewed organizations are withheld in order to fulfill the commitment of full anonymity between the project group and these organizations. Accordingly, all information in this report and any views expressed originate from the project group unless otherwise stated.

The report starts out by giving a general introduction to the Chinese market including demographic and economic indicators and moves on to review the Chinese IT and telecom market. Chapter 3 discusses in more detail the state of the Chinese IT and telecom sector, including examining regulations and policies and the major actors in the market place.

Chapters 4 through 13 give detailed accounts on each one of the ten sub sectors defined by the IFC as the focus of this study: Telecom Equipment, the Chinese IC Industry and Fabless Chip Design, the Chinese Software Industry, Security Services, Mobile Data, Online Gaming, e-Commerce, Digital Media Applications, Software Outsourcing & IT Services, and Handset Design.

2 General Market Conditions

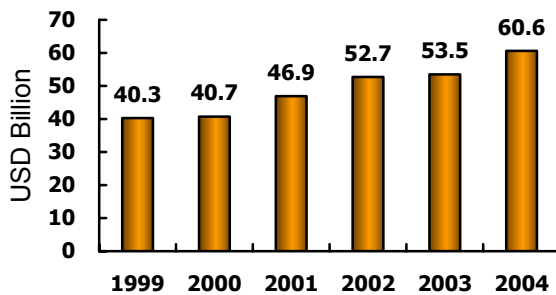
2.1 Main Demographic Indicators and Market Characteristics

2.1.1 Economic, Telecom, and IT Market by the Numbers: The Size and Shape of the Market

China's vast population and increasing prominence as not only a base for manufacturing but also as a home to domestic demand has attracted the focus of many investors. Although China's population of roughly 1.3 billion overstates true consumer demand, a growing middle class concentrated in cities in the country's developed coastal provinces is buying up consumer electronics, mobile phones, automobiles and other consumer goods.

At the same time, foreign direct investment (FDI) continues to flood into the country first to develop manufacturing capacity for export and increasingly to service domestic demand. In 2003, China attracted USD 53.5 billion in FDI. China's FDI reached USD 60.6 billion in 2004, up 13.3% from 2003.

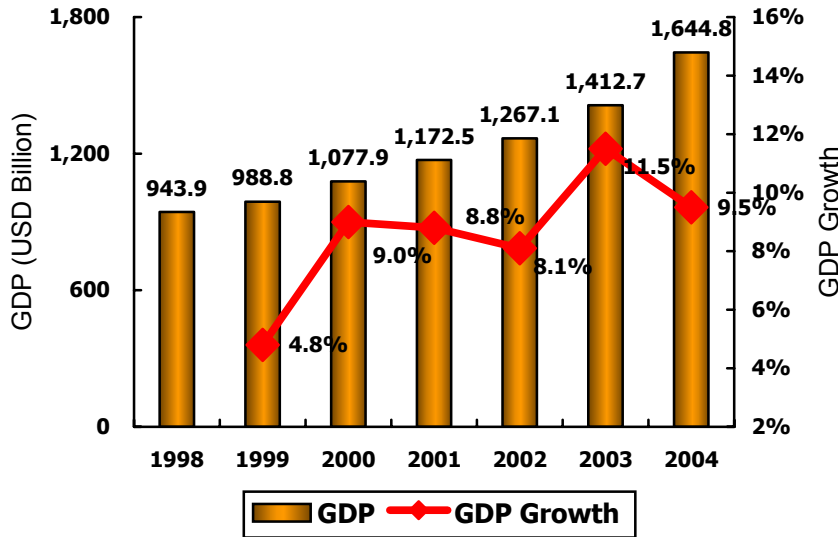
Figure 2a: China FDI Growth 1999-2003



Source: BDA, China, 2004 Yearbook, Ministry of Commerce of China

This growing consumer demand coupled with continued growth in the export-led manufacturing sector has fuelled growth in China's gross domestic product (GDP). China's GDP in 2004 reached USD 1644.8 billion, up USD 232.1 billion from 2003.

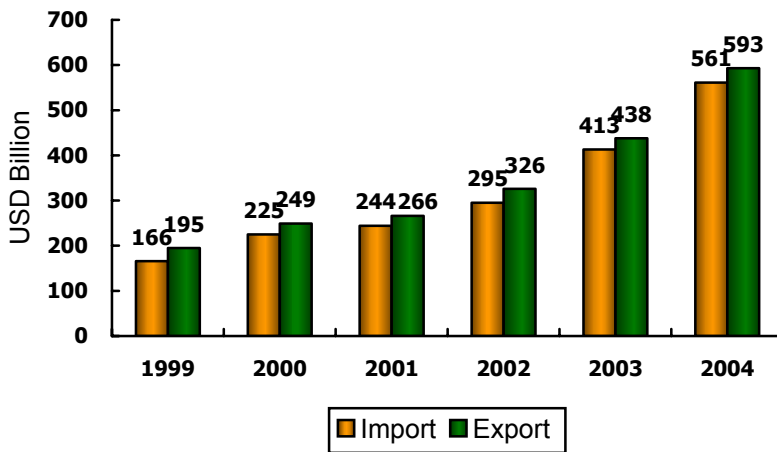
Figure 2b: China GDP Growth 1998-2003



Source: BDA (China 2004 Year Book, National Bureau of Statistics of China)

Continued growth in imports and exports tells a similar story of robust economic growth.

Figure 2c: China Import & Export 1999-2003

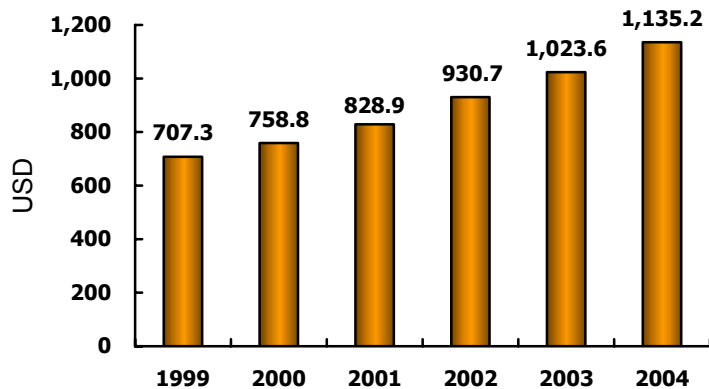


Source: BDA (China 2004 Year Book, Ministry of Commerce of China)

Strong economic growth has led to increases in GDP per capita and urban disposable incomes as a growing middle class emerges in China.

China's GDP per capita in 2003 calculated on a purchasing power parity basis was USD 4,580 (UN, 2004). Urban disposable incomes have grown from USD 707 per year to USD 1,135 per year from 1999 to 2004.

Figure 2d: China Urban Disposable Income: 1999-2004
(annual basis)



Source: BDA (National Bureau of Statistics of China).

3 The State of the IT Sector

3.1 IT Policy and Regulatory Environment - Overview

China faces a long list of regulatory issues as it moves into 2005. These include the issuance of 3G licenses, potential restructuring of the state-owned telecom operators, development of Chinese technology standards, opening of the market to foreign telecom operators, development of a system for a Universal Service Obligation, and the control and censorship of content and applications offered over fixed-line and mobile telecom networks.

Uncertainty over how the government will address these issues and a lack of transparency in the decision making process remains a consistent concern of industry players complicating their business planning and ability to raise capital. This uncertainty is in some respects an unavoidable consequence of the complexity of the issues the government faces as it manages explosive growth in an industry that is in the midst of a transition from being directed by state planning to market forces.

However, the myriad agencies that lay claim to regulating some portion of the industry add unnecessary complexity for all concerned. Indeed, regulatory convergence continues to trail industry and technology convergence, and competing industry regulators vie for a larger say in the future of new convergent applications.

The most obvious area of overlapping responsibilities is the continued existence of both the Ministry of Information Industries (MII), China's telecom regulator, and the State Administration of Radio Film and Television (SARFT), which regulates the cable TV industry among other industries. Without regulatory convergence of the MII and SARFT, the entry of cable television operators into telecom services remains clouded in uncertainty. And although SARFT is the weaker of the two organizations and has not been as effective in restricting telecom actors from entering media, it has also sought to use its regulatory authority to stave off convergence. Of the 66 licenses SARFT has issued for Video-on-Demand (VOD) services, only one has been issued to a telecom operator despite the fact that telecom operators are among the largest VOD providers in China.

Other sectors also face overlapping regulatory authority. In online gaming, the Ministry of Culture and the General Administration of Press & Publication have both asserted control. In a recent crackdown on illicit mobile data content, the list of regulatory bodies involved included the MII, the Publicity Department (formerly the Propaganda Department) of the Communist Party, the Ministry of Public Security, the Supreme People's Court, the Supreme People's Procurate, the Legislative Affairs Office of the State Council, the General Administration of Press and Publication, and the State Administration of Industry and Commerce.

While competing regulatory authorities continue to complicate the regulatory environment, ongoing reform is gradually leading to a more transparent – or at least less opaque – regulatory environment. As part of these changes, China’s regulatory agencies are shifting away from an economic planning function to act as more independent regulators.

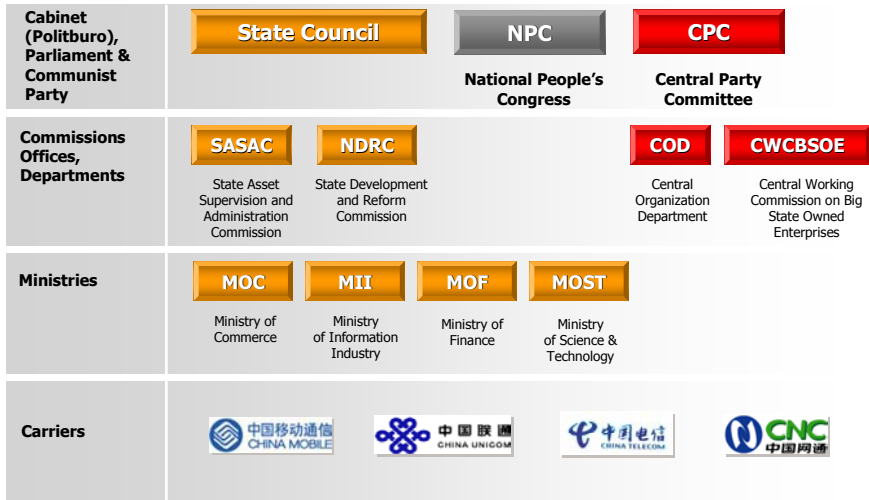
At the March 2004 National People’s Congress (NPC), the former State Development and Planning Commission (SDPC) was renamed as the State Development and Reform Commission (SDRC) after absorbing the former State Economic Reform Office. The dropping of the “planning” element of SDPC in the new SDRC indicates a further move away from a resource allocation function towards a policy advisory and research function. At the helm of SDRC, Mr. Ma Kai replaced Mr. Zeng Peiyan, who has been promoted to become one of China’s four Vice Premiers.

Of greater potential impact to the telecom sector was the creation of the State-owned Assets Supervision and Administration Commission (SASAC) to take over the former State Economic and Trade Commission (SETC). Former SETC director Xu Rongrong was appointed as director of the new SASAC. The key function of SASAC is to oversee the management of state owned enterprises (SOEs), including the six nationally licensed telecom carriers of China Telecom, China Netcom, China Mobile, China Unicom, China Tietong (formerly Railcom) and China Satcom. The SASAC is significant in that it provides a mechanism for the government to seek to avoid destructive price competition among the state carriers and prevent the devaluation of state assets so as to protect the State’s interest as the largest shareholder in each company. However, despite the change in ownership structure to bring all of the telcos under one roof, there has been no let up in the competitive instincts of company management and deep price competition continues.

Furthermore, while the MII in the past played the dual roles of deciding industry policies and overseeing state assets in the form of the six telecom carriers, the spin-off of the second role from MII should make it more possible for MII to treat private and foreign interests in the telecom sector on equal terms. Further reform of MII, possibly as it is rolled up into a State Communication Commission along the lines of the United States Federal Communications Commission (FCC), could ultimately help to achieve convergence over the telecom and cable industries, which would eventually give a lift to the cable sector in offering Internet access services.

Relevant government bodies and their key functions are summarized in *Figure 3a* and *Table 3b* below.

Figure 3a: China's Regulatory Framework for the Telecom Sector.



Source: BDA

Table 3b: Key Functions of Telecom Related Government Bodies

Government Bodies	Key Functions
NPC (National People's Congress)	
NPC	Approves telecom legislation, including the Telecom Law (draft still pending) Supervises the implementation of telecom legislation
CPC (Central Party Committee)	
COD (Central Organization Department)	In charge of HR issues, such as the appointment of senior officials of the MII and senior executives of state carriers
CWCBSOE (Central Working Commission on Big State Owned Enterprises)	Macro-control of state owned telecom carriers Also involved in the restructuring of state telecom carriers
State Council	
MI (Ministry of Information Industry)	In charge of telecom industry policies and drafting the Telecom Law Issues basic and value added telecom service licenses
SCIO (State Council Informatization Office)	Sets guidelines for national 'informatization' (spreading telecom/IT throughout country) and promotes implementation
GAPP (General Administration of Press and Publication)	In charge of press, publication and protection of copyrights. Issues publishing approvals to publications for print, video, audio and electronic formats
SASAC (State-owned Assets Supervision and Administration Commission)	Formed in 2003 to oversee the State's estimated USD 1.3 trillion worth of holdings in State Owned Enterprises Focused on how to maintain/increase the value of State assets
NDRC (National Development and Reform Commission)	Macro-economic policy making Determines basic telecom services tariffs together with MI and MOF Issues manufacturing licenses, including handset vendors
MOC (Ministry of Culture)	Sets guidelines and administers China's culture related affairs Involved in regulation of Internet cafes and content distributed over both wired and wireless networks
MOC (Ministry of Commerce)	Combined former foreign and internal trade ministries Approves foreign investment in telecom sector, including foreign-invested JVs (in conjunction with MI and NDRC)
MOF (Ministry of Finance)	Manages budget planning and execution Manages the use of international loans
MOST (Ministry of Science and Technology)	In charge of high-tech telecom & IT projects, such as supporting domestic manufacturers in R&D on 3G standards

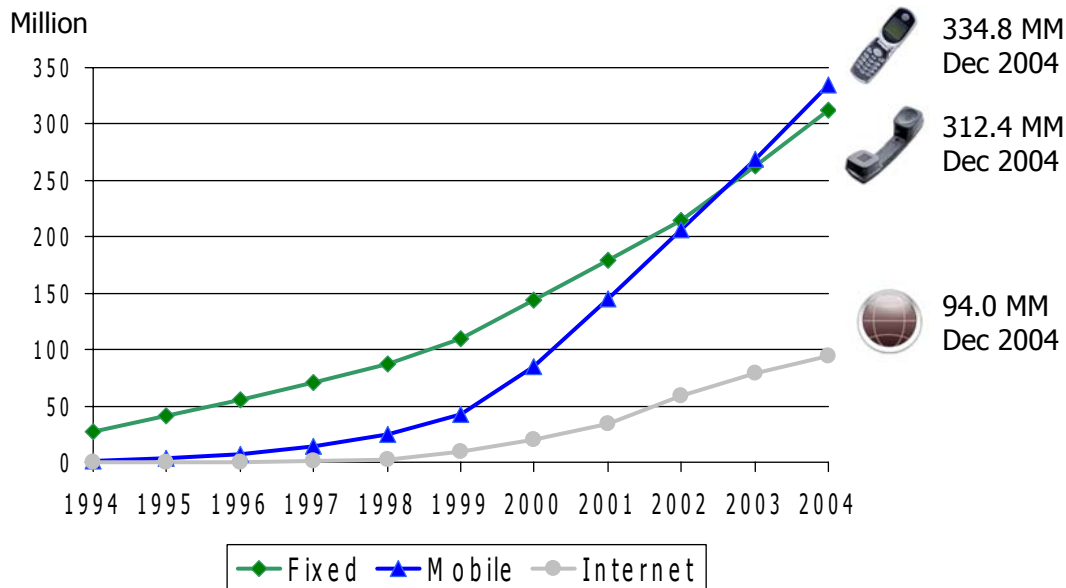
Source: BDA

3.2 Communication Infrastructure and Usage

The mobile subscriber base has now surpassed the fixed subscriber base, with fixed-line penetration of 25% (including PHS) and mobile penetration of 21% mobile (GSM and CDMA). The number of Internet users reached 94 million at the end of June 2004.

Strong growth continues with China adding 4.9 million mobile subscribers in the month of December 2004.

Figure 3c: Fixed, Mobile, and Internet Subscribers



Source: MII and CNNIC.

3.3 Urban vs. Rural Connectivity

Ensuring universal access to telecom services in China is an enormous challenge given the market's scale both in geographic and population terms.

While prosperous east coast and second tier inland cities boast telephone penetration rates of 40-70% - well above the national average of 20% - some 15% of administrative villages, home to at least 124 million people, do not even have access to a public phone.

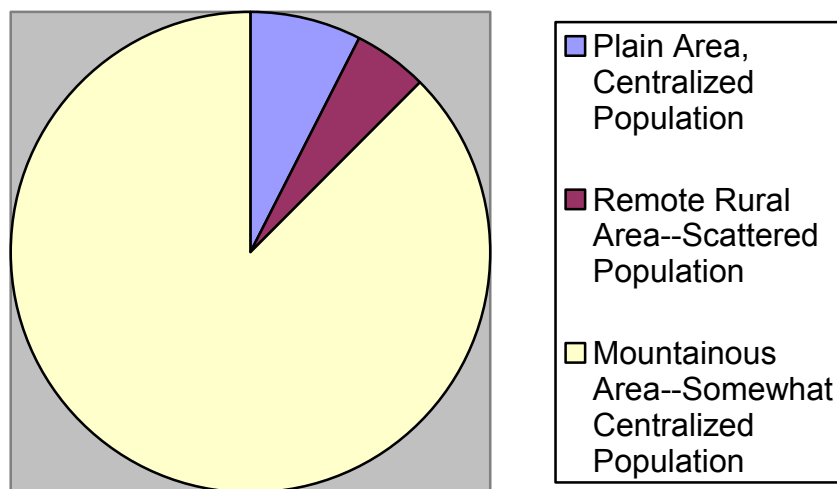
When China Telecom was a national monopoly, it was required to extend service into high cost/low use areas and allowed to charge high prices for lucrative services, such as international direct dial to fund these expansions. But the intense competition between carriers in China makes this system unworkable.

Many nations in similar circumstances have shifted to using Universal Service Obligation (USO) funds, raised through a tax on telecom companies' gross revenues, which is then redirected for wiring up rural areas. According to Vodafone, this tax averages 1.54%

internationally. It applies only to voice services, not including data or Internet revenues. Funds are then allocated through a competitive bidding process among operators.

Internationally, operators usually handle the USO tax by simply passing the cost on to consumers in the form of higher rates. However, price hikes passed on to consumers are a rarity in China where consumers are militant in their rights to pay low rates for basic services, and operators are keen to avoid disputes.

Figure 3d: Location of China's Rural Population without Telephone Access



Source: China Academy of Telecom Research

The 12.5% of China's 733,000 administrative villages that are currently without telephones can be divided into three categories. 7.5% of them are located on a plain with a relatively centralized population and will probably be best served by copper or fiber cable, possibly combined with a wireless local loop (WLL) service.

Another 5% of the villages are in very remote, mountainous, sparsely populated areas and will be most efficiently reached through satellite technology utilizing VSAT (very small aperture terminals). VSAT operates through a network of local terminals spread throughout the countryside connected via a satellite link to a central hub, which is attached to the national fixed line network. Each terminal can support 4-5 phone lines. The advantage of this is that VSAT can provide service to a large area with severe weather conditions, where it would prove prohibitively expensive to either run ground lines or install the many cellular towers that would be required to cover a scattered population. However, VSAT is extremely expensive, with deployment costs that are

approximately 4 times as high as either landlines or wireless, and this limits its usefulness to remote, harsh areas. Still, VSAT has been successfully introduced in Tibet and Xinjiang, where almost 3,000 terminals provide telephone access across a broad swath of western China.

The vast majority of villages without telephone access, 87.5%, are located in mountainous regions. While the population is centralized enough not to require the expense of VSAT, it is difficult to reach these areas with landlines. The technology most suited to these areas would be CDMA 450, a wireless network with a tower coverage range of up to 70 km per tower. However, CDMA-450 operates on public bandwidth and has been disallowed by the Ministry of Information Industry (MII). Though there are several “gray” CDMA-450 networks operating in China, the MII has decreed that they must all be dismantled. An exception has been made for Tibet, where CDMA-450 has been successfully deployed and is now serving approximately 20,000 subscribers.

An alternative to CDMA-450 is home-grown SCDMA technology. Produced exclusively by Xinwei, a subsidiary of Datang, SCDMA is also capable of running at low frequencies, 400 MHz, and thereby extending service to a large area, 40 km per tower. This helps keep deployment and maintenance costs lower than those of GSM or CDMA services, though still slightly higher than CDMA-450. The major advantage of SCDMA is that it is supported by the government. In April 2004, the MII issued a circular recommending SCDMA as an appropriate technology to be used for USO. SCDMA has been the only technology to garner such backing.

However, SCDMA is an immature technology. It has only one vendor supplying equipment and handsets. Xinwei has performed well with revenues in 2004 projected to exceed 2002 sales by 300% (USD 75 million up from USD 25 million). This revenue is due to contracts with China Netcom and Railcom to extend SCDMA networks in urban areas to compete with China Telecom’s PHS service. SCDMA urban networks run on 1800 MHz bandwidth, however, so this experience in the cities does not translate into increasingly mature USO-appropriate technology (1800 MHz SCDMA has a range of only 1-2 km.). Thus, though it has government support, it may take several years before SCDMA can be successfully deployed in rural areas.

Beyond extending access to all Chinese villages, USO would also encompass boosting the raw rate of telephone penetration. Currently, even in eastern China, penetration is only 40%, and it is much lower in the central and western regions. In most rural areas, fixed line providers operate at a loss; without subsidies, maintaining service to these areas is unsustainable. In 2001, for instance, the fixed line sector turned a profit in “rural” areas in only 4 provinces: Zhejiang, Fujian, Beijing, and Shanghai. In other areas, recorded losses totaled USD 343 million. To maintain and upgrade rural service, subsidies must be put into place to support affordable telephony.

In addition to subsidizing low-income subscribers, there are a variety of other methods that can be employed to attract new rural subscribers. Phone bills can be sent out more frequently, and in small amounts to enable subscribers to pay on an incremental basis. Service can also be pre-paid for outgoing calls; when this money is used up, outgoing service, except for emergency numbers, would be denied but incoming calls still allowed. This system prevents subscribers from racking up a large phone bill, being unable to pay it, and falling into debt, a common fear among low-end subscribers.

Though change is needed, revamping USO in China would not be difficult. A USO fund should be adopted with competitive bidding among operators for contracts. Subsidies, combined with some simple service changes, can lead to a material increase in household penetration. If implemented, an upsurge in rural telecommunications might provide sustained growth for the sector.

3.4 Actors and Solutions in Chinese Telecom Services Market

The telecom operators are exclusively domestic and consist of two fixed-line operators with nationwide licenses (China Telecom and China Netcom), two mobile carriers (China Unicom and China Mobile), as well as two minor actors (China Satcom and China Railcom).

3.4.1 Actors in the Fixed Network

Although four operators have licenses to offer basic fixed line services, China Telecom and China Netcom, the descendants of the former national monopoly, continue to dominate the market. The other two players, China Unicom and China Railcom, have a limited market share in some local regions.

The present China Telecom and China Netcom were created in an industry restructuring in 2002. At that time, the former national monopoly (also called China Telecom) was broken up geographically. The 10 northern provinces were merged with two small carriers to become the new China Netcom group. The former monopoly's remaining 21 southern provinces became the new China Telecom. In the past three years, both fixed-line giants have attempted to enter each other's territories especially with IP phone and data services, but direct competition between the carriers remains at an early stage.

Table 3e: Chinese Fixed Telecom Operators

China Telecom (China Telecom Corporation)	<ul style="list-style-type: none"> ▪ Descendant of China's incumbent carrier. ▪ Operates primarily in 21 southern and western provinces. ▪ Runs domestic and international fixed-line networks and provides fixed-line voice service, data services, and wireless local loop PAS/PHS services. ▪ Although China Telecom lacks a full mobile service, its WLL, PAS/PHS service has been extremely successful (see chapter 3.4.4.2). ▪ Broadband service is offered primarily over Ethernet and ADSL. ▪ By the end of 2004, the largest fixed-line operator in China with 190 million subscribers including PAS/PHS users. ▪ Listed in Hong Kong and New York.
China Netcom (China Network)	<ul style="list-style-type: none"> ▪ Founded on May 16th 2002 through the merger of the former China Telecom monopoly's 10 Northern provinces with the operations of China Netcom Corporation

Communications)	<p>and Jitong Communications.</p> <ul style="list-style-type: none"> ▪ 110 million fixed-line subscribers including PAS/PHS users by the end of 2004. ▪ Operating primarily in China's northern provinces (including Beijing), China Netcom's strategy is to enter the southern territory currently operated by China Telecom. ▪ Offers fixed-line voice service, data services, and wireless local loop PHS service, and also operates an international arm called CNC International. ▪ Listed in Hong Kong and New York.
China Unicom (China United Communication Corporation)	<ul style="list-style-type: none"> ▪ Currently the only operator in China licensed to offer mobile and fixed-line services. ▪ Second largest mobile operator after China Mobile operating both a GSM and CDMA network. ▪ Also offers fixed-line services, but trails far behind China Telecom and China Netcom in this market. ▪ Listed in Hong Kong and New York.
China Railcom (China Railways Communications)	<ul style="list-style-type: none"> ▪ Commercial operator formed by the Ministry of Railways to leverage the Ministry's telecom networks. ▪ Very small fixed telephony subscriber base but an extensive backbone network. ▪ 11.9 million subscribers by the end of 2004. ▪ Grows at slow pace partly due to lack of funds to upgrade the company's existing network.

3.4.2 Solutions and Competition in the Fixed Network

3.4.2.1 Internet Access

China's Internet access market is in the midst of a migration from narrowband to broadband access. Total broadband users in China reached 26 million by year-end 2004, compared with 1.9 million in 2001.

ADSL is the dominant broadband technology followed by LAN and cable access. The two fixed-line operators monopolize the ADSL market. China Telecom and Netcom also provide LAN Internet access to some subscribers. Despite regulatory barriers to entering the Internet access market, cable TV operators do offer Internet access services. In many cases, they have opted to build out fiber networks and offer Internet access over LAN's rather than offering service over their cable networks. A few non-telco ISPs, such as Great Wall Broadband, also offer broadband access over LANs, but these companies trail far behind China Telecom and Netcom.

Without any network resources of their own, most independent dial-up access ISPs could not compete and have exited the market especially after fixed-line operators aggressively promoted ADSL service by cutting ADSL tariffs to dialup levels and offering free ADSL modems to new subscribers.

3.4.2.2 WiFi

WiFi in China has been a disappointment. The global hype around WiFi began in 2002, and China's fixed-line operators were quick to pounce on the technology as a means to drive broadband revenues and compensate for the declining appeal of Plain Old Telephone Service (POTS).

Both China Telecom and China Netcom set up hotspots in public places and offer wireless Internet access service. China Telecom also bundles WLAN with ADSL service to private users and small offices to offer in-house wireless access. China Mobile and China Unicom have also entered the market, using WLAN service as a complement of their mobile network based wireless access, GPRS and CDMA 1X. However, WiFi subscriber numbers remain small, and the service is a very minor revenue contributor for operators.

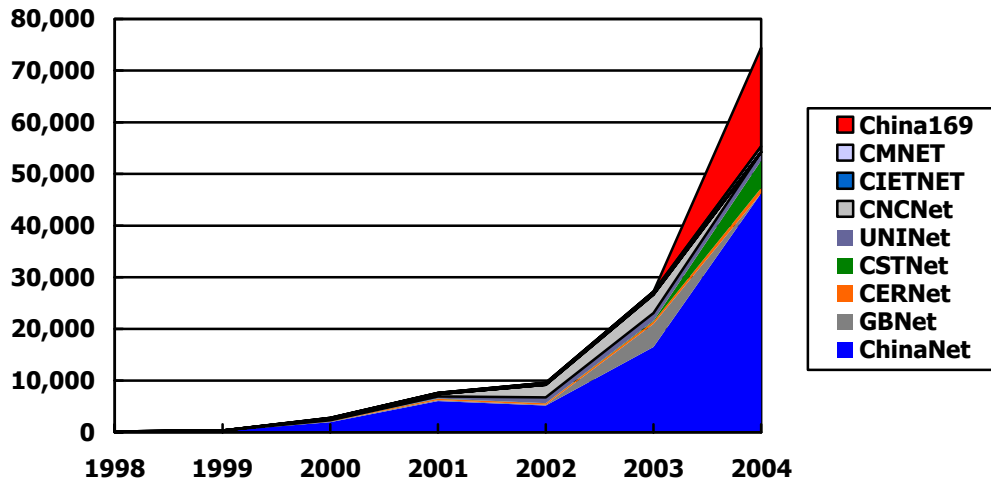
3.4.2.3 Backbone and International Gateway Operators

There are seven major state-owned data communications networks in China. The seven major backbones and their sponsors are as follows:

- ChinaNet - China Telecom and China Netcom
- GBNet/China 169 - Jitong, now part of China Netcom
- CERNet - Operated by the Ministry of Education
- CSTNet - Chinese Academy of Science (CAS)
- CNCNet - China Netcom
- UNINet - China Unicom
- CMNet - China Mobile

Connections between domestic networks and the Internet overseas have grown from 84.64 Mbps in June 1998 to 74429 Mbps by year-end 2004, as detailed below.

Figure 3f: China International Bandwidth (Mbps)



Source: CNNIC

3.4.3 Actors in Mobile Networks

There are only two mobile operators in China, China Mobile and China Unicom, both of which offer mobile services nationally. China Mobile operates a GSM network and had 222 million subscribers at the end of 2004. China Unicom offers GSM to 84.27 million subscribers as of the same date, and CDMA service to 27.81 million.

China Mobile leads the market with about 66% market share to China Unicom's 34%. Both mobile operators also face competition from the PAS/PHS wireless local loop (WLL) service offered by China Telecom and China Netcom. PAS/PHS competes primarily at the low-end of the market with cheaper tariffs and calling-party-payment attracting subscribers despite the lack of roaming service and poorer voice quality.

Table 3g: Mobile Telecom Operators

<p>China Mobile (China Mobile Communications Corporation)</p>	<ul style="list-style-type: none"> ▪ Spun off from China Telecom in April 2000. ▪ In addition to voice service offered over its GSM network, China Mobile also offers value-added services including General Packet Radio Service (GPRS), MMS, WAP, JAVA, and IP telephony. ▪ Largest operator in China. ▪ Ranked number one in the world in terms of network scale and customer base. ▪ China Mobile Hong Kong Limited reported its revenue totalled RMB 138 billion (USD 17 billion) in the first three quarters of 2004, up 18% from the same period in 2003,. ▪ 222 million subscribers by the end of 2004. ▪ Listed in New York and Hong Kong.
<p>China Unicom (China United Communication Corporation)</p>	<ul style="list-style-type: none"> ▪ Established in 1994. ▪ Currently the only telecom operator in China licensed to offer both mobile and fixed-line services. ▪ Offers fixed-line, mobile, IP telephony, VoIP, data, Internet, and broadband. ▪ The world's third largest mobile operator and the only one in China operating a CDMA network. ▪ China Unicom Hong Kong revenue up 19% year-on-year to RMB 59 billion (USD 7 billion) in the first three quarters of 2004. ▪ 112 million subscribers by year-end 2004, of which 84 million are GSM users and 28 million are CDMA users. ▪ Listed in Hong Kong and New York.

3.4.4 Mobile Networks Competition and Solutions

3.4.4.1 3G – WCDMA, CDMA 2000 and TD-SCDMA Trial

The timing of 3G license issuance, which operators will receive licenses, and the selection of technology standards remains uncertain. China Mobile is certain to receive a license for W-CDMA, and Unicom is expected to upgrade its CDMA network to EVDO, but whether both fixed-line operators will receive licenses and what technology they might deploy is still undecided with China's TD-SCDMA standard representing the biggest wild card. The possible break-up of China Unicom complicates the outlook further.

In November 2004, the China Academy of Telecom Research (CATR) under the MII completed the MT-Net Phase II technical trials for W-CDMA, CDMA 2000 and TD-SCDMA. W-CDMA and CDMA2000 EV-DO which have been widely deployed in other markets were well-reviewed in the MT-Net trials. TD-SCDMA was reported not to be ready for commercial deployments. It is widely believed that the government will delay the issuance of 3G licenses until the second half of 2005 at the earliest.

3.4.4.2 PAS/PHS

PAS/PHS (Personal Access System / Personal Handy Phone System) has emerged from regulatory limbo to enjoy explosive growth. For several years, though officially banned by the MII, China Netcom and Telecom slowly built PAS/PHS networks in lower tier cities across China. As the fixed-line market has stagnated due to mobile substitution and IP telephony, PAS/PHS has become an important revenue driver for the fixed-line operators.

PAS/PHS allows mobile access to telecom services within a city. PAS/PHS services are built off of existing fixed line capacity, which makes them cheap to deploy; a savings that is passed on to users in the form of tariffs at least 50% lower than competing GSM and CDMA services. With extensive uptake, MII found itself with little choice other than to endorse PAS/PHS and open top-tier cities, including Beijing and Shanghai, to the service.

Although PAS/PHS's future is unclear once 3G licenses are issued, with 65.2 million subscribers already using the service by the end of 2004, PAS/PHS has already reached such a scale that any migration of PAS/PHS subscribers on to new 3G networks would take years to complete.

3.4.4.3 CDMA-450

Once viewed as a possible technology to offer telephony across rural China, CDMA-450's prospects in China now seem dim. In 2004 the MII ordered that all CDMA 450 networks nationwide, excluding those in Tibet, be dismantled despite the fact that many networks were already in operation and servicing customers. The order was made

presumably to replace CDMA 450 with the home-grown SCDMA technology, developed exclusively by Datang subsidiary Xinwei and strongly supported by the government.

3.4.4.4 SCDMA

SCDMA was originally developed by Beijing Xinwei Telecom Technology (Xinwei), a joint venture set up in November 1995 between Datang Group and US-based CWill.

SCDMA has emerged as the choice for expanding USO (Universal Service Obligation) into China's remote, rural areas.

Aside from rural deployments, China Netcom has also targeted its SCDMA deployment in southern China to specifically compete with the PHS networks of rival China Telecom in those areas. China Tietong (formerly China Railcom) is carrying out commercial trial for SCDMA in Shanghai.

3.5 IT and Telecom Actors

Key actors covered in the IT sectors covered in this study can be broadly divided into three categories:

- Foreign Firms: Multi-National Corporations that have established a presence in China either to manufacture their products in China for export, to target domestic demand or both.
- Domestic firms: Domestic enterprises including both state-owned and private firms.
- Venture capital-backed enterprises: A subset of domestic firms are backed by venture capital firms and have listed or are targeting listings on overseas stock exchanges.

3.5.1 Foreign Firms

Foreign IT and telecom equipment vendors are well established in China. In fact, foreign firms in these sectors are among the largest foreign investors in China and the largest exporters from China.

For example, Motorola's investment in China exceeds USD 3 billion. It is also China's 4th largest exporter, selling over USD 3 billion of its production from China in overseas markets in 2003. Nokia is also one of China's largest foreign investors and exported over USD 2 billion in 2003 ranking 10th. In addition to Motorola and Nokia, China's top 20 exporters in 2003 included Dell, Intel, a company invested by IBM, and five Taiwanese IT companies.

3.5.2 Domestic Firms

Domestic IT and telecom equipment vendors have emerged from the shadow of foreign market leaders and won significant market share in important market segments. In mobile handsets, domestic vendors have won close to 50% share in a market that was once completely dominated by foreign vendors. In ADSL, Huawei alone holds 44% of the market, while two other domestic vendors, ZTE and Harbour Networks, hold an

additional 16% and 9% share respectively. Thanks to improved R&D, domestic vendors are also expected to take a larger share of China's 3G market, once licenses are issued. Huawei and ZTE in particular have mature 3G products and are a likely to win a significant slice of operators' capital investment in 3G networks.

Increasingly, leading domestic vendors have global ambitions for their business. Lenovo's recent purchase of IBM's PC business for USD 1.25 billion in cash and stock is the most significant example of a Chinese company expanding overseas, but Lenovo is not alone. In fact, the Lenovo-IBM deal is part of a continuing trend of Chinese firms striking deals to expand their business overseas.

TCL, China's second largest handset maker and one of the largest makers of consumer electronics, has made a string of overseas deals. In 2002, TCL purchased the bankrupt German TV manufacturer Schneider for 8.2 million Euros. Through the acquisition, TCL hoped to gain access to a recognizable brand to support its entrance into the European market.

In November 2003, the company took a larger step into international markets by forming a joint venture with Thomson for its TV business. The JV is reported to be the largest TV manufacturer in the world as TCL and Thomson TV sold a total of 18 million units in 2003, accounting for 10% of the global market. TCL has a controlling stake in the JV with 67% with Thomson holding the remaining 33%.

More recently, TCL formed a joint venture with Alcatel for its handset business. The JV officially began operations on October 10, 2004. TCL holds a 55% stake in the venture with Alcatel holding the remaining 45%.

Chinese telecom equipment vendors are also moving overseas. Huawei, China's largest telecom equipment vendor with USD 5.58 billion in sales in 2004, formed a JV with 3Com in November 2003. Through the partnership, Huawei assigned most of its Ethernet switch and mid/low end router R&D team and network equipment manufacturing to the JV and took a 51% share of the company. 3Com invested USD 160 million and licenses for its IP products taking the remaining 49% share. The Huawei-3Com JV forecasts RMB 5 billion (USD 604 million) revenue in 2004.

Through overseas partnerships and its own overseas sales, Huawei has turned its international business into a multi-billion dollar operation. Huawei generated USD 2.28 billion in international revenues in 2004, up 117% from 2003.

The company's international sales span the globe. In early November 2004, Huawei won over USD 400 million in contracts in Africa from telecom operators in Kenya, Nigeria and Zimbabwe covering 3G, NGN, optical transmission, switches, routers and Intelligent

Networks products. Huawei also won new contracts in Australia and Latin America in November.

In 3G, Huawei has won contracts in both developing and developed markets. In October 2004, Huawei signed Africa's first 3G contract with Mauritius operator EMTTEL. The company has also sold to Etisalat in the United Arab Emirates. In more developed markets, the company has won contracts for USD 155 million from Huawei-invested Hong Kong mobile operator Sunday.¹ And in December 2004, Huawei broke into the European 3G market by securing a 3G contract valued at approximately EUR 200 million in the Netherlands.

ZTE, China's second largest equipment vendor with contract revenues reaching USD 4.13 billion in 2004, is also expanding aggressively overseas. The company had USD 1.64 billion of sales overseas in 2004, representing a year-on-year increase of 169.5%. The company listed on the Hong Kong Stock Exchange in December 2004 raising additional capital to fund its international expansion.

3.5.3 Venture Capital Backed Firms

Growth in China's IT and telecom industry is also fuelled by venture capital primarily from international investors. Many of the early leaders in China's IT industry have their roots as state-owned or at least state-backed firms. State-owned firms include Lenovo, TCL, ZTE, and Bird, China's largest handset maker. Although Huawei is technically private, it has also benefited from government support and has its roots in the Chinese military.

Newer IT and telecom companies are often private and backed by venture capital. This is true of all of the Chinese IT companies that have listed on NASDAQ including AsiaInfo, UT Starcom, and the Internet companies, Sina, Sohu, and Netease.

In all in 2004, venture capitalists invested USD 1.269 billion in 253 Mainland China or Mainland-related companies according to Zero2IPO, a research firm. The number of deals was up 43% from 2003, and the funds invested increased 28% from the previous year.

¹ Huawei took a 5% stake in Sunday in February 2004.

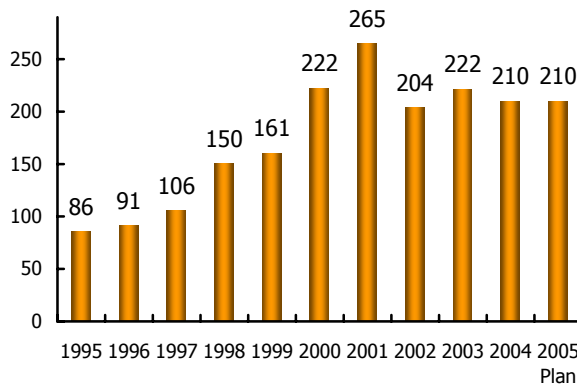
4 Telecom Equipment

- *With 3G most likely delayed until the second half of 2005 at the earliest, investments by China’s telecom operators’ have shown a downward trend. Stagnant CAPEX reflects a structural shift in China’s telecom industry from new network builds and capacity expansion to network optimization, increased efficiency, and a focus on the launch of new services. CAPEX is expected to remain flat at least until the issuance of 3G licenses drives increased investment in mobile networks.*
- *The MII announced that China’s planned telecom CAPEX in 2005 is RMB 210 billion (USD 25 billion), equal to the planned CAPEX for 2004 and down slightly from the actual 2004 CAPEX of RMB 214 billion.*

4.1 Key Sector Trends

With 3G delayed until the second half of 2005 at the earliest, investments by China’s telecom operators’ have shown a downward trend. Stagnant CAPEX reflects a structural shift in China’s telecom industry from new network builds and capacity expansion to network optimization, increased efficiency, and a focus on the launch of new services. CAPEX is expected to remain flat at least until the issuance of 3G licenses drives increased investment in mobile networks.

Figure 4a: CAPEX for China’s Telecom Industry (RMB Billions)



Source: MII

China’s telecom CAPEX grew rapidly during the late 1990s, reaching a high of RMB 264.8 billion (USD 31.9 billion) in 2001. This surge was driven by an aggressive build-out and expansion of GSM networks and backbone transmission networks. In 2002, however, CAPEX declined 23%, as China Telecom’s restructuring delayed investments by the fixed-line carrier, while the MII required all carriers to cut spending in an effort to

improve returns. Telecom investments rebounded in 2003, rising 9%, largely as a result of China Unicom's CDMA Phase III projects.

2004 CAPEX came in at RMB 214 billion exceeding the MII's original RMB 210 billion plan by RMB 4 billion. The MII has again announced that planned CAPEX for 2005 is to total RMB 210 billion.

4.1.1 Regulatory Direction

Investment decisions by Chinese operators are not made completely independent of government oversight. The government has a strong influence over technology selection through the issuance of licenses and over investment scale through its review of operator investment plans.

In some cases, the MII's power to select the technologies adopted by operators may have a direct impact on operators' investment decisions and vendors' sales revenues. For example, in 2004 the MII ordered that all CDMA 450 networks nationwide, excluding those in Tibet, be dismantled despite the fact that many networks were already in operation and servicing customers. The order was made presumably to replace CDMA 450 with the home-grown SCDMA technology, developed exclusively by Datang subsidiary Xinwei and strongly supported by the government, regardless of SCDMA's technological immaturity and higher costs. As a result, Xinwei has seen strong business growth, with 2004 revenues projected to have exceeded 2002 levels by 300% (USD 75 million, up from USD 25 million in 2002). The growth has mainly been driven by contracts from China Netcom and China Railcom to extend SCDMA networks in urban areas.

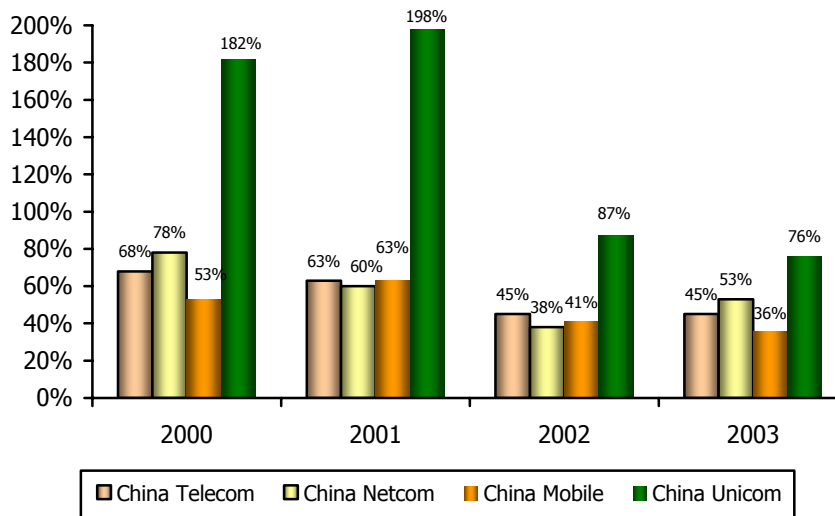
Although the government's control over technology selection has a clear impact on the market, operators are generally free of government influence when they make the final determination on which vendor's equipment to use.

4.1.2 Operators Strategies

China's telecom CAPEX to sales ratio has long been higher than in other countries, but it began falling from 2002, reflecting more rational investment decisions being made by the operators.

To some degree, this has been due to operators' increasing accountability to their shareholders and investors since China Telecom, China Mobile, China Unicom and China Netcom are all publicly-listed companies. At the same time, slowing subscriber growth, maturing networks and increased competition (such as PHS versus mobile, and China Telecom and China Netcom's broadband rivalry) have forced operators to shift their investment strategies from, for example, new network builds to network optimization.

Figure 4b: China's 4 Leading Operators: CAPEX to Sales Ratio



Source: MII, BDA

4.1.3 The Impact of 3G

3G remains the biggest source of uncertainty for telecom CAPEX in China. The timing of license issuance, the selection of technology standards, and the choices of vendors will have a significant impact on the CAPEX outlook and what companies will be beneficiaries.

In November, the MII (China Academy of Telecom Research) completed the MT-Net Phase II technical trials for W-CDMA, CDMA 2000 and TD-SCDMA. W-CDMA and CDMA2000 EV-DO which have been widely deployed in other markets were well-reviewed in the MT-Net trials. TD-SCDMA was reported not to be ready for commercial deployments. It is widely believed that the government will delay the issuance of 3G licenses until a final determination can be made on the readiness of TD-SCDMA probably in the middle of this year after a new round of trials.

Once China's State Council issues 3G licenses CAPEX should get a boost as operators begin building new 3G networks. For example, greenfield operator China Telecom estimates that it will cost about RMB 80 billion (USD 9.6 billion) to deploy a nationwide WCDMA network. (However, the possible break-up of Unicom and spin-off of its mobile networks to China Telecom and Netcom means that there might not be any greenfield operators in China. If this was the case, 3G CAPEX would be significantly reduced.) Existing mobile carriers will also need to make huge investments to construct/upgrade their 3G networks in top-tier cities.

3G's expected arrival is also impacting investment in other services. PHS investment by both China Telecom and China Netcom has slowed since 2003 as operators have begun to plan ahead for 3G.

4.1.4 Telecom Equipment Investment Focus

4.1.4.1 Mobile Operators

Mobile carriers are focusing their investment on network optimization, new services and support systems to attract new subscribers and retain existing subscribers, while stemming slides in ARPU.

4.1.4.2 Mobile Networks

With subscriber growth slowing, pushing down demand for new capacity, investments are increasingly focusing on network optimization and new services with outlays for GSM and CDMA expected to fall.

Since mobile network construction began in the late 1990s, foreign vendors have continued to dominate the sector largely because mobile operators prefer original equipment vendors to maintain service continuity and to avoid high switching costs. This means that major vendors, which have built strong relationships with the operators, will continue to win new network expansion contracts.

China Mobile's major GSM equipment vendors are: Ericsson, Motorola, Alcatel Shanghai Bell, Siemens, Nortel and Nokia. Nokia, Motorola, Ericsson, Siemens, Alcatel Shanghai Bell and Nortel, as well as domestic vendors, ZTE, Jinpeng and Huawei, have all won GSM contracts from Unicom. China Unicom's CDMA vendors include: Motorola, Lucent, Nortel, Ericsson and ZTE.

The pecking order of these vendors is likely change when 3G contracts are awarded. Domestic vendors, such as Huawei and ZTE, are expected to increase their share thanks to government support and the availability of more mature products at the start of the 3G investment cycle.

4.1.4.3 Transmission Networks

Transmission networks also make up a large portion of planned investments by mobile carriers. However, as the two operators' transmission networks are near completion, investments in this area should decrease until more capacity is demanded with 3G service deployment (both increased voice usage as well as data).

Key transmission equipment vendors in China include domestic vendors including Huawei, ZTE, FiberHome and multinationals such as Lucent, Siemens, Nokia and ECI.

4.1.4.4 New Services

Mobile carriers are increasingly focusing on investments in new services.

China Mobile's new business investment is mainly devoted to mobile data services including SMS, MMS, and GPRS. China Unicom, meanwhile, mainly focuses on BREW, CDMA1x and IP-based applications such as video conferencing.

As mobile data services are a necessity for attracting new subscribers and offsetting declining voice ARPU, mobile operators are expected to continue investing in and promoting new services. Vendors in this area include Intrinsic, Kunlun Mobile Technology, and Locus.

4.1.4.5 Support Systems

To improve operational efficiency and service quality, and to support new businesses such as mobile data services, the two mobile carriers have started to increase spending on support systems.

China Mobile first began investing in BOSS (Business Operation Supporting System) in 1999 and began integrating and upgrading provincial BOSS from 2001. BOSS Phase I was completed in 2003. In 2004, China Mobile planned to increase investment in support systems to RMB 7.8 billion (USD 940 million), of which its BOSS upgrade is a key project.

Six vendors - AsialInfo, Linkage Technology, Digital China, BEA, Si-Tech, and Langchao – make up the majority of China Mobile's investment in BOSS. AsiaInfo and Linkage Technology are the two biggest vendors, winning BOSS contracts in nine and six provinces respectively. The other four vendors have each won deals in the remaining 16 provinces. These vendors have built up strong relationships with provincial level operators, making it extremely difficult for new players to break into the market.

In addition to BOSS, China Mobile continues to invest in CRM (Client Relationship Management) and MIS (Management Information System) to improve its support systems, of which AsiaInfo has the leading market share.

Like China Mobile, China Unicom will also increase investment in support systems. China Unicom's biggest vendors are AsiaInfo, Neusoft and Longshine.

4.1.5 Fixed Line Operators

China Telecom and China Netcom will focus more on optimizing their networks and improving capacity utilization, while investing in new growth areas such as broadband access to drive revenues.

4.1.5.1 PHS

With subscribers numbering 65.2 million by year-end 2004, PHS continues to be a key revenue driver for the fixed line operators. Both China Netcom and China Telecom continue to add capacity in 2004. However, PHS CAPEX is likely to continue to trend downward as 3G approaches.

4.1.5.2 Broadband Access Networks

The broadband access market has been a key growth driver for fixed line operators since 2003. By year-end 2004, the two operators had 23.9 million broadband subscribers, of which 16.9 million were ADSL users.

The four leading vendors, Huawei, Alcatel-Shanghai Bell, ZTE and UTStarcom, accounted for as much as 85% of the total DSL market in 2003, and will continue to benefit from operators' investments in this sector. CAPEX will also increase in local area transmission, IP MAN and IP backbone, which provides backhaul capacity for broadband access networks, but growth is expected to be modest.

4.1.5.3 Support Systems

Support systems CAPEX will increase significantly, albeit from a low base. With market competition intensifying, the operators must focus on how to better serve their key customers and improving efficiency, with IT systems that support these initiatives being the major focuses of investment.

The immediate beneficiaries of investments in BOSS include Linkage, AsiaInfo and Neusoft. But opportunities for new players to enter the market will also emerge.

4.1.5.4 Soft Switches and NGN

Although most 3G mobile network investment will be delayed until the issuance of licenses, operators have already increased spending on soft switches and NGN, which are core components of future 3G networks.

China Telecom and China Netcom need to invest more in reconstruction, connecting their PSTN and IP networks, than mobile operators, which completed soft switch trials in 2003 and began rolling out commercial networks in the second half of that year. Although still a very small percentage of total CAPEX, soft switch and NGN outlays are expected to increase in operators' future spending over the next few years, with key vendors jockeying for position.

This should benefit leading vendors including Alcatel, Ericsson, and Nortel as well as domestic player ZTE, which has a number of trial deployments with both China Telecom and China Netcom.

4.2 Key Domestic Players

Company Name	Company Description
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<p>Huawei www.huawei.com.cn</p>	<p>Key facts: Headquartered in Shenzhen, Huawei is China's leading telecom equipment vendor. Its product have been deployed in over 40 countries through its 32 branch offices worldwide, and its international partners include 3Com, Microsoft, Siemens, Qualcomm, Motorola and Infineon. 41% of its total revenues from international sales in 2004</p> <p>Main products: Access Networks, Switches, Optical Networks, Data Communications, Mobile Data Services, Multimedia Products, Wireless and NGN.</p>
<p>ZTE www.zte.com.cn</p>	<p>Key facts: ZTE was founded in 1985 and is headquartered in Shenzhen. It is China's largest listed telecom equipment provider. ZTE had its start as part of a government-funded initiative to improve domestic telecom capabilities and is still majority-owned by the government. ZTE has emerged as a full-scale equipment manufacturer with 15,000 employees, and sells its products in more than 40 countries. In 2004, ZTE's revenues mainly came from its PHS and CDMA products.</p> <p>Main products: Network Centralized Surveillance, PHS, NGN, Wireless, Switching System, Access Network, Optical Transport, Mobile Communication, Data Communication, Videoconference</p>
<p>UTStarcom www.utstarcom.com.cn</p>	<p>Key facts: UTStarcom growth has been driven by the sale of its PHS products. The company has entrenched relationships with China Telecom and China Netcom and is promoting other products in new markets such as 3G and NGN.</p> <p>Main Products: PHS; Broadband; Wireless; 3G Mobile Communications; Optical Networking; Soft Switches</p>
<p>Harbor Networks www.harbournetworks.com</p>	<p>Key facts: Harbor Networks was founded in 2000 by Li Yanan, a former vice president of Huawei, and received a combined funding of USD 53 million from Warburg Pincus in 2001 and 2002. The company competes with Huawei mainly in routers and IP DSLAMS. Its revenue grew rapidly in 2003, driven by its aggressive expansion in the domestic IP DSLAM market.</p> <p>Main products: Broadband Access; Ethernet Switches; IP Core and Edge Routers; VoIP; Multi-Service Optical Transport Platform</p>

5 The Chinese IC Industry and Fabless Chip Design

- *According to RAND, China accounts for 13% of world demand for semiconductors, up from 7% in 2000. But with domestic IC consumption growing at almost twice the global rate, domestic demand is growing much faster than domestic production capacity. As a result, 90% of the domestic demand is met by imports.*
- *Despite the opening of an increasing number of foundries in China, imports are expanding rapidly. In 2001, China imported USD 20 billion in chips. In 2002, these figures reached USD 30 billion, and in 2003, USD 42 billion.*
- *Strong domestic demand for semiconductors, government backing, and venture capital are all contributing to rapid growth China's IC design market. Today there are anywhere from 350 to 450 IC design firms in China according to various estimates.*
- *Despite the growth in the industry, China's IC design market remains at a very early stage of development. Many of the companies with the strongest R&D capability may still be developing their first products, so they have yet to generate revenues.*

5.1 Key Sector Trends

China's leaders have recognized semiconductors as a strategic high-growth industry, but until recently semiconductors constituted the weakest link in the Chinese electronics industry in the views of many analysts. The weakness in the domestic industry has been highlighted by accelerating growth in IC demand as more and more manufacturing in IC-intensive industries, including consumer electronics, telecom, and automobiles, move to China. According to China Daily, in the first half of 2004, IC demand grew 57.5% compared to the same period in the previous year.

When investors and government started to turn their interest towards the Chinese IC industry, the general view was that design capability was the bottleneck limiting the industry's growth in China. In January 2000, a group of industry representatives pointed to the need for foundries, the manufacturing facilities in which chips are made, to attract design talent and develop a more complete value chain including testing and packaging that would drive growth in the semiconductor industry in China. It was the lack of foundries, rather than design capability, which they believed was slowing the industry's development.

Following this foundry-first strategy, Richard Chang, former CEO of a Taiwanese chipmaker, founded Semiconductor Manufacturing International Corporation (SMIC) in April 2000. SMIC received heavy government backing and some RMB 12.3 billion (USD 1.48 billion) in initial investment. Following SMIC, a larger number of companies have shifted production to China or established new foundries in China, including Grace

Semiconductor in Shanghai, Huahong in Shanghai, UMC in Suzhou, and TSMC in Ningbo.

Due to the industry's momentum, an increasing number of design houses have also started to sprout up in China. In January 2000, there were less than 100 design houses in China. Most were state-owned or device makers with some design capability but not truly independent design firms. Today there are anywhere from 350 to 450 according to various estimates. These companies can be divided into:

- State owned enterprises (SOEs), or spin-offs from universities, the Chinese Academy of Sciences, and other institutions;
- Companies founded by overseas Chinese or Taiwanese;
- Foreign companies.²

5.1.1 Key Trends in the Chinese IC Industry

China's IC industry consists of three main parts: design, manufacturing, and encapsulation and testing. Sales revenues of design and manufacturing are growing quickly in China as China-based design houses bring new products to market and new foundries open. However, since most of the IC demand in China is still met by imported chips, testing still takes up the lion's share of industry sales in China.

Table 5a: Development of China's IC Industry Segments 2003.

Industry Segment	Sales Revenues (billion RMB)	Growth (%)	Proportion of IC Industry (%)
Design	4.49	107.9	12.8
Manufacturing	6.05	80.3	17.2
Testing	24.60	15.4	70.0

Source: CEInet, 2004

5.1.1.1 Market Prospects

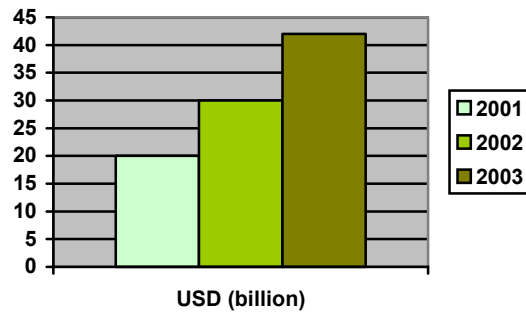
China is currently one of the world's fastest growing IC markets. The opening of SMIC's fifth factory in Beijing in late September 2004 is a big breakthrough for the Chinese semiconductor industry. The plant is China's first to process silicon wafers of 300 mm in diameter. However, despite the growth in demand and manufacturing capacity, China still trails other markets in terms of domestic design capability.

5.1.1.2 Large Gap between Demand and Supply Leading to High Rates Imports

According to RAND, China accounts for 13% of the world's demand for semiconductors, up from 7% in 2000. But with domestic IC consumption growing at almost twice the global rates, domestic demand is growing much faster than domestic production capacity. As a result, 90% of the domestic demand is met by imports.

² Foreign design companies are approaching the Chinese IC design market by two different paths. One is by forming partnerships, setting up JVs, and/or by acquiring Chinese companies of interest. Another option is to off-shore design, to set up design centres in China in order to lower costs and to gain access to the local market.

Figure 5b: Chinese Import of Semiconductors 2001-2003



Source: China Semiconductor Association

Despite the opening of an increasing number of foundries in China including SMIC, imports are expanding rapidly, as illustrated in figure 4b. In 2001, China imported USD 20 billion in chips. In 2002, these figures reached USD 30 billion, and in 2003, USD 42 billion.

Interestingly, as pointed out by CEInet, despite the tide of imports, 90% of those chips that are manufactured in China are actually exported. A large share of these exported chips end up being re-imported after processing. These means foreign companies are still able to add value even on chips produced domestically for consumption ultimately in China, highlighting the challenges the Chinese IC industry still faces.

5.1.1.3 Product Focus

According to CEInet, the four main products sold in the Chinese IC market are metal oxide semiconductors (MOS) micro parts, MOS storage, MOS logic parts, and MOS analogical parts. Together these accounted for 97% of the total market in 2003, with MOS micro parts occupying 41.7% of this figure. The same year, the three main IC application fields (computer, consumption, and network communication) held 86.5% of the total demand for integrated circuits in China.

5.1.1.4 Government Initiatives

Government officials identified limited investment as the primary cause of China's slow growth in this sector. As a result, officials are now inviting foreign investors into China in order to fuel the industry's growth. Between 2000 and 2002, China's IC industry received approximately RMB 29 billion (USD 3.5 billion) in investment, according to FSA. Investment in these two years equalled all previous investment in the sector.

The government views semiconductors as a strategic industry and has offered extensive support to companies involved in IC design and manufacturing. Support has come from central and provincial governments and science parks. In 1999 the Chinese authorities

began to discuss new policies and incentives for the promotion of the IC industry. The discussions resulted in Document 18 (*Policies for Encouraging the Development of Software and Integrated Circuit Industries*) published in June 2000, proposing a number of different actions to support the industry including bank loans subsidized by public authorities, government investments, tax reductions, and the founding of design centres. Local government implementation of the document has varied with Shanghai one of the cities to implement the most of the proposed actions. Tax breaks implemented as part of Document 18 were recently withdrawn due to US government pressure.

The government's emphasis on the IC industry is also reflected in China's 10th Five Year Plan, which identifies the time period to 2010 as critical to the Chinese semiconductor industry, and sets out two major objectives (figures from RAND):

1. By 2005, national IC wafer production should reach RMB 20 billion (USD 2.4 billion) with sales reaching between RMB 60-80 billion (USD 7.2-9.6 billion). The production should constitute between 2-3% of international sales and meet 30% of domestic demand.
2. By 2010, national IC wafer production should reach RMB 50 billion (USD 6 billion) with sales of RMB 200 billion (USD 24 billion). The production should constitute 5% of world sales and meet 50% of domestic demand.

In order to attain these goals, China will:

1. Establish a national IC R&D centre to research and develop large-scale technology production and system-level IC
2. Support an independent design group with annual sales of more than RMB 100 million.
3. Build a number of fabs (6-12 inch, capable of manufacturing 0.13-0.18 μ m process technology) as well as five or six packaging plants.

Central government policies are complemented by incentives provided by Chinese local governments in order to attract IC manufacturers. Local governments often compete with each other to offer better incentives to attract investment in the IC industry. For example, Beijing is reportedly offering a "Shanghai + 1" policy to better any financial incentive offered by Shanghai by an additional year.

Government contracts are still an important source of revenue for some companies especially those that make IC-based identity cards for the government (e.g. Datang and Tsinghua Tongfang). However, according to the EE Times, there have been discussions on how the government may shift policy away from supporting the industry through government procurement and towards supporting applications with potential for the Chinese market, such as HDTV, and home networking.

5.1.2 Key Trends in Chinese IC Design

5.1.2.1 Limited Size

Despite the rapid growth, China's design industry is still quite small, as is the average design firm. Referring to previous reports, the Fabless Semiconductor Association (FSA) places the Chinese IC design industry's annual revenue between RMB 1.2 billion (USD 150 million) and RMB 2 billion (USD 250 million), with 90% of the design firms having fewer than 150 employees and less than 50 design engineers. The small size reflects the relative youth of the companies, most of which were formed in the last few years. In the coming years, the market is likely to consolidate, resulting in fewer but stronger companies.

5.1.2.2 Development of the Foundry Industry Leading to Improved Environment

The competition to attract semiconductor industry investment is intense among Chinese cities, especially in Beijing and Shanghai, both of which are vying for leadership in the sector. Both Beijing and Shanghai have set goals of attracting IC fabs that far exceed the goals announced in the Chinese Communist Party's Five Year Plan. If both cities meet their goals, the total number of IC fabs in Beijing and Shanghai alone could increase from the original government plan for building ten fabs to as many as 15 fabs by 2005.³

The rapid development of foundries in China is creating an environment in which IC design firms can begin to succeed. Proximity to foundries reduces costs, makes it easier for IC design firms to put their chips in production and ultimately bring their products to market, and provides better access to technology.

5.1.2.3 Geographic Dispersion & Regional Design Clusters

Table 5c: Regional IC Design Clusters

City	Description
Shanghai	<ul style="list-style-type: none"> • Approximately 200 design houses are situated in Shanghai. • The large concentration of electronic manufacturers means IC design firms benefit from a close proximity to end clients. • Main foundries: Advanced Semiconductor Manufacturing Corporation Limited, Huahong NEC, and SMIC. • In 2003 Shanghai IC industry revenues accounted for 1/3 of the total industry revenues in China, according to the Shanghai IC Industry Association. • According to the Shanghai IC Industry Association, revenues for the Shanghai district are expected to climb 110% to RMB 20 billion (USD 2.4 billion) in 2004, and then RMB 30-35 billion (USD 3.6-4.2 billion) in 2005, and RMB 100 billion (USD 12 billion) in 2010. • As the industry matures, Shanghai has become home to a larger number of fabless design companies that are reaching scale. In 2003, 2-3 Shanghai fabless companies had revenues above RMB 100 million (USD 12 million). In 2005, five companies are expected to have reached this level.
Beijing	<ul style="list-style-type: none"> • Approximately 100 design houses are located in Beijing. • Many are government backed companies. The Beijing government bought a building for IC design firms and paid for testing equipment for the companies located in the building to use. Currently approximately 30 companies are

³ Beijing plans to build five to eight 8-inch wafer fabs capable of producing 0.25-micron technology by 2005 and another ten advanced-product lines by 2010. Shanghai on the other hand plans to build about ten IC fabs capable of manufacturing 8-inch wafers with 0.35-micron technology by 2005 (RAND, 2004).

	<ul style="list-style-type: none"> located in this centre. Engineering talent from Beijing's universities and access to government projects are key advantages for Beijing-based firms.
Hangzhou	<ul style="list-style-type: none"> Approximately 40 companies focusing on telecom applications, and on the low-end and mid-range consumer IC market, including chips for toys and TVs.
Chengdu	<ul style="list-style-type: none"> Intel made a USD 375 million in a Chengdu foundry. Focus on packaging.
Wu Xi	<ul style="list-style-type: none"> IC cluster
Shenzhen	<ul style="list-style-type: none"> Approximately 40 design houses are located in Shenzhen, Dongguan, and other cities along the Pearl River Delta. Focus on low-end consumer electronics and high-end products for electronics OEMs.
Xi'an	<ul style="list-style-type: none"> Approximately 30 companies designing analog and power products for consumer and military applications.

Overall, the Yangtze River Delta District including Shanghai and Zhejiang and Jiangsu provinces seems to have the most potential to become the center of China's IC industry. Shanghai is already a major center in its own right, and its close proximity to foundries in Ningbo and Suzhou, the design centers of Hangzhou as well as packaging firms located in Jiangsu in Jiangyin and Nantong, has created a critical mass that is likely to fuel continued growth of the industry.

5.1.2.4 Chinese IC Design – Focus Areas

Many of the top Chinese IC companies in revenue terms focus on low-end applications, particularly smart cards. In fact, half of the top 10 fabless companies have specialized in some form of IC card. IC cards have been the low-hanging fruit for Chinese IC design firms for a number of reasons. First, less design capability is required to produce a basic IC card, so companies with less in-house R&D capability can still compete. Second, the Chinese government and major state-owned companies are major buyers of IC cards, and in some cases, for sensitive government projects, foreign companies are excluded from bidding for the design work. As a result, domestic companies are able to win this less competitive business. In addition, the use of IC cards in mobile phones and for bill paying applications including consumer electricity creates a massive market for low-end IC cards in China.

However, margins for basic IC cards are limited, so even a substantial IC card business may not generate enough revenues to fund the development of other more advanced products. As a result, some of China's early IC design revenue leaders that focus on IC cards may be leapfrogged by companies developing more advanced products even if their current revenues are limited.

Aside from IC cards, other major areas of focus for Chinese IC design firms include consumer electronics, digital TV sets, cellular phones, MP3 & flash memory, and Wi-Fi. China's role as a major production base for all of these areas is a major attraction for companies seeking to design chips for these products. To carve out a new market niche,

many IC design companies in China are focusing on emerging markets such as TD-SCDMA and DTV set-top boxes. In these areas, China-specific standards may create market niche for Chinese players, while foreign companies may not create products for these new standards.

5.2 Key Players

Table 5d: Selected Foundries

Foundry	Est.	Staff	Offices
Advanced Semiconductor Manufacturing Corp. Ltd. (ASMC) www.asmc.com	1995	▪	▪ HQ in Shanghai
	<ul style="list-style-type: none"> ▪ A leading foundry for analog, power and smart card applications. ▪ One of the largest wafer fabrication companies in China. ▪ The company has one 5 inch wafer fab with 40,000 wafer output per month, one 6 inch wafer fab with 35,000 wafer output per month, and one 8 inch Fab with 30,000 wafer output per month capacity. 		
Central Semiconductor Manufacturing Corp. (CSMC) www.csmc.com.cn	1997	▪ 700<	HQ in Wuxi, Shanghai
	<ul style="list-style-type: none"> ▪ The first foundry opened in China. ▪ Three main future objectives: <ul style="list-style-type: none"> • a) expand capacity in the mainstream manufacturing market in China; • b) maintain cost effective operations through procurement of reconditioned equipment; • c) increase business with Chinese fabless design houses and further develop relationships with international customers. ▪ Received IFC investment 2003 		
Grace Semiconductor (GSMC) www.gsmcthw.com/index.html.en	2000	▪	▪ Located in Zhangjiang Hi-Tech Park in Pudong, Shanghai.
	<ul style="list-style-type: none"> ▪ Two 12 inch fabs have been constructed. ▪ Expects to reach a monthly capacity of 27,000 8 inch wafers by the second half of 2004. ▪ Makes mixed-signal chips for customers including Oki Electric Industry. ▪ Investors in Grace, which is legally domiciled in the Cayman Islands, include Silicon Storage Technology. ▪ Technology: 2003: 0.25µm/0.22µm/0.18µm/0.15µm Technologies; 2004/2H: 0.13µm Full Copper Technologies; Logic, Flash, SRAM, Mask ROM, Mixed Signal, RF, High Voltage etc. 		
Semiconductor Manufacturing International Corp. (SMIC) www.smics.com	2000	▪	▪ HQ in Shanghai Factories in Tianjin and Beijing.
	<ul style="list-style-type: none"> ▪ One of China's largest microchip maker ▪ Opened its 5th factory in September 2004. ▪ China's first plant to process 300 mm wafers. 		
Shanghai Hua Hong NEC Electronics Co., Ltd. www.hhnec.com.cn	1997	▪ 900<	▪ HQ in Shanghai Pu Dong Jin Qiao Export Zone
	<ul style="list-style-type: none"> ▪ A JV by Shanghai Hua Hong Group and NEC Corporation. ▪ China's first 200 mm foundry. ▪ 0.25µm-0.13µm Logic/MIX/RF CMOS process, 0.18µm in yield production in June 2004. ▪ Monthly capacity objective is 80,000. 		
SIM-BCD www.simbcd.com	2001	▪ 247 (2003)	▪ Shanghai
	<ul style="list-style-type: none"> ▪ China's first 6 inch bipolar fab and 2µm bipolar power IC foundry. ▪ Capacity of 40,000 6 inch wafers/month and 20,000 4 inch wafers/month. 		

Table 5e: Selected IC Design Companies

Design Company	Est.	Staff	Offices
Comlent www.comlent.com/en/index	2002		▪ HQ Shanghai ▪ R&D centre in Southern California
	A fabless RFIC design house focusing on the wireless communications markets in Greater China and Asia Pacific. Products under development include PHS/PAS and 2.4GHz short range devices. Investors include Intel, 3i, and DFJ ePlanet Ventures.		
Datang	1998	▪ Staff: 3600	▪ R&D in Beijing and Shanghai

Microelectronics Technology Co. http://www.datang.com/english/index.html	Datang Microelectronics' leading products include high-capacity digital switching series, light communication series, mobile communication series, data communication series, digital microwave communication series, software and system integration series, micro-electricity and dedicated integrated circuit series.	
Hangzhou Silan Microelectronics Joint-stock Co., Ltd. http://www.silan.com.cn/english/cpfb/cpfb.htm	1997	<ul style="list-style-type: none"> ▪ HQ ShengZheng, Huangzhou ▪ Xiamen ▪ Korea
	Silan specializes in Integrated Circuit products. The company possesses advanced EDA tools in IC design and testing capability in both wafers and finished products. Dedicated to invest more than 10 % of gross profit in R&D, Silan introduces dozens of new products and models to the market every year.	
Huada Electronic Design Inc., Ltd http://www.hed.com.cn/english/index.htm	2002	<ul style="list-style-type: none"> ▪ 120 ▪ Beijing ▪ Guangzhou
	CIDC (HED) provides IC design, system application development and EDA Tool Development. HED also has strong experience and business operations in IC card chips, ASIC designs and DVB set-top box product development.	
Nanjing Micro One Electronics http://www.microne.com/index.htm	1999	<ul style="list-style-type: none"> ▪ 80 ▪ Nanjing
	Nanjing Micro One Electronics' business scope covers the R&D and marketing of ASIC chips and a variety of ASIC chips-based electronic products used in information home appliances, wireless and digital communications, network technology and other areas. Most of R&D efforts have been put into developing ASIC chips for digital cameras and internet telephones (VoIP), CMOS image sensor, image codec, digital voice codec, embedded controller, etc. Other R&D outcomes include solutions for inverter-driven air-conditioner controllers, CTV signal digital processor, and internet telephone, all of which are available on the market.	
Shanghai Huahong Integrated Circuit Co., Ltd. http://www.shhic.com/new/index.asp	2000	<ul style="list-style-type: none"> ▪ HQ Shanghai
	Shanghai Huahong Integrated Circuit Co., Ltd. is one of the top five semiconductor design companies in China. The company focuses on the technology development and production of smart card chips and is extending into consumer and automobile electronics.	
Shenzhen State Microelectronics Co., Ltd http://www.ssmec.com	1993	<ul style="list-style-type: none"> ▪ Shenzhen
	Shenzhen State Microelectronics Co., Ltd. (SSMEC) is the first integrated circuit design company started up by the national Project 909. The company is primarily engaged in design, development and sale of digital audio & video IC, embedded CPU & DSP chips and ASSP for consumer electronics. The company provides customized service on IC design & development, as well as application solutions for customers.	
Trident Multimedia Technologies Co., Ltd. http://www.tridentmicro.com/tti.asp http://www.trident.com.cn/	1987	<ul style="list-style-type: none"> ▪ 100 ▪ HQ Sunnyvale, California
	Trident Multimedia Technologies (Shanghai) Ltd develops video processors and highly integrated system-on-a-chip devices, targeting the converging HDTV-ready and PC-ready digital CRT TV, LCD TV, PDP TV, and DLP TV applications.	
Vimicro Corporation http://www.vimicro.com/english/index.html	1999	<ul style="list-style-type: none"> ▪ HQ Beijing ▪ Shenzhen ▪ Silicon Valley
	Vimicro develops embedded multimedia signal processing chips and solutions that enable multimedia applications for mobile phones over 2.5G/3G network and PCs over broadband Internet.	

5.3 Investment Issues

5.3.1 Main Obstacles Hindering the Development of the Chinese IC Industry

While the growth trends in China's IC industry are impressive, the industry continues to face important challenges. These include a lack of capital, IPR issues, obstacles to design houses to selling into major customers, lack of IDMs, and lack of skilled personnel.

Table 5f: China's IC Industry – Main Obstacles

Obstacle	Concern
Capital	<ul style="list-style-type: none"> ▪ Despite the investment currently flowing into the industry, many industry participants still point to limited access to capital as an obstacle slowing the market's growth. Poorly developed domestic capital markets and limited domestic venture capital means that most companies must rely on foreign capital. ▪ The foreign investment that is coming into the industry has generally been directed at IC design companies, but capital is still needed to fund start-ups in other areas of the value chain such as packaging and testing. ▪ For foundries, the contrarian view of the market is that the problem may not be too little capital but too much. With so many new foundries being built in China, some worry about a glut in supply which could impact the industry globally. However, this would not necessarily be a negative for IC design houses in China since they would have ready access to manufacturing capacity.
IPR Issues	<ul style="list-style-type: none"> ▪ Many semiconductor firms are still nervous about designing in China, waiting for better protection of IPR. Meanwhile, these firms sometimes attempt to protect their IPR by dividing up the design and keeping critical parts outside of China or by spreading the design work across several locations in China. ▪ Another IPR issue that impacts the creation of domestic design firms is that Chinese law states that university IPR belongs to the state, making it difficult to commercialize technology or include it in a spin-off company. State owned companies (SOEs) have a similar problem.
Obstacles to Design Houses to Selling into Major Customers	<ul style="list-style-type: none"> ▪ In many cases, Chinese IC design houses struggle to convince customers to replace existing suppliers with their newly designed chips. For many companies, the risk and switching costs outweigh the lower prices a Chinese IC design firm may offer. ▪ Chinese companies are starting to break in to the market with low-end products (for example AC power control chips), but they still face challenges in higher-end products. ▪ As Chinese players struggle to establish themselves in the market, they are likely to face stiff resistance from major international players for whom China is a large and strategic market that they are unlikely to give up easily.
Lack of IDMs	<ul style="list-style-type: none"> ▪ China has only two Integrated Device Manufacturers (IDM). <ul style="list-style-type: none"> ○ BCD operates a wafer production line in Beijing. Half of production is used for internally designed products, with the other half used for outsourced manufacturing for other companies. ○ Selai is a Zhejiang-based company with 60% of production dedicated to internally designed products and the remainder for outsourced manufacturing for other companies. ▪ It has generally been harder for IDMs to raise capital than for foundries to since trying to be an IDM means competing with the most successful foreign companies including Intel.
Lack of Skilled Personnel	<ul style="list-style-type: none"> ▪ The system-level design talent and software expertise needed to compete in more sophisticated, higher-margin markets is limited (Shelton, 2004). ▪ Few universities provide majors in microelectronics, and those that do started these courses only in the last few years. ▪ International companies such as Intel and AMD have built R&D centres in China, leading to an intensified competition for professionals. ▪ Above all China needs experienced IC designers and professionals with experience managing the design process. ▪ Highly educated overseas Chinese are returning to mainland China, but not in sufficient numbers to fill the industry shortfall.

As a result of these obstacles, China's IC design industry remains at a very early stage of development. Many of the companies with the strongest R&D capability may still be developing their first products, so they have yet to generate any revenues. As a result, identifying more mature companies to invest in may be difficult.

Since many of China's early stage IC design firms are only just beginning to bring products to market, their designs are, in many cases, untested by customers, which makes it difficult for investors to evaluate the quality of their technology.

Further risk is introduced by the uncertainty over technology standards in a number of key segments that IC design firms are targeting. Many Chinese IC design firms are seeking a competitive advantage by focusing on standards developed in China or whose primary market is China. These include TD-SCDMA, PHS, and DTV standards. However, in each case, the prospects for the standards adoption or continued use is uncertain.

6 The Chinese Software Industry

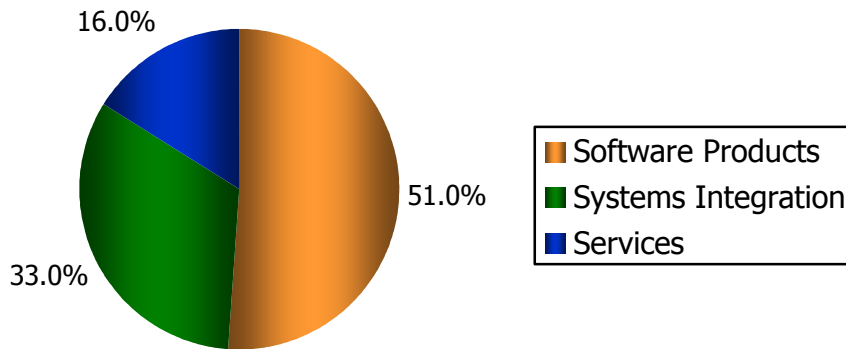
- *China's software industry has continued to grow rapidly in the last few years. According to a study by the MII and the National Bureau of Statistics of China, the Chinese software industry (comprising software products, system integration and services), reached RMB 163.3 billion (USD 19.67 billion) in 2003, 48.5% higher than in 2002. Revenues from software products, system integration and software services accounted for 51%, 33% and 16% of total revenue respectively.*
- *In 2003, China's industry exports reached RMB 16.6 billion (USD 2 billion), up 33.3% from 2002. Despite the rapid growth, software exports accounted for only 1.4% of total IT industry exports, reflecting China's comparative strength in IT product manufacturing and weakness in software.*
- *Japan is currently the biggest market for Chinese software exports, accounting for 61% of the total, followed by the US.*
- *The government actively supports the software industry. For example, software companies are not required to pay any taxes during their first two years of operations, and receive a 50% tax reduction in the third and fourth years. Other policies include simplified administrative procedures, such as relatively quick approval to secure international investment. Preferential treatment is also given to research facilities that successfully commercialize their research.*

6.1 Key Trends

6.1.1 Market Size & Structure

China's software industry has continued to grow rapidly in the last few years. According to a study by the MII and the National Bureau of Statistics of China, the Chinese software industry (comprising software products, system integration and services), reached RMB 163.3 billion (USD 19.67 billion) in 2003, 48.5% higher than in 2002. Revenues from software products, system integration and software services accounted for 51%, 33% and 16% of total revenue respectively.

Figure 6a: 2003 China Software Market Revenue Structure



Source: MII

The Software Industry Association forecast that the market in 2004 would reach RMB 210 billion (USD 25.3 billion), representing annual growth of 29%. System integration and software services together are expected to surpass software products to reach RMB 109.2 billion (USD 13.2 billion) compared to RMB 100.8 billion (USD 12.1 billion) for software products. (Full year 2004 data is not yet available.)

By the end of 2003, there were 8,700 registered software companies in China, of which 2,000 were new entrants in 2003. The majority of software companies are located in Beijing, Guangdong, Zhejiang and Shanghai. Private and foreign software companies dominate the market. For example, in Shenzhen, more than 95% of the top 100 software companies are either private or foreign-invested companies.

Eyeing international markets, many China software companies are attempting to qualify for international standards, such as the CMM (Capability Maturity Model) certificate system, issued by the Software Engineering Institute, an internationally accepted evaluation of software firms. By March 2004, more than 100 software companies in China passed CMM2, 45 had passed CMM3, and 9 companies had passed CMM4 or CMM5.

6.1.2 Software Export

In 2003, China's industry exports reached RMB 16.6 billion (USD 2 billion), up 33.3% from 2002. Despite the rapid growth, software exports accounted for only 1.4% of total IT industry exports, reflecting China's comparative strength in IT product manufacturing and weakness in software.

Japan is currently the biggest market for Chinese software exports, accounting for 61% of the total, followed by the US.

6.1.3 Government Support

The government actively supports the software industry. For example, software companies are not required to pay any taxes during their first two years of operations, and receive a 50% tax reduction in the third and fourth years. Other policies include simplified administrative procedures, such as relatively quick approval to secure international investment. Preferential treatment is also given to research facilities that successfully commercialize their research.

Moreover, local governments also provide financial support for the construction of software parks (see table 6b).

Table 6b: Chinese Software Parks

Dalian Software Park	<ul style="list-style-type: none"> ▪ Established in June 1998 by the Dalian city government to centralize the development of the local software industry. ▪ Most tenants are Japanese and South Korean MNCs, as well as local companies.
Shanghai Pudong Software Park	<ul style="list-style-type: none"> ▪ Operations began on May 6, 1998. ▪ Jointly invested in by China Electronic Corporation and Zhangjiang Hi-tech Park Development Corporation.
Beijing Zhongguancun Science Park	<ul style="list-style-type: none"> ▪ First state-level high-tech development zone that was approved by the State Council in May 1988. ▪ Largest software development and production center in China. ▪ Consists of five science zones.
Guangzhou Software Park	<ul style="list-style-type: none"> ▪ Established as the software industry base of the National Torch Plan in December 1999.

6.1.4 Government Market

Government investment in software represents a major market for software companies. According to the CCID, 30% of the government's IT investment was spent on software and IT services. Investment in this area is expected to remain on a growth trend for the next several years. In 2004, CCID forecast total e-government expenditure to hit RMB 40 billion (USD 4.8 billion), including RMB 13.9 billion (USD 1.7 billion) in software and services. E-government spending is expected to grow to RMB 49 billion (USD 5.9 billion) in 2005.

The government channels a portion of its software purchasing to domestic companies to support the domestic industry.

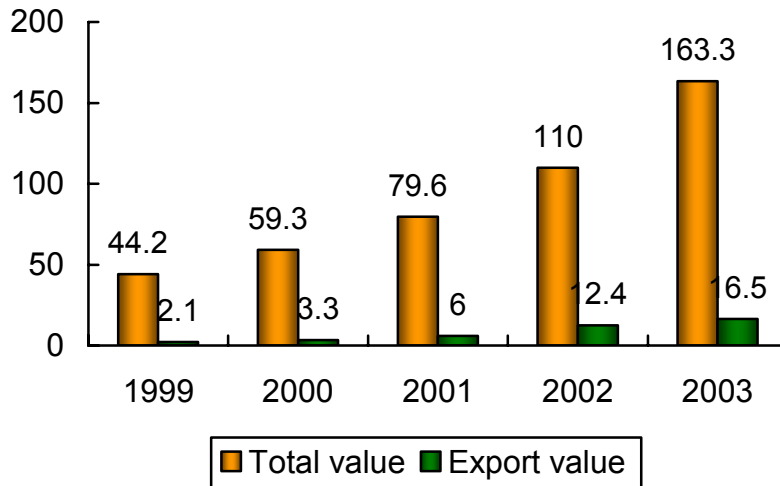
6.1.5 Enterprise Software Market

The enterprise software market also maintained strong growth in 2003. According to CCID, the market size of enterprise management software, including ERP, SCM, EAM, CRM and financial software, was RMB 4 billion (USD 480 million), 19.7% higher than in 2002. Industries such as finance, telecom and power were the first to deploy enterprise management software in the 1990s, and they will require further spending to upgrade their systems. Meanwhile, increasing demand from small and medium-sized enterprises is also helping to drive the enterprise software market. In 2003, the market size for small/mid-sized enterprise software was RMB 1.9 billion (USD 229 million), which is expected to increase to RMB 5.5 billion (USD 663 million) in 2008. The total enterprise software market is estimated to grow to RMB 9.7 billion (USD 1.17 billion) in 2008, representing a CAGR of 19.6% from 2003.

6.1.6 Growth Prospects

As mentioned above, the market size of the Chinese software industry (comprising software products, system integration and software services), reached RMB 163.3 billion (USD 19.7 billion) in 2003, 48.5% higher than 2002, according to the MII and National Bureau of Statistics. In 2004, the software market was expected to have reached RMB 210 billion (USD 25.3 billion), representing annual growth of 29%, according to the Software Industry Association's forecast.

Figure 6c: 1999 – 2003 China Software Market Size (RMB billion)



Source: MII

6.2 Key Players

Table 6d: Main Chinese Players in the Software Industry

Kingdee International Software Group, Ltd.	<ul style="list-style-type: none"> ▪ Kingdee has 46 branch locations and more than 2,700 employees, with approximately 1,000 developers in three development centers across China. ▪ Domain expertise in enterprise software sectors including ERP, CRM, SCM, Knowledge Management, e-commerce services, and middleware integration tools. ▪ Technical capabilities include MS Windows, Unix, Linux, OS/400, OS/390; J2EE, .NET; Java/JavaScript, Visual Basic/VB Script, C/C++, HTML, XML, JSP, ASP, PHP; Rational Rose, UML; MS SQL Server, Oracle, DB2 and more. ▪ Kingdee is one of only 100 companies to achieve ISO9001 and SEI CMM 4 level certification. ▪ Expects to be SEI CMM level 5 compliant in 2005. ▪ Listed on Hong Kong's Growth Enterprise Market (GEM).
UF Soft	<ul style="list-style-type: none"> ▪ Established in 1988, UF Soft listed on the Shanghai Stock Exchange in May 2001 (ticker: 600588). In 2003, UF Soft's listed subsidiary posted revenue of RMB 602 million and profit of RMB 75 million. ▪ The company has 35 branches and 15 representative offices nationwide, with nearly 4,000 employees, including over 1,000 software developers and 1,000 software implementation consultants. ▪ Originally focused on financial management software, UF Soft's product line has expanded to many other areas including ERP, SCM (Supply Chain Management), CRM, HR, EAM (Enterprise Assets Management) and OA. ▪ UF Soft services clients in the electronics, finance, auto, medical, retail and chemicals industries. ▪ In 2004, UF Soft announced that it was seeking to become the largest management software supplier in Asia by 2006 and the world's top management software supplier by 2010.
Neusoft	<ul style="list-style-type: none"> ▪ Founded in 1991 and headquartered in Shenyang, Neusoft is one of China's leading software suppliers, employing over 6,000 people. Its 2003 revenue was RMB 2.2 billion, up from RMB 2.0 billion in 2002 and RMB 1.8 billion in 2001. ▪ In December 2002, the company became the first Chinese software company to pass CMM5 certification. ▪ Key areas covered include Software & Services, Digital Medical Products & e-Hospital Solutions, and IT Education & Training. Its listed subsidiary, Shenyang Neusoft Co., Ltd. (ticker: 600718), posted revenue of RMB 2.0 billion, of which 74% was from software and system integration, and 24% from medical-related products. ▪ The company has 40 branches nationwide and has set up software parks in Shenyang, Chengdu, Dalian and Nanhai. It also has branches in the US, Japan and Hong Kong. ▪ Key software clients are in various industries including telecoms (e.g. GSM and CDMA billing systems and China Unicom's Java platform), government (e.g. tax management systems and social insurance management systems), enterprise and e-commerce, power, communications, education and finance. ▪ Clients include Haier, Chunlan and Qilu Petrochemical. ▪ The company set up a joint venture with Nokia in 2000 to develop mobile data platforms.
CS&S (China National Computer Software and Technology Service Corporation)	<ul style="list-style-type: none"> ▪ Founded in 1990, CS&S is a large state-owned, enterprise specializing in computer software, IT products development, systems integration, information services and software outsourcing. Currently, the company has over 3,000 employees. ▪ 2002 revenue hit RMB 1.3 billion with profits of RMB 89 million. The company listed on the Shanghai Stock Exchange in 2002 (ticker: 600536). ▪ CS&S passed CMM2 in 2001. ▪ Key businesses include software development, system integration and software outsourcing. ▪ CS&S's products cover operation systems, OSS, government and enterprise office management systems and application products (e.g. tax compliance system). ▪ The company set up a joint venture with CA in 2001 to sell ERP products.

Huawei Technology	<ul style="list-style-type: none"> ▪ Although Huawei is better known as a telecom equipment vendor, it also possesses strong software development capabilities. In the MII's list of 2004's Top 100 Chinese Software Companies, Huawei was ranked No. 1 with software revenue of RMB 6.2 billion. ▪ Huawei's India software institute passed CMM5 in August 2003, while its Beijing and Nanjing software institutes passed CMM4 in January and June 2003 respectively. ▪ Unlike Kingdee and UF Soft, whose software products cover a wide range of areas, Huawei focuses on software development for telecom equipment, such as mobile gateways, intelligent network products and base stations. Huawei sells most of its software bundled with telecom equipment, and is not focused on software as a major business. ▪ Huawei has around 22,000 employees including an R&D staff of 10,000, of which over 70% are estimated to be involved in software development.
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Table 6e: MII's 2004 Top 10 Independent Software Developers⁴

Rank	Company
1	CS&S (China National Computer Software and Technology Service Corporation)
2	Shenyang Neusoft
3	UF Soft
4	Kingdee
5	ZTE Software Co., Ltd.
6	Shangdong Langchao
7	Shanghai Baoxin
8	Shandong Zhongchuang
9	SAP
10	Hangzhou Xinzhongda

⁴ Independent software developers are companies focused on software development rather than other businesses.

7 Security Services

- *The security market can be divided into two areas: the heavily regulated government sector and the more open corporate market.*
- *Most government projects are awarded to domestic companies. In some cases, for the most sensitive government projects, only government-backed, domestic companies are able to participate. There are signs that the government market is gradually opening to private domestic firms, but foreign companies are likely to remain unable to penetrate this market.*
- *Given the barriers to foreign entrants, China's government projects will continue to be an important driver for domestic security vendors. The niche market, currently accounting for approximately 1/5 of the total, provides a captive market in which they can develop their capabilities.*
- *The less-regulated corporate market is likely to see rapid growth. Increased corporate investment in and dependence on IT systems and continuing security risks caused by viruses, hacking, spam, and other security threats is driving increased investment in the sector.*
- *Domestic security vendors are catching up with the foreign counterparts in terms of market share, primarily because of continued government support and regulatory barriers in some sectors. Those who have strong technology capabilities and are actively expanding their business beyond the government sector are more likely to succeed over the long term.*

7.1 Key Sector Trends

Expanding Internet penetration as well as escalating computer and network attacks is driving the growth of China's security market. In 2003, the information security market was worth RMB 1.7 billion (USD 200 million), and by 2007, it is expected to grow to RMB 5.6 billion (USD 670 million), according to IDC. This represents a CAGR of 34%, much higher than IDC's forecast of 22.9% in the Asia Pacific region during the same period.

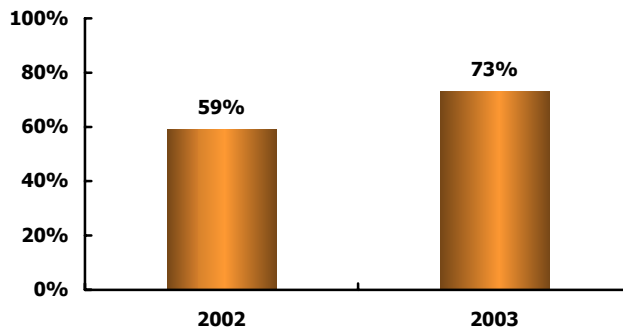
Currently, the deployment of security systems in China, especially by domestic companies, is still at a relatively early stage. Foreign enterprises invest an average of 4-5% of their total IT investments on security products, while Chinese companies spend less than 2%, according to IDC. As investments in IT by Chinese companies progress, they are likely to reach global norms for investment in security. These increases will be a major driver of growth for the industry.

7.1.1 Anti-virus Software, Firewalls Most Widely Adopted

To date, anti-virus and firewall products have been the most widely adopted security products, since the biggest security threat for individuals and most enterprises in China are virus and hacker attacks.

As computer virus attacks in China grow in both numbers and scale, the network and computer security industry is emerging to address this threat. A 2003 survey conducted by CRC-Pinnacle, a Chinese consulting firm, showed that more than 73% of Chinese Internet users have been hit by computer viruses, up 14% from 2002.

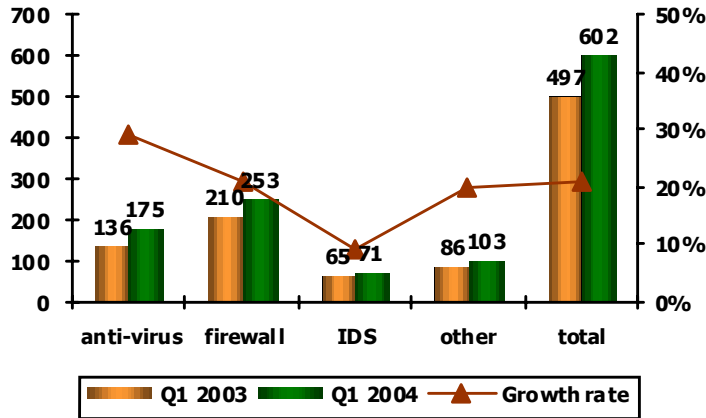
Figure 7a: Security Attacks in China (% of internet users)



Source: CRC-Pinnacle Consulting

According to CCID, the sale of firewalls accounted for 42% of the network security market in Q1 2004. The anti-virus software market trails firewalls, with 29% of the total network security market, but is growing faster. The anti-virus software market grew 29% year-on-year in Q1 2004, compared to the 20% and 9% growth rates of firewall and IDS respectively.

Figure 7b: Network Security Product Revenues and Growth Rate (RMB million)

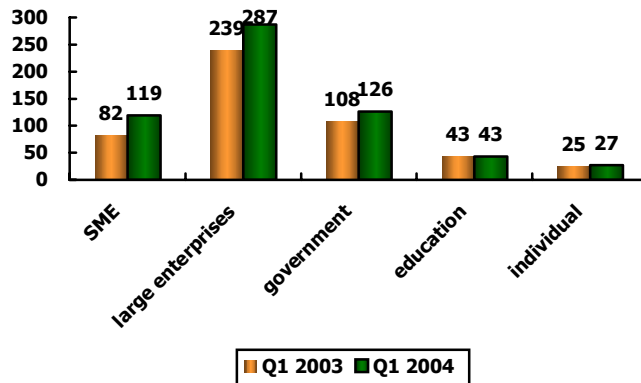


Source: CCID, April 2004

7.1.2 Government Versus Enterprise Market

Enterprises and the government are the two biggest vertical markets in China. In Q1 2004, large enterprises were still the largest buyers of network security products, far ahead of government institutions and SMEs.

Figure 7c: Network Security Vertical market revenue (RMB million)



Source: CCID, April 2004

The enterprise and government sectors make up around 90% of the total market. Demand from educational institutions and individuals remains very small.

7.1.2.1 Large Enterprise Market – Biggest Expenditure

Large enterprises lead in overall IT system implementation in China. A survey jointly conducted by the State Asset Management Commission and CCW Media Group in 2003 showed that the IT investments of 3,000 large enterprises in China accounted for 20.9% of total national investment. The average IT investment of large enterprises was RMB 17.5 million (USD 2.1 million) in 2002, with cumulative investment on IT systems averaging RMB 67.8 million (USD 8.2 million) by 2002.

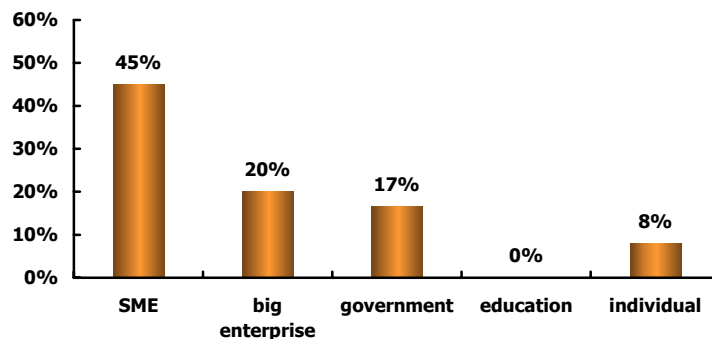
As IT systems become increasingly complex *and* critical to businesses, security has emerged as a key issue. Large enterprises have traditionally been more proactive in investing in security measures due to their larger overall investment in IT.

Investments in security systems are generally ongoing in nature with services, license fees and product updates and replacements regularly being made, so investment by large enterprises continues to be a major driver behind the industry's growth. This vertical market will continue to grow quickly and account for the majority of the market in 2004 and going into 2005.

7.1.2.2 SME Market – Strong Growth Prospects

SMEs still lag behind large enterprises in terms of total investment on security, but the SME market is growing rapidly as shown in the following graph.

Figure 7d: Vertical Market Growth Rate Q1 2004 (over same period in previous year)



Source: CCID, April 2004

As more IT and Internet applications are deployed by SMEs across China, demand for security products is also growing.

At the same time, the Chinese government is also urging SMEs to deploy security products amid concern that poor information security can be a national security issue. The government has even begun implementing inspections to confirm that companies are implementing security software according to a security software firm interviewed for this

study. Government-mandated security upgrades will also help drive China's security market in the future.

7.1.2.3 Government Security Market – Key for Domestic Players

Although the government trails enterprise customers in security investment, government-backed projects have been one of the key drivers for domestic security vendors, since foreign vendors are not permitted to bid for most of these projects. The government sector, which currently accounts for approximately 1/5 of the total market, is still seen as the most promising by many leading domestic companies.

In 2003, government IT investment reached RMB 34.5 billion (USD 4.16 billion), up 15% from the previous year, according to CCW Research. Government investment is expected to expand further, with total investment to reach an estimated RMB 40 billion (USD 4.82 billion) in 2004, according to CCW Research.

As IT investment expands, the government has recognized that ensuring the security of IT systems is becoming increasingly important. A survey by China Computer User, under CCID, of 20 government ministries and affiliated departments at the end of 2003, showed that 60% of respondents saw the deployment of security systems among 6 of their top investment focuses, closely following business operating systems at 70%. In Q1 2004, security products revenue from the government sector rose 17% quarter-on-quarter to RMB 126 million, according to CCID.

In 2003, China enacted a new government procurement law that requires investment plans (including IT investments) to receive central government approval. The government has been able to use the approval process to ensure that sensitive security projects are handled by domestic vendors.

For some projects, only domestic companies with a government background are permitted to take part. For example, only three government-backed companies - Koal Software, Jilin University Information Technology Co., Ltd, and iTruschina – are in the running to provide e-signature related technology and products for China's national and metropolitan CA (Certification Authority) Centres.

Some smaller privately-owned domestic security vendors, such as GateGuard (www.gateguard.com.cn) and CNNS (www.cnns.net), have participated in certain government projects, but they still face difficulties in securing contracts for large-scale, core projects.

Foreign security vendors are still restricted from participating in some government projects.

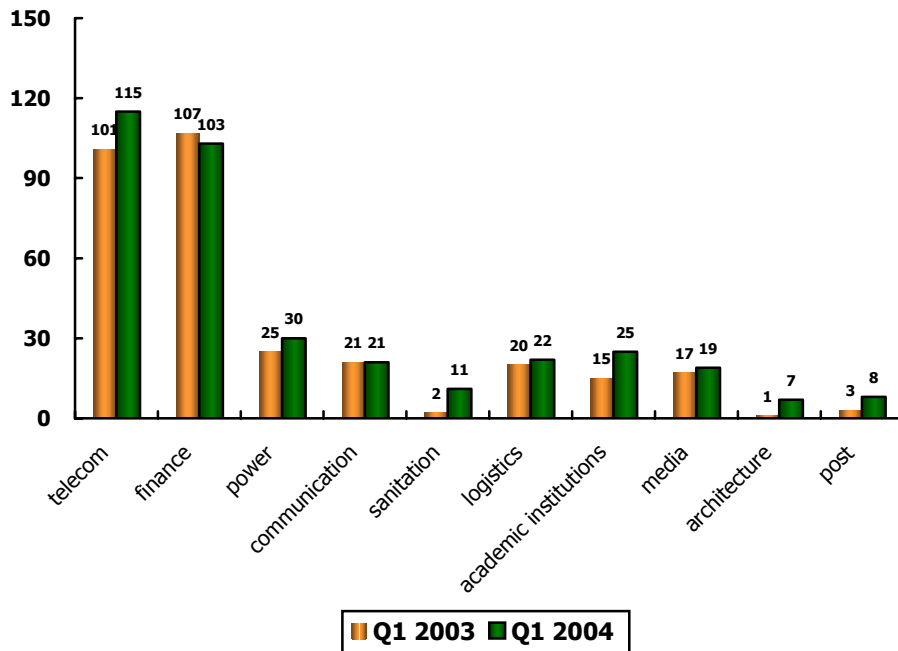
7.1.3 Niche Market - Telecom and Finance

The telecom and finance industries lead China’s security deployment drive and are one of the biggest purchasers of security equipment and services.

According to CCID, network security revenues from the telecom and finance industries totalled RMB 155 million and RMB 103 million respectively in Q1 2004, accounting for 19% and 17% of the total market. In the late 1990s, when telecom and finance companies first began investing in security, Chinese vendors lacked the technical capability to compete with their foreign counterparts, which continue to dominate the field to this day.

Since key telecom and finance companies such as operators and banks are mostly state-owned, the Chinese government is actively encouraging them to adopt more domestic security products. Although government pressure may influence their decisions to some extent, the high security demands of their businesses will mean that decisions will still be based on the quality of products and reliability of technology. As a result, any shift to domestic vendors is likely to occur slowly.

Figure 7e: Selected Niche Market Revenue (RMB million)



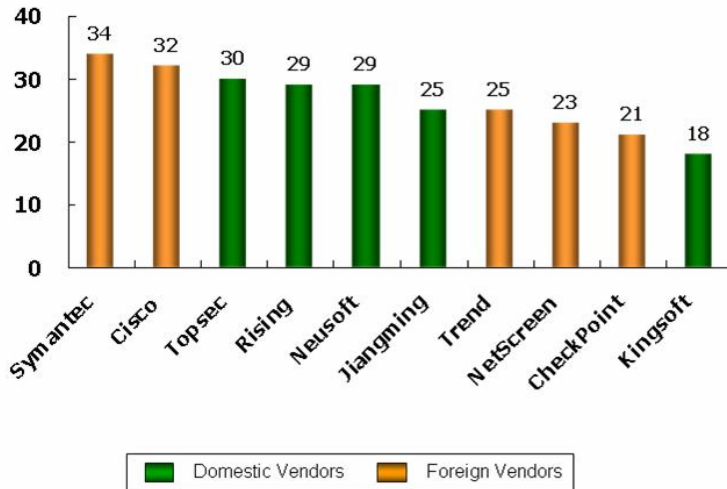
Source: CCID, April 2004

7.1.4 Domestic Security Vendors Grabbing More Market Share

Domestic vendors have made significant strides in catching up with foreign vendors in recent years, in terms of technology, services and marketing, aided by favourable government policies. By revenue, 5 of the top 10 network security product vendors in

China in Q1 2004 were domestic companies.⁵ Competition is expected to intensify, with the market to become further segmented in the next few years.

Figure 7f: Top 10 Security Vendors in China in Q1 2004 (revenue: RMB million)



Source: CCID, April 2004

Domestic vendors accounted for 49% of the top 10 vendors' total revenues in China.

TopSec, the leading domestic security firm, has benefited from strong support from the national and Beijing metropolitan governments. In 1999, TopSec's *Net Guard* firewall system became the first such product recommended by the State Security Bureau. Later that year, the *Net Guard* series of information security products was also listed among the products in a government program to promote science and technology products. TopSec was also assigned three 863 projects for Security Auditing Technologies.

The company is starting to see some success especially with its firewall products. In the second half of 2003, according to data released by IDC, TopSec took 17.28% of the firewall market, leading both domestic and foreign security vendors.

Domestic companies have seen their biggest successes in anti-virus software and services particularly in the consumer segment. Rising Technology, Jiangming and Kingsoft's consumer anti-virus products are widely used in the domestic market, while Symantec is less known to most individual Chinese PC users. Foreign vendors, however, are stronger in the enterprise market.

However, intensifying competition has forced the three leading domestic anti-virus companies to adopt a low price strategy. Kingsoft's 2003 anti-virus software for PCs was

⁵ The top 10 vendors accounted for 44.2% of total market revenue, down slightly from Q4 2003.

priced at RMB 79, compared to Norton's 2003 anti-virus software at RMB 199, according to zol.com, a Chinese e-business website. Rampant piracy is also affecting sales of anti-virus software, further eating into vendors' profits.

Domestic anti-virus companies are now focusing on developing more advanced products and offering online anti-virus services to lift profits. In addition, domestic vendors are seeking to grab a bigger share of the more profitable enterprise anti-virus market. Rising is ambitiously targeting a 50% share of the domestic market. Kingsoft is also targeting the enterprise anti-virus market, investing RMB 10 million in its "Blue Fire Project" to develop a proprietary product, according to domestic media.

In markets with high security requirements such as telecoms and finance, foreign vendors still dominate. As they were the original equipment suppliers, most customers are reluctant to switch vendors due to concerns over system continuity and compatibility. Moreover, foreign companies still lead the market in technology and quality and will remain strong players in these markets.

7.2 Key Players

Table 7g: Chinese Security Service Key Players

Organisation	Est.	Staff	Offices	Main Security Products
Symantec http://www.symantec.com.cn	1998	▪ N/A	▪ Beijing ▪ Shanghai ▪ Guangzhou	Anti-virus & antispyware, Vulnerability Assessment, Firewall, IDS, Security Management System
	Symantec is a US information security company providing a broad range of software, appliances and services designed to help individuals, small and mid-sized businesses, and large enterprises secure and manage their IT infrastructure. Symantec's Norton brand of products is the world leader in consumer security and problem-solving solutions. Headquartered in Cupertino, California, Symantec has operations in more than 35 countries.			
Cisco Systems (China) http://www.cisco.com/cn	1998	▪ N/A	▪ Beijing ▪ Shanghai ▪ Guangzhou ▪ Chengdu	Firewall, Endpoint Security, DDoS Mitigation Service, Identity Management, IDS, Security Management.
	Cisco is a US company providing products and solutions for networking deployment. It was founded in 1984 and entered China in 1994 with the opening of its Beijing Office. Cisco Systems (China) was founded in 1998 and began offering network security services in China in 2002 by promoting its SAFE Blueprint. The SAFE Blueprint is a flexible, dynamic blueprint for security and VPN networks. Cisco Systems' network security products include Firewall, VPN and IDS.			
TopSec http://www.topsec.com.cn	1995	▪ 500+	▪ Beijing (HQ) ▪ R&D centers in Beijing, Chengdu and Wuhan ▪ 29 offices	Firewall, VPN, Filterate Gateway, Security Manager, Auditor, Extensive Security Platform
	Founded in November 1995, Topsec is China's earliest and largest company in the network security area. Topsec developed the country's first domestic Firewall in 1996, and subsequently launched security auditing and security management products. In 2003, Topsec launched a wider range of security solutions. Topsec is one of the organizations authorized by the Chinese Government to evaluate the source code of Microsoft Windows.			

Rising http://www.rising.com.cn	1998	▪ 400+	▪ Beijing (HQ) ▪ Shanghai ▪ Guangzhou	Anti-virus (Client and online), Firewall, IDS, VPN, Network Monitoring
	Rising Technology Corp Ltd, Beijing, founded in April 1998, is a leading anti-virus software provider in China. The company offers anti-virus, firewalls and intrusion detection functionality and security services to enterprises customers and SPs around China.			
KingSoft www.kingsoft.com	1988	▪ 900	▪ Zhuhai (HQ) ▪ Beijing	Anti-virus
	Kingsoft entered the software industry in 1988, providing application software products and network services in China. Its products include desktop office applications, information security, games and entertainment. In the information security field, KingSoft's main focus is anti-virus software and online anti-virus services for both the consumer and enterprise market.			
Venus Info Tech http://www.venustech.com.cn	1996	▪ 100+	▪ Beijing (HQ) ▪ Offices in 16 cities	IDS, Intrusion Positioning, Network Traffic Monitoring, Vulnerability Assessment, Anti-spam, Information Filtering System
	Venus Info Tech was founded in 1996 and offers security solutions, services, and products. The company has been very active in R&D undertaking over forty research information security projects initiated by various government institutions.			

7.3 Investment Issues

7.3.1 Strict Monitoring and Regulatory Barriers Leading to Unclear FDI Issues

The Chinese government has implemented strict controls on the research, manufacturing and marketing of security-related products through several certificate approval processes.

All security-related products sold in China must first be certified by the Computer Information Network Security and Product Quality Supervision Center of the Ministry of Public Security. A Certificate for Information Security Products from the China Information Technology Security Certification Center (CNITSEC) is also necessary for products sold in the civilian market. For products to be sold to the intelligence or military sectors, manufacturers must receive additional certification from the State Secrecy Bureau and the People's Liberation Army Information Security Evaluation and Certification Centre. For some technologies such as PKI and encryption, government regulations are particularly strict, with only selected state-owned companies appointed to engage in product development. In addition to the certification process, there are also limitations on foreign firms participating in government projects and investing in the sector.

The Chinese government has allowed some international vendors to participate in important security infrastructure projects including in the telecom and financial sectors, due to the lack of domestic players with the required technology. However, China remains wary of foreign vendors due to the lack of domestic ownership of core technologies and worries about possible hidden programs imbedded in their products. Foreign security products have also been cited as a threat to national security. Moreover, it is very difficult for foreign vendors to participate in governmental projects that cover approximately 20% of the total Chinese market. These policies provide domestic

companies with exclusive business opportunities and help them grow in a less competitive environment.

As a result, foreign investment in these areas remains problematic. Some domestic companies, which entirely depend on governmental projects, often reported that they were unwilling to consider foreign investment because of the unclear regulatory environment and fear that accepting foreign investment would preclude their participation in future government projects.

However, other domestic players are aggressively expanding in the enterprise market. Some are considering establishing JVs to take in foreign investment or are establishing subsidiaries focused on the enterprise market in order to skirt government restrictions on foreign capital. Other companies have considered setting up two separate companies owned by the same Chinese shareholders.

Enterprise-tailored applications such as anti-spam solutions are likely to remain more open to foreign investment.

The Chinese government may ultimately decide to open the country's security market in order to promote the development of related technologies and increase revenues. Foreign vendors are eyeing future opportunities as they step into the highly regulated industry, but it remains uncertain when the government will open the market further.

Cisco, a leading global security vendor, has established a Network Security Training Base with the Beijing University of Posts & Telecommunications. According to interviews conducted for this study, foreign companies are also beginning to break into niche markets that are less regulated by the government. For example, MessageSoft, a security firm providing anti-spam products mainly to Chinese customers was acquired by UK company SurfControl in 2004.

TopSec, China's leading domestic security vendor, received foreign financing earlier this year from SoftBank Asia Infrastructure Fund (SAIF), according to interviews, suggesting that the government is gradually loosening market restrictions. These early investments in the sector are being watched closely to see how much foreign participation the government will allow in the sector, in order to bring in capital, technology, and more competition.

8 Mobile Data

- *The overall wireless market size for service providers is estimated to have grown to RMB 6.5 billion (USD 783 million) in 2004, 36% of which were derived from 2.5G services.*
- *The China wireless market is in the midst of a migration from 2G service to 2.5G service. The 2G market, primarily SMS-based services, is saturated, and growth is stagnant. 2.5G services have become the new driver of wireless market. China Mobile and China Unicom will strategically support the 2.5G wireless data market to maintain overall growth in the sector.*
- *The uptake of WAP and MMS accelerated in 2004 because of increased penetration of 2.5G handsets and aggressive promotional activities by the operators. However, Java and BREW-based services are unlikely to realize similar growth to SMS because the penetration of Java-enabled or BREW-enabled handsets is still low.*
- *The technological entry barriers in the 2.5G market are higher than in SMS, and operators have limited the number of SPs for these new services. These trends are likely to drive market consolidation. At the same time, third-party content providers are increasingly entering the 2.5G data services market. As a result, content acquisition and partner management have become key success factors for 2.5G service providers.*
- *3G licenses are not expected to be issued until sometime in 2005. Given the time it will take to deploy networks and the likelihood that initial subscriber growth will be slow, 3G is not likely to have a major impact on the mobile data market in the short or medium term.*

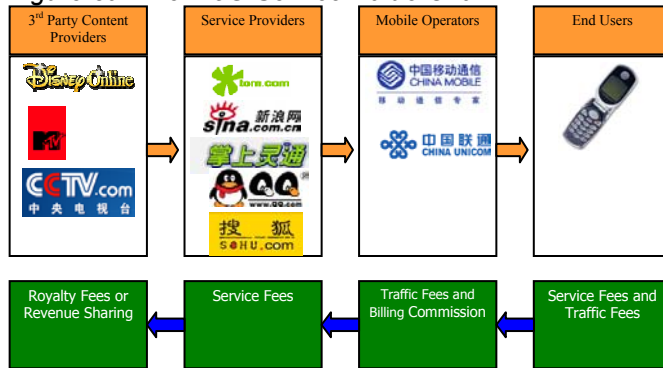
8.1 Key Sector Trends

Prior to 2002, mobile operators offered limited mobile data services including p2p SMS and mobile secretary, directly to their subscribers without any involvement from third party service providers (SPs). The market began to open to new players and service revenues began to take off in the first half of 2001 when China Mobile launched Monternet, its wireless value-added service platform.

Copying the i-mode business model of Japan's NTT Docomo, China Mobile launched its Monternet platform to promote wireless data services. Under the platform, SPs offer content and services to mobile subscribers and China Mobile collects information fees on behalf of SPs through its billing system. SPs pay China Mobile commissions of 15% of the revenues collected. The uniform service platform and billing channel that China Mobile launched allowed third party players to build profitable businesses around mobile data services, and a large number of SPs and CPs (content providers) entered the sector.

That, in turn, attracted more data users and generated traffic fees and billing commissions for the mobile operators (see figure 6a).

Figure 8a: The 2.5G Service Value Chain



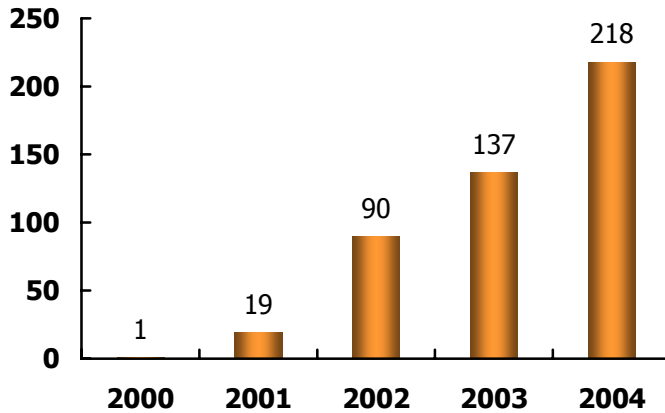
Source: BDA

China Unicom launched a similar business platform, Uni-info, with a flexible revenue sharing rate ranging from 10/90 to 40/60 depending on the SP's scale and performance.⁶ However, Uni-info has not been as successful as Monternet, because China Unicom has a smaller user base than China Mobile and because China Unicom has focused more on promoting CDMA subscriber growth than on mobile data. In addition, many service providers focus their attention on China Mobile due to its larger subscriber base, leaving Unicom with fewer content and service partners dedicated to supporting the operator. As a result, although China Unicom has approximately 35% of the country's mobile subscribers, its share of the mobile data market lags far behind.

SMS is the most popular wireless data service in China. According to the two operators, total SMS traffic in 2000 was 1 billion messages, with the number jumping to 230 billion in 2003 (see figure 8b). Currently all handsets in the market are SMS-enabled and more than 70% of mobile subscribers use SMS. SMS has become an extremely popular form of communication. For example, on Chinese New Year in 2005, China's mobile users sent 11 billion SMS messages, a 12% increase from 2004. About 70% of all SMS is point-to-point messaging, for which revenue goes exclusively to operators. Other value-added services such as ring tones, pictures, and news subscriptions are provided by SPs under the revenue sharing model described above.

⁶ China Unicom uses the same business model for its CDMA 1X data services, called "U-Max".

Figure 8b: SMS Traffic in China (billion)



Source: MII

SMS-based wireless services have become an extremely profitable business. From Q4 2002, all three leading Chinese portals listed on Nasdaq - Sina, Sohu and Netease - achieved profitability because of the rapid growth of their SMS-based services, boosting their stock prices by ten times in 2003. Despite efforts to diversify, the portals continue to be dependent on SMS-related revenues, particularly on China Mobile's Monternet platform. In Q4 2004, wireless revenue accounted for 63%, 19% and 9% of total revenues at Sina, Sohu and Netease, respectively.

Although China Mobile has sought to control the number of SPs since the beginning of 2003, there are still more than 2,000 players in the market. The majority of the market is made up of the four portals and large national pure-play wireless service companies (see table 6e). Small SPs, which usually hold local SP licenses, survive in provincial markets by offering specific region-orientated services.

8.1.1 Growth Prospects

From the end of 2003, the SMS market began to slow following two years of rapid growth. Demand for SMS-based services, such as ring tones, pictures and weather forecasts, has become saturated. Portals' revenues from those services were either flat or down in 2004. For example, Sohu and Netease both recorded consecutive quarterly drops in wireless revenues in Q1 and Q2 2004.

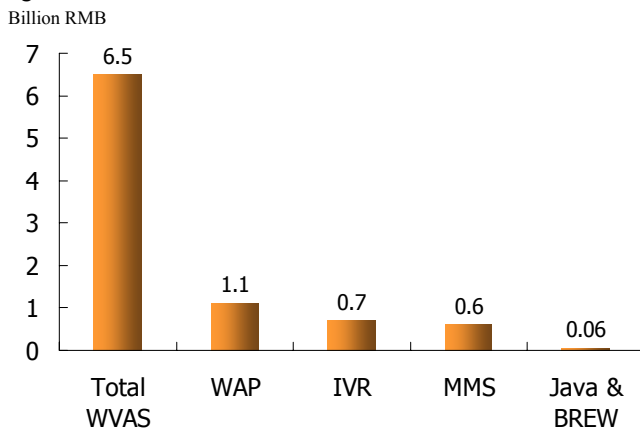
As SMS growth has stagnated, China's wireless value-added service market has begun to shift its focus to 2.5G services, including MMS, WAP and Java, as well as new 2G services like IVR (Interactive Voice Response).

The migration to 2.5G services will drive growth in the overall wireless data sector and help offset slowing SMS growth. Although the market is still in the early stages of this transition, the migration to 2.5G services is expected to continue to accelerate as handset

penetration increases and new, more compelling services are offered. 2.5G services have become the key growth driver for wireless businesses and contribute an increasingly larger portion of SPs' total revenues. For example, according to Tom Online's Q3 2004 results, 2.5G service revenue rose 46% while SMS-based revenue decreased 3%.

The overall wireless market size for content providers is estimated to have grown to RMB 6.5 billion (USD 783 million) in 2004, 36% of which were derived from 2.5G services and IVR (see figure 8c).

Figure 8c: Market Size of Overall Wireless Data and 2.5G Services Markets in 2004



Source: BDA estimates

The take-up of WAP, MMS and IVR accelerated in 2004 because of the increased penetration of 2.5G handsets and aggressive promotional activities by operators. Java and BREW-based services are unlikely to achieve similar growth as the penetration of Java-enabled or BREW-enabled handsets is still low.

Table 8d: Market Status of 2.5g Services

Services	Market Status
WAP	WAP services, available on China Mobile's GPRS network and China Unicom's CDMA 1X network, are the most popular 2.5G services. At the end of 2004, China Mobile's WAP users reached 30 million, up 275% from the end of 2003. China Unicom had 8 million users, up 281%, during the same period. More than 50% of handsets in the market are estimated to be WAP-enabled. The WAP market is estimated to total RMB 1.1 billion (USD 133 million) in 2004.
MMS	China Mobile's WAP-based MMS service, "Cai Xin" ("Color Messaging"), began to gain traction in the second half of 2003 due to aggressive promotions by the operators and service providers. The number of MMS users increased from 0.2 million in Q1 2003 to 16 million in 2004. However, the MMS market still faces bottlenecks including the low penetration of MMS-enabled handsets, high tariffs, and the lack of interconnection between China Mobile and China Unicom's networks. MMS will likely continue to gain momentum throughout the year, and start taking off at the end of this year or the beginning of 2005.

IVR	IVR is a voice-based 2G service, but it is currently one of the main drivers of the value-added services market. Total IVR revenue is estimated to top RMB 700 million (USD 84 million) in 2004. China Mobile helped drive the IVR market when it opened its Monternet platform to IVR services in August 2003, giving IVR providers a billing mechanism and a revenue-sharing model. China Unicom launched an IVR platform in April 2004.
Java and BREW	Java and BREW services will continue to experience slow growth throughout 2005. The low penetration of Java and BREW-enabled handsets is hindering the development of these services.

The overall structure of the 2.5G services value chain has remained largely unchanged from the 2G-world, but operators are taking a more active role managing the industry.

Operators have continued to use their 2G business models, i.e. China Mobile's Monternet and Unicom's U-info, in offering 2.5G services. These platforms are the only existing billing channels for the service providers, allowing the operators to maintain their dominant role in the wireless data value chain.

China Mobile continues to offer its generous 15/85 revenue-sharing model, which is a major positive for the portals and large service providers. China Unicom has a tiered revenue-sharing system – 40/60, 30/70, 20/80 and 10/90 – depending on the traffic generated by service providers, with larger providers taking a larger share of revenues.

To manage its partners more efficiently and help push the development of new services, China Mobile has limited the number of 2.5G service providers by raising the entry requirements. High technical entry barriers for 2.5G services and the operators' stricter management have kept the majority of the current SMS service providers out of the 2.5G market. Smaller players in particular have not been able to make the shift from SMS to 2.5G services. This is positive for the leading service providers, such as the portals, which have led the migration to 2.5G services. At the same time, 2.5G pure-plays have benefited from the new opportunities opening up in the 2.5G market.

Although 2.5G services are likely to show strong growth over the longer term (2 to 3 years), they are unlikely to repeat the explosive growth seen in SMS in 2002 and 2003. Mature business models and stricter management by the operator as well as limited penetration of 2.5G handsets should put a check on growth.

8.2 Key Players

Table 8e: Top Monternet SPs

Company Name	Company Structure	Date of Listing/Acquisition
Sina	Nasdaq-listed	Apr. 13, 2000
Tom Online	Nasdaq-listed	Mar.10, 2004
Sohu	Nasdaq-listed	July 12, 2000
Netease	Nasdaq-listed	July 30, 2000
Tencent	HK-listed	June 16, 2004

Kongzhong	Nasdaq-listed	July 9, 2004
Linktone	Nasdaq-listed	Mar.4, 2004
Newpalm	Acquired by Chinadotcom	July 13, 1999 (Chinadotcom)

8.3 Investment Issues

8.3.1 Regulation

With the growth in mobile data users and the number of mobile data applications, the mobile phone has become a new type of media in China, and inevitably, the government is enforcing stricter management as it does for other media. From the outset, some of the most popular wireless services, such as mobile dating and SMS pictures, included “inappropriate” (adult-content related) content, and stood on the regulatory fringe. After several years of silence, the Ministry of Information Industries (MII), which regulates the wireless sector, began asserting its control of the wireless market through a series of new rules.

In the second half of 2003, the MII forced China Mobile to crack down on Website Union, which produced SMS content outside the operator’s domain, and to stop billing for non-SMS services on its Monternet platform, which offered a billing loophole for illegal online content. In April 2004, the MII issued specific rules on regulating the SMS market. The new regulations require operators and SPs to offer a convenient system to unsubscribe from services to prevent users from being charged for unwanted content.

The MII is expected to continue tightening controls over wireless content, which will have a mixed impact on the market. First, clear and complete regulations will help wash out unwanted or illegal content from the wireless market, providing a fairer playing field for SPs. However, stricter controls on content may smother the development of some services and deal a fatal blow to some SPs. In addition, it is likely to make it much more difficult for SPs to raise new rounds of funding as concerns about regulations lower valuations and drive some investors away.

8.3.2 Dependence on Operators

Mobile operators dominate the wireless value chain as their platforms are the only channel for SPs to distribute and bill for their services. Operators design the rules of the game and set the revenue sharing rates. So far, no SPs have been strong enough to negotiate with the operators. China Mobile’s long-term strategy for the Monternet platform is to ensure the healthy development of the market and to consolidate its dominant position in the value chain.

As early as the end of 2002, China Mobile began limiting the number of Monternet SPs to improve operating efficiency. The operator cut out a great number of small SPs through a strict evaluation system.

As China Mobile tightens its grip on the sector, there are concerns that the operator will change the current Monternet revenue sharing rate or seek to supplant SPs and independently produce content. China Mobile's recent moves imply that it may be planning to take a bigger slice of the wireless market, and it is likely that China Mobile will seek a larger share of revenues in 2.5G and other new services. Given China Mobile's dominance in the market, the potential change in the revenue sharing rate will be obligatory for all SPs. However, China Mobile is unlikely to damage the current Monternet value chain by directly replacing service providers to generate its own content on a large scale.

8.3.3 Competition and M&A

There are thousands of SPs, and competition has become intense. The top SPs combined hold more than a 90% market share. For most SMS-based services, the market has matured. To compete with the more established, existing SPs, newcomers must create their own compelling content or applications on a new technology platform such as 2.5G services or Location Based Services (LBS). For start-ups that do succeed in taking an early lead in new applications, the most likely exit may be a sale to one of the already listed players in the sector.

A number of acquisitions have already taken place (see table 8f), and further consolidation is likely.

Table 8f: Selected Mobile Data Mergers and Acquisitions the Last Two Years

Company Name	Buyer	Revenue of the Company Purchased	Cost (USD million)
Memestar	Sina	N/A	20.8
Crillion	Sina	USD 10.5million (2003)	> 17.9
GoodFeel	Sohu	USD 1 million (2003)	18
Treasure Base Investments Limited	Tom	N/A	< 66.4

9 Online Gaming

- *In 2004, the online gaming market size reached RMB 2.47 billion (USD 298 million), up 48% year-on-year. The online gaming market is expected to grow rapidly with a 5 year CAGR (Compounded Annual Growth Rate) of 34.7% for the to 2009 to reach RMB 11 billion (USD 1.3 billion) in 2009.*
- *The online gaming market is driven by China's growing Internet and broadband penetration, the availability of PCs and Internet cafes, and low connection fees. However, the domestic industry must overcome challenges including sometimes contradictory government regulations and more experienced foreign game developers.*
- *The success of online gaming is in large measure a product of the successful development of pre-paid card distribution channels by leading on-line gaming companies.*
- *Competition in the industry is increasingly intense. It is expected to become even more so as a wave of new titles come to market in the month's ahead. As a result, consolidation, driven both by the failure of unsuccessful game operators and mergers or acquisitions, is believed to be inevitable.*
- *The convergence of some mobile and online games and of mobile and online game operators is an emerging trend in the industry.*

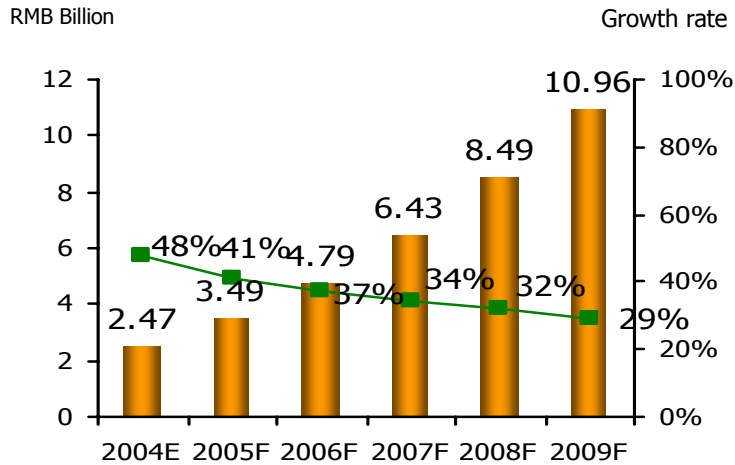
9.1 Key Sector Trends

9.1.1 Strong Growth

China's online gaming market grew strongly in 2004, after seeing revenues exceed the country's movie ticket sales in 2003. In 2004, the market size reached RMB 2.47 billion (USD 298 million), up 48% year-on-year, according to statistics released by the General Administration of Press and Publication of China.

The online gaming market is expected to grow rapidly with a five year compounded annual growth rate (CAGR) of 34.7% to 2009 to reach RMB 11 billion (USD 1.3 billion) (see figure 9a).

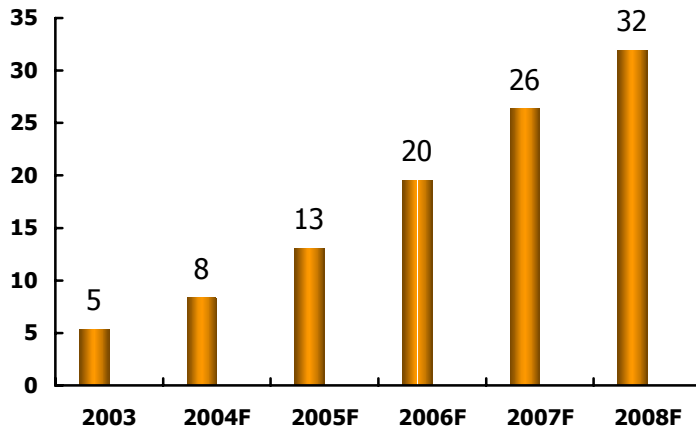
Figure 9a: Online Gaming Market Size in China



Source: GAPP

At the end of 2004, China will have nearly 20 million online gamers, around 40% of which pay to play. The 20 million gamers represent 18% of total Internet users, up slightly from 16% in 2003. Online gamers are expected to account for nearly 30% of total Internet users in 2007.

Figure 9b: Number of Paying Online Gamers in China (million)



Source: BDA

The online gaming market is driven by China's growing Internet and broadband penetration, the availability of PCs and Internet cafes, and low connection fees.

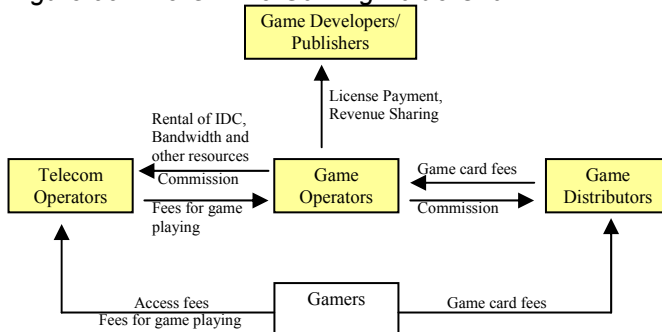
- Chinese telecom carriers have been aggressively promoting broadband services since 2003. Broadband users jumped 111% year-on-year to 26.3 million in 2004.
- According to recent official statistics, there are around 120,000 Internet cafes operating 6,000,000 PCs nationwide. The prevalence of computers and Internet cafes helps make online games accessible.
- Most Massively Multi-player Online Role Playing Games (MMORPGs) are priced below RMB 40 per month and many players pay little more than RMB 30 per month. ARPU (Average Revenue per User) has remained relatively stable.

9.1.2 Online Gaming Value Chain

Most Chinese online game operators license games from domestic and foreign online game developers. License agreements typically include one or more of the following terms:

- Revenue sharing
 - The game operator pays the game developer a percentage of revenue based on previously agreed terms.
- License Payment
 - The game operator pays the game developer an upfront fee to operate the game within the contract period.
- Joint Venture
 - The game developer invests in a JV with a local game operator, contributing the game, cash, or both (e.g. Sina-NC Soft).

Figure 9c: The On-line Gaming Value Chain



Source: BDA

9.1.3 Access & Distribution

Games are distributed to end-users through a number of channels. The game playing client software can be downloaded on the Internet for free, or in some cases, game companies distribute free CD-ROM copies of the client software to promote their games. In addition, games are available in Internet cafes for players without a PC or broadband connection at home or for those who prefer playing with friends.

The success of on-line gaming is in large measure a product of the successful development of pre-paid card distribution channels by leading on-line gaming companies. Pre-paid cards are widely available in most major cities, through on-line and offline distribution channels, including bookshops, Internet cafés, newspaper stands, electronics retailers and websites. The widespread availability of pre-paid cards allows gamers to easily purchase credits that are charged based on the amount of time played or as part of weekly, monthly or annual subscriptions.

Although scratch card distribution can be expensive, sometimes costing game operators as much as 30% of the card's face value, it is the ability to charge users for playing through pre-paid cards that has allowed game operators to turn online gaming into such a profitable business. Scratch cards have been so successful because other payment mechanisms are less well developed and game operators have been able to extend distribution channels all over China. Today, despite the costs, no operator can ignore the scratch card system without risking being at a competitive disadvantage.

Since players are essentially paying for access to an online community that exists in real-time, online gaming has escaped the issue of piracy, which has stopped the PC and console game market from developing in China. As a result, online gaming is often referred to as a piracy-proof business model.

However, although online gaming is 'safe' from the pirating of its client software, some games in China have been hacked into by companies or individuals that then operate the game on illegal servers. New efforts to address this issue by government and telecom operators should help, but the risk of hacking is likely to continue.

9.1.4 Emerging Game Categories

9.1.4.1 MMORPG

MMORPGs have developed a mature business model that has allowed them to dominate the Chinese market over other types of online games. For example, Shanda has achieved its huge success operating the South Korean MMORPG title *The Legend of Mir II* since 2001. Today *Mir II* is continuing to drive revenues for the company. In Q4 2004, Shanda's revenues reached RMB 453.1 million (USD 54.7 million), representing a growth rate of 133.3% year-on-year.

However, MMORPGs normally require a development period of more than one year and can cost up to RMB 10 million (USD 1.2 million), with no guarantee of revenue. As a result, it is risky for companies to rely solely on one or two MMORPG titles, especially given the intense competition between similar titles now in the market.

9.1.4.2 Casual Games

Persuading players to pay for casual games, e.g. card games, board games, and other games designed expressly for play on computers, has proven to be difficult, even if they

are priced much lower than MMORPGs. In 2003, casual game revenues were less than 1/10 of those of MMORPGs in China, according to an industry executive.

But casual games provide operators opportunities to grow their player base and revenue since the games are easier to learn and play and, therefore, accessible to a wider audience. As a result, more and more companies, including MMORPG operators, are quickly diversifying into casual games directly and through partnerships. For example, Shanda operates BNB (Pao Pao Tang), a casual game developed by South Korean game company NEXON Corporation. In September 2004, BNB was reported to have recorded 700,000 peak concurrent users, making it the world's largest game by this measure.

Casual game revenues are also beginning to grow due to new revenue sources, mainly from the sale of avatars and virtual items.

9.1.4.3 Mobile Online Games

Mobile online games are at a very early stage. Both online gaming and wireless service companies are entering the mobile game market, and crossover games bridging PCs and mobile platforms are beginning to emerge.

Mtone, a Chinese wireless service provider, launched China's first mobile online game in October, preloaded in Motorola E680 handsets. The game, *Legend of the Three Realms*, is operated via China Mobile's GPRS platform and is priced at RMB 12 (USD 1.44) per month. Ourgame has also brought several of its online casual games to mobile phones and is cooperating with handset vendors to pre-load the games on to their handsets. Two are already available on Motorola's E680 handset.

9.1.5 Domestic versus Foreign Games

As China's on-line gaming market took-off starting in 2002, most of the games played were produced by South Korean and Japanese companies and licensed to Chinese game operators. According to the 3rd China On-line Gaming Market Survey conducted by 17173.com (a top on-line game portal in China) and iResearch, 39 of the 57 titles that were either being trialled or in commercial operation were licensed from overseas companies. This represented 68% of the games on the market.

In an effort to reduce their reliance on licensed games and avoid revenue sharing with game developers, many Chinese game operators are investing in in-house development, a trend that should start to shift the market towards domestically developed games. By April 2004, this had yielded only modest increases in the share of domestically developed games operating in China. At that time, the number of online game operators in China totalled 77, up from 38 a year earlier, and there were 136 online game titles on the market (55 in beta testing and 81 in public trials or commercial operations). Of these gaming titles, 37.5% were domestically developed up from 32% a year earlier.

The proportion of domestically developed games is expected to rise as a large number of games come onto the market and government restrictions on game imports begin to have an effect.

Figure 9d: Selected Recent In-house Online Games

Title Name	Developer	Status
Blade Online	Pixel Software	Public trial in Oct 2004
Fengshen Bang	Kingsoft	Beta testing in Sep 2004
Voyage Century	Snail Game	Beta testing in Oct 2004
Joyxy	The9	Beta testing in Oct 2004
The Three Kingdoms	Shanda	Beta testing in Dec 2004
The Fate of the Dragon	Object Software	Beta testing at year-end 2004
Glory Online	Cyber Pioneer	Public trial at year-end 2004
Hero Online	TQDigital	Planned launch in 2005

Source: BDA

9.1.6 In-house Development Efforts

The gradual shift towards domestically developed content described above is part of a larger trend in which China is building up its online game R&D capability, and companies are developing localized content and seeking to gain control of core technologies. In order to more rapidly bring proprietary games to market, some domestic game companies are seeking to partner with or acquire design houses and development teams.

China's in-house game development is increasing, but remains weak compared to leading overseas markets since the development of core technologies such as network and graphic online game engines has been slow.

A talent shortage has also slowed the development efforts at domestic online gaming companies. Capable and experienced game developers, especially project managers, are few in China. The talent that is available in China is also heavily concentrated in a few leading companies. According to the online game research report released by 17173.com and iResearch, more than half of the estimated total of 2,300 game developers in China in H1 2004, worked for one of the four biggest gaming companies (TQDigital, Shanda, Kingsoft and Netease). Many domestic developers have R&D teams of no more than 50 people, which results in lengthy development times and high costs, according to interviews conducted for this project.

The weak R&D capabilities and shortage of game developers will continue to be a bottleneck for in-house game development in China. However, a gradually developing talent pool is expected to boost the fortunes of Chinese developers as they challenge South Korean dominance in the field.

9.1.7 Chinese Online Games Venture Overseas

China's leading online gaming companies are beginning to explore overseas markets, but there are currently only a handful of Chinese companies with the resources to compete outside of China.

Chinese software developer Kingsoft has reached an agreement with PUC Founder (MSC) Berhad, the Malaysian-based subsidiary of Founder Technology, to launch Kingsoft's online game, "JX Online", in Malaysia and Singapore. Object Software, one of China's leading game developers, has received requests from foreign operators to license its two new titles.

Chinese game developer NetDragon also launched a game in the US at the beginning of 2004. The game called *Conquer* was developed in-house and now has 10,000 concurrent users in the US. The company has also developed another title *Huan Ling* which it plans to launch in Taiwan and Japan.

9.1.8 Growth Prospects for the Online Gaming Industry

Online gaming revenues in China will maintain double-digit growth for the next few years, reaching RMB 10.9 billion (USD 1.3 billion) by 2009. Key drivers behind this growth are described below.

Table 9e: On-line Gaming Key Growth Drivers

Growing Internet & Broadband Penetration	<ul style="list-style-type: none"> ▪ China's Internet market is one of the world's fastest growing. According to CNNIC, Chinese Internet users numbered 94 million at the end of 2004, up 18% year-on-year. The figure is forecasted to rise to 185.1 million in 2006. ▪ Chinese telecom carriers have been aggressively promoting broadband services since 2003. In 2004, Chinese broadband users jumped to 26.3 million, representing an annual growth rate of 111%. ▪ Driven by the strong growth in Internet and broadband, on-line gamers are expected to continue growing. The popularity of on-line gaming, in turn, will also help drive broadband adoption.
Pervasive PC & Internet Cafes	<ul style="list-style-type: none"> ▪ A recent survey by 17173.com showed that approximately 50% of online gamers play at home and another 30% play in Internet cafes. ▪ China is one of the world's biggest PC markets. According to IDC, PC shipments in China are forecast to reach 24 million units in 2007, with a CAGR (2002-2007) of 16.5%. 31% of PCs are expected to be purchased by individuals. ▪ According to recent official statistics, there are currently around 120,000 Internet cafes operating 6 million PCs. The prevalence of computers and Internet cafes will help facilitate the growth of China's on-line gaming market.
Low Monthly Fees	<ul style="list-style-type: none"> ▪ Most online games (MMORPG) are priced below RMB 40 (USD 4.82) per month and most gamers pay less than RMB 50 (USD 6) per month on games. The low fees have made online gaming affordable for average Chinese Internet users driving the huge growth in the number of on-line game players.
Government Support	<ul style="list-style-type: none"> ▪ The Ministry of Science and Technology (MOST) has included on-line gaming in its "863 Plan", a national plan to support high priority technology projects. ▪ On-line game developers benefit from the same preferential tax policies designed for all software firms. The benefits typically include 3 to 5 years of preferential tax treatment. ▪ Government agencies are also taking steps to crack down on the illegal operation of private servers to ensure the healthy development of the industry. Effective December 20th, 2003, the Ministry of Information Industry (MII), the National Copyright Administration, the State Administration for Industry & Commerce (SAIC) and the

Ministry of Public Security (MPS) launched a crackdown on illicit servers.

- Local governments are also providing support to the on-line gaming sector in the form of specific regulations or direct investment. The Shanghai municipal government has revealed plans to invest RMB 30 million to purchase on-line game development tools in order to stimulate on-line game development in Shanghai. Xu Hui District government in Shanghai collaborated with several on-line game companies to establish training programs in the city.

9.2 Key Players

Table 9f: Selected On-line Game Companies in China

Operator	In-house Games	Imported Games	Comments
Shanda	The Wool, The Sign, The Age, The Three Kingdoms	The Legend of Mir 2, Crazy Tank II, BNB, Broken Galaxy, MapleStory	Leading on-line game operator in China. Strong R&D capability.
The9	Joyxy	Mu, WOW, Mystina Online	Chinese on-line game operator, started in-house development in April 2004. Joint venture with Korean game developer Webzen.
Netease	Journey to the West I and II, Fantasy West Journey	Priston Tale, Fly For Fun	Nasdaq-listed portal with focus on on-line game since 2001. Has introduced several successful in-house titles.
Kingsoft	Swordsman On-line, Feng Shen Bang	N.A.	Chinese software development company. On-line games are one of its three main businesses.
Net Dragon	Monster & Me, Conquest, Era of Faith	N.A.	Fuzhou-based online gaming company. Netdragon's subsidiary, TQ Digital is one of the leading game developers in China.
Optic Communications	Shuihu Fantasy	The Legend of Mir 3	A subsidiary of CITIC group.
Asiagame	Worm, Hellbreath	Red Moon	A subsidiary of China's Searainbow.
NCSOFT Sina	N.A.	Lineage I, II	JV between Sina and South Korean game company NCSOFT.
Happy Digital	Search God, Talent	Rainbow Adventure, WYD	JV between Sichuan Telecom and Korean game developer HanbitSoft
Square Enix/Softstar	Xuanyuan Sword On-line	Cross Gate	JV between Japanese game developer Enix/Square and Taiwan game developer Softstar
Ourgame	More than 40 casual games (chess and board games)	N.A.	JV between China Searainbow and South Korean portal and casual game operator NHN.
Tencent	N.A.	Casual games	Leading wireless data service provider with approximately 234 million subscribers.

9.3 Investment Issues

9.3.1 Government Policies

The Chinese government's policies on online gaming are sometimes contradictory with the government promoting the industry's development on the one hand while asserting strict control and in some cases censorship on the other.

The government continues to implement tough regulations and punish companies for publishing "inappropriate" content. For example, the Ministry of Culture banned the operation of six online games due to "unhealthy" content, and punished four companies accused of operating online games without licenses in September 2004.

Rivalries between the main regulatory bodies also complicate the regulatory environment for the online gaming industry. In October 2004, the Ministry of Culture (MOC) made a formal announcement re-emphasizing its authority over the online gaming industry. Earlier regulatory announcements had been made by the General Administration of Press & Publication (GAPP). However, management of China's online gaming industry by competing regulatory bodies is likely to continue for some time.

9.3.2 Intense Competition

In the last two years, a large number of new players have entered the market, operating more than 150 online game titles. The overcrowded market is becoming intensely competitive and only a handful of players are expected to achieve success and survive.

Currently, only 10% of titles in commercial operation are profitable, according to an executive at a pre-paid card distributor, a leading online game distributor in China. With more games coming online, competition is likely to intensify further.

9.3.3 Rising Costs, Declining Margins

Game development and operation costs are rising, and only players with deep pockets are likely to succeed.

For online game developers, demand for higher quality games is further lengthening development periods and pushing up costs. Today, developing a single MMORPG can cost up to RMB 10 million (USD 1.2 million).

Operating games also costs more. License fees can now reach as high as several million USD, many times more than *Legend of Mir 2* which Shanda originally licensed for only USD 300,000. Moreover, as many domestic games have similar designs and story plots and can only be differentiated through frequent promotions and advertising, marketing costs are rising, which is hard for smaller companies that have weak branding and little capital to afford.

9.3.4 Lack of Human Resources and Technology

Leading online gaming companies are seeking to expand their in-house development efforts, but most companies interviewed for this study reported that a shortage of experienced engineers was slowing their development efforts. In addition, Chinese development companies still trail Korean firms in developing game engines, the core technology behind online games.

9.3.5 Online Piracy

Hackers, illicit private servers and “black-market”⁷ trading may ruin the gaming experience and discourage gamers from the on-line world.

9.3.6 Market Set for Consolidation

While the online gaming market is booming, newcomers will find it increasingly difficult to achieve profitability. Competition is escalating since a large number of titles are coming to the market, and growth in new gamers is unable to keep pace with the increasing number of games.

⁷ Gamers can sell game IDs or items. As the value of items has increased, there have been cases of people stealing user IDs, so they can resell the ID or the items owned by the user.

Promotions have become extremely important for online game operators to attract gamers, especially for new titles from new companies that are not well-known. Marketing expenses, including advertisements, PR events, and offline membership activities, are also increasing, and smaller companies may find it difficult to effectively promote their games compared with larger, cash-rich players.

Although the entry barriers to developing a new game may be low, the costs of effectively competing and promoting a game in this highly competitive environment have increased. As a result, the leading players are expected to continue to win market share. Already, it is estimated that the top 10 operators account for more than 70% of the market, but their position is under constant threat from new contenders. These leading operators benefited from their early market entry by soaking up initial demand without significant marketing expenditure. During this time, they have built up loyal user bases. Switching costs from one on-line game community to another are high, as players have invested substantial time in building up their characters and relationships with other players. These advantages are likely to lead to market consolidation in which the leading players hold on to their dominant position in the market.

10 e-Commerce

- *China's B2C (Business to Consumer) market in 2003 was RMB 790 million (USD 95 million), compared with RMB 60 million (USD 7.2 million) in 1999. The figure was forecast to reach RMB 1.6 billion (USD 193 million) in 2004.*
- *The China B2C market will maintain rapid development in the future. However, the increasing trade quantity may not ensure the profitability of leading B2C websites. Margins are limited due to the high cost of operation and intense price competition. Furthermore, logistics, distribution and payment system are still issues with the reach of logistics and payment system limiting the market to higher tier cities.*
- *Since leading players have already raised capital, with one company purchased by eBay and another invested by Amazon, the market is likely to consolidate around these top players. Some smaller players may survive in particular market niches.*

10.1 Key Sector Trends

10.1.1 The IT Bubble and Forward

E-commerce, a key component of the Internet economy, has grown steadily in China over the past three years since the dot-com crash. During the Internet bubble, hundreds of B2C websites operated at a loss, focusing primarily on the number of page views and registered users they generated rather than revenue and profit. Many B2C websites offered significant discounts to attract the limited number of online shoppers. Offers at the time included "RMB 1 (USD 0.12) for a dozen cans of Coca Cola" and "RMB 1 for one music CD". After the dot-com bubble burst in 2000, many of the early leaders in B2C exited the market. Some survived and have seen the market recover starting in 2003.

According to iResearch, a Shanghai-based market research company, China's B2C market size in 2003 was RMB 790 million (USD 95 million), compared with RMB 60 million (USD 7.2 million) in 1999. The figure was forecast to reach RMB 1.6 billion (USD 192 million) in 2004.

The SARS (Severe Acute Respiratory Syndrome) outbreak in the first half of 2003 gave a much-needed boost to the e-commerce market. During the period, sales of B2C companies skyrocketed, with many Internet users, unable or unwilling to go to the store to shop, began to shop on-line for the first time. By Q2 2003, China's two biggest B2C websites both announced that they turned profitable in the first quarter. However, China's B2C market is still in its early stages.

10.1.2 Online Shoppers⁸

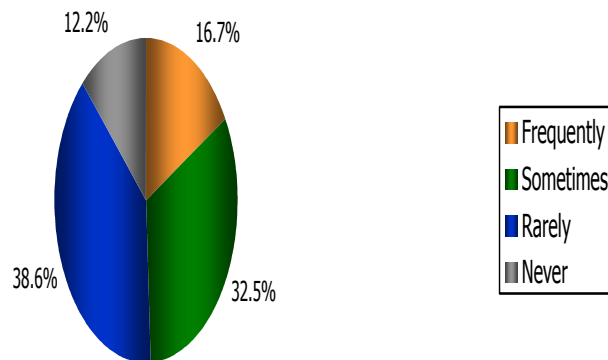
⁸ Online shoppers are defined as those who have bought goods or services on-line.

China’s Internet users have continued to grow rapidly over the last decade. Internet users reached 94 million at the end of 2004, according to CNNIC. However, the CNNIC survey showed only 7.3% of Internet users saw online shopping as one of their major online activities, suggesting that B2C is still not as popular as e-mail (84.3%), web searches (64.4%), news (62.1%) and online chatting (40.2%).

The survey also measured the preferences of current online shoppers, such as the frequency of visiting B2C websites, types of goods bought online, payment methods, delivery methods and concerns about online shopping (see figure 9a and 9b). Only 16.7% of Internet users frequently visit B2C websites, compared with 50.8% of Internet users who rarely or never visit shopping sites. A total of 37.8% of Internet users had purchased goods or services online in the past 12 months. Online shoppers also claimed that the two biggest obstacles for online purchases were security and after-sales services. Internet users expectations for the year ahead pointed to continued growth in the sector. 24.6% of Internet users said they will definitely make online purchases in the next 12 months, while only 5.5% said they will definitely not shop online.

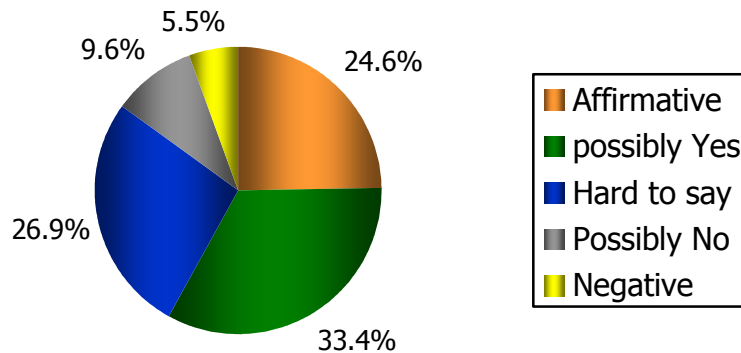
iResearch estimates that there were 31.3 million online shoppers in China in 2003, and forecasts that the number will reach 42.8 million by the end of 2004.

Figure 10a: Frequency of accessing on-line shopping websites



Source: CNNIC

Figure 10b: Will you consider making an on-line purchase in next 12 months?



Source: CNNIC

10.1.3 Growth Prospects

China's B2C market is expected to continue to experience stable growth as obstacles including the immaturity of credit and payment systems, tax regulations and distribution are gradually overcome.

Table 10c: Remaining Obstacles

Remaining Obstacles	Description
Personal Credit System	China's personal credit system is not well developed in China. Online payment methods such as credit cards and bank transfers are still not widely used, with more than 60% of online shoppers preferring to make payment offline according to CNNIC.
Legal Framework	As the legal obstacles of online transactions are slowly cleared away, it is becoming easier and more secure for Internet users to make purchases through their computer terminals. On August 2004, the Standing Committee of the 10 th National People's Congress issued a Law on Electronic Signatures, legalizing the use of electronic signatures for online financial transactions. The law, which takes effect on May 1 st 2005, gives the same legal weight to electronic signatures as handwritten signatures and seals.
Banking System	Banks are also paving the way for customers to pay for online purchases with credit cards. Starting in the late-1990s, banks in China slowly began offering on-line payment services. Currently, there are about 20 types of credit card services and bankcards that can be used for online payment nationwide. In the country's coastal areas, there are up to 50 types of online payment services. Most leading e-commerce websites are linked to these online payment systems.
Taxation	The government has not yet implemented any laws to regulate taxes on online B2C sales, and many small B2C websites are thought to currently be evading tax payments.

Logistics/Distribution	Undeveloped logistics systems, especially in rural areas, are still a bottleneck for B2C websites.
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10.2 Key Players

Copying the Amazon model, early Chinese B2C websites focused on the sale of books and then expanded to music and video products. The two biggest B2C websites in terms of traffic and revenue, Joyo and Dangdang, still focus on these products. In other product segments, there are several market leaders. For example, 7cv, China's third biggest B2C website, is the leading online seller of adult and health products, 18900 sells mobile handsets, 800buy sells gifts, Soit and Enet sells IT products, and Cncard sells various discount cards (see table 9d).

The B2C market is split between the largest players that typically offer a wide range of products and have built up their distribution channels across China and smaller B2C websites, which have focused on particular products in local markets. For the largest companies, price competition and high operating costs driven by distribution and marketing costs have reduced their margins. As a result, few large B2C websites are profitable depending instead on the venture capital they have raised to survive. Some small B2C websites, in contrast, have done reasonably well by focusing on specific products and small local markets. However, they have been unable to expand their businesses due to a shortage of capital.

Some B2C websites are not directly involved in online sales but offer B2C platforms, similar to being a shopping mall operator. Examples include Sina and eNet. Their target customers are small businesses or traditionally offline companies that want to carry out online sales but do not operate a B2C website. The B2C platform offers these companies an online sales window with the payment of a rental fee or revenue-share. An increasing number of portals or vertical websites with brand recognition, are providing a shopping mall model without becoming directly involved in managing e-commerce sales and the challenges of carrying inventory, providing after-sales service, and fighting through price competition.

Some companies are starting to offer technology solutions or services to both B2C websites and online shoppers, such as billing solutions for online purchases and online product searches for online shoppers. 8848 offers both services.

Table 10d: Leading B2C Websites in China

Company Name	Product Lines	Corporate Structure
Joyo	Book, CD and Video	Subsidiary of Amazon
Dangdang	Book, CD and Video	Private company with foreign investment
7cv	Romantic and health products	Private company with foreign investment

Sohu	Book, CD, Video and gift	Listed in Nasdaq
800buy	Gift	Under China.com
Bol	Book, CD, Video	Bertelsmann's China Subsidiary

Source: BDA

10.3 Investment Issues

10.3.1 Regulations

B2C companies come under the management of several government agencies. In addition to an ICP license issued by the MII, they must also have licenses for the products and services they sell. For example, a B2C website selling audio and video products must have approval from the Ministry of Culture, while a website selling medical equipment must get permission from the Ministry of Health. Some products are still restricted from online sales, such as over the counter (OTC) drugs. The government is expected to issue new regulations on the issuance of on-line sales licenses in the future. This may help standardize the B2C marketplace, but will also raise market entry barriers and may complicate the regulatory picture if some of the existing companies are unable to win licenses.

10.3.2 Consolidation

With thousands of B2C web sites in China and the vast majority operated by small companies, consolidation is inevitable. Leaders in specific product segments or local markets may become M&A targets of large B2C websites that are looking to expand their product lines or enter new regions. For example, on-line gift shop 800buy recently bought Shalala, which is China's biggest online flower shop.

10.3.3 Price Competition

Although online shopping in China is still in the early stages, price wars have heated up in some competitive product sectors. For example, in the online book, music and video market, websites are only able to differentiate themselves through price competition as they all sell the same products. The two leading players in this sector, Joyo and Dangdang, both offer below cost prices and waive delivery fees during promotions. However, price wars put significant pressure on profits throughout the industry.

10.3.4 Investment

Since 2003, China's B2C market has seen explosive growth in investment. Almost all of the country's leading B2C websites have received capital from or have been acquired by foreign investors (see table 10e).

Table 10e: Recent Investment and M&A in B2C Sector

Company Name	Buyer or Investor	Cost (USD million)
Joyo	Amazon	75
Dangdang	Tiger Technology	11
8848	IDG	N.A.
Shalala	800buy	N.A.

Source: BDA

11 Digital Media Applications

11.1 DTV Industry

- *The digital TV (DTV) market is at very early stage, with less than 1% of the total 120 million cable subscribers accessing DTV programs. A number of city-level cable operators, including Shanghai, Chengdu, Guangzhou, and Suzhou, the pioneer cities for broadcasting DTV, reported that DTV subscriber growth slowed after reaching 20,000 subscribers for each operator this year. Operators were forced to subsidize set-top boxes (STBs) to attract new subscribers.*
- *The limited market demand can be attributed to a lack of DTV content and the availability of pirated content as well as the high-cost of STBs. The DTV content currently produced by TV stations is too similar to free programs offered over analogue TV services to attract new users, while foreign content is strictly censored by the State Administration of Radio Film and Television (SARFT).*
- *The cost of STB is not expected to come down dramatically in the short term because so many cable operators still demand STBs designed to their own specifications, especially for conditional access (CA), which makes large scale production impossible.*
- *SARFT has called on cable operators to drive STB adoption through subsidies, helping install STB for most cable TV subscribers in the next few years, but operators could only fund this transition through growth in new pay DTV services. Given slow growth in service revenues, the lack of a business model to support subsidies will likely trump a political push by SARFT to force subsidies on the industry.*
- *Cable networks are highly fragmented, which is likely to delay the industry's growth. SARFT has made an effort to integrate city networks within one province into one provincial network but progress has been still slow.*
- *Despite these challenges, a focus on moving the DTV market forward ahead of the Beijing Olympic Games in 2008 may give the industry the extra push it needs to take off.*

11.1.1 Key Sector Trends

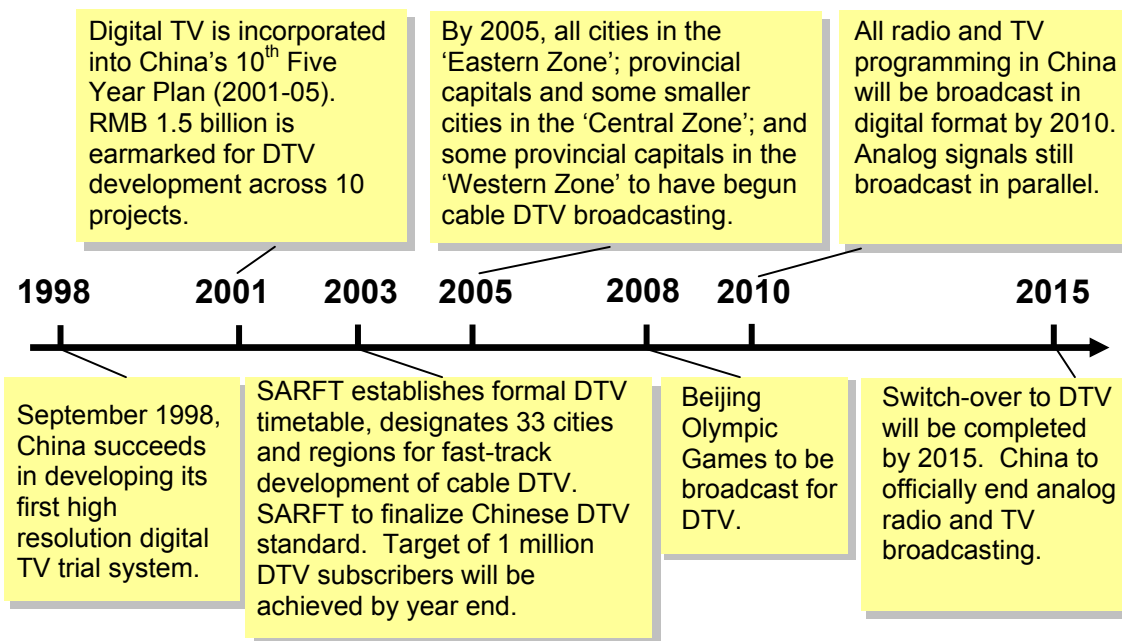
DTV is an emerging market in China. Starting in early 2000, it has been heavily promoted by SARFT. SARFT support for DTV is part of reforms to China's TV sector, designed to develop new revenue sources such as DTV pay-per-view and other value-added services, in preparation for increased competition.

To pave the way for DTV, SARFT began by focusing on the development of the cable TV broadcasting industry. SARFT has pressed all cable TV operators to upgrade their

networks to Hybrid Fiber Coaxial (HFC) cable to prepare for digital TV broadcasting. Cable TV subscribers are believed to be the most willing to pay for DTV programs and, therefore, the most attractive target market. Nearly 10 million CATV households were estimated to have upgraded to HFC in 2002, or about 10% of the more than 100 million cable TV households in China.

In 2003, SARFT established a formal timetable for the rollout of nationwide DTV broadcasting as shown in figure 11.1a below.

Figure 11.1a: Timeline for the Development of Digital TV in China



Source: SARFT, BDA

SARFT also set aggressive subscriber targets as follows:

- 2003: 1 million cable DTV users by year-end 2003
- 2004: 10 million cable DTV users
- 2005: 30 million DTV subscribers

Initially, these subscribers will be primarily cable DTV users with DTV broadcasting over terrestrial and satellite networks to start later, from 2006 according to SARFT.

China's DTV market, however, has grown at a much slower pace than SARFT's original targets. By 2003, there were only 400,000 households that had installed set-top boxes (STBs) to receive DTV programs, according to SARFT, and 168,000 actual DTV subscribers, according to domestic market research firm CCID, far behind SARFT's target of 1 million cable DTV subscribers. The slow take-up is the result of a number of

factors including disagreement over standards, weak market demand, and the difficulty building a DTV business among fragmented cable network operators.

11.1.1.1 Disagreement Over Standards

Key DTV standards that were originally scheduled to be finalized by year-end 2003, including those for transmission and Conditional Access (CA), are still pending. In all, standards must still be set for 92 technical issues, according to Zhao Xinhua, the General Secretary of the National Audio, Video and Multimedia Standardization Committee (AVMSC). This backlog of unresolved regulatory issues, in turn, is preventing large-scale equipment production and deployment, which is necessary to reduce prices and make the service more affordable for consumers.

The regulatory paralysis is in part the result of disputes between competing regulatory bodies. The Ministry of Information Industry (MII) and SARFT have been debating the adoption of a domestic transmission standard or the European DVB-C standard. Using a domestic standard would reduce intellectual property fees, but DVB-C is a more mature standard which has been proven through trials over the past two years.

Early reports are that a decision has now been made to support DVB-C as the final solution. Disputes over remaining standards are expected to be settled by the end of this year or in 2005, after trials are completed.

11.1.1.2 Weak Market Demand

In addition to regulatory issues, limited market demand has also slowed the growth of DTV. DTV is not well understood by consumers. For example, in Shanghai, a recent survey quoted in the domestic media showed only 6% of respondents knew what DTV was.

While limited consumer knowledge of DTV can be overcome by educating the market, DTV faces other, more pressing challenges to developing consumer market demand. These include the lack of content, high cost of STBs, and piracy.

Table 11.1b: Factors Influencing the Chinese DTV Market Demand

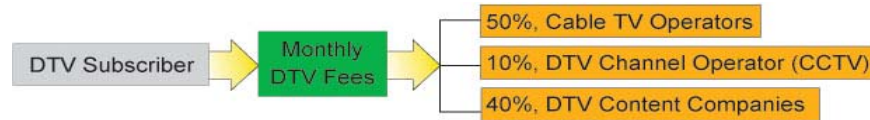
Lack of Content	<p>Lack of content is a key issue slowing the industry's growth. Without attractive content which subscribers want to see, there is little reason for them to purchase a STB and pay for extra channels. Similarly, if operators plan to subsidize STB purchases, they need to be sure subscribers will sign up for pay channels, so they can earn back their investment.</p> <p>Domestic TV stations and movie producers are struggling to create attractive programs under strict government controls, while new media companies are still small in scale with most having entered the media sector in the last one or two years. Meanwhile imported foreign content is strictly censored. For example, CCTV's DTV channel is reportedly prohibited by SARFT to import the popular US series, 'Friends', as it is considered to contain inappropriate adult content. (Pirated content fills the void left by censorship. 'Friends', for example, is widely available on pirated DVD's.)</p> <p>To address the lack of content, SARFT is encouraging private investment in the DTV sector, including content production and DTV channel operation, which will intensify market competition and boost development of program content that users would be willing to pay for. Private investment is still prohibited in analogue TV channel operation.</p>
High Cost	<p>STBs cost between RMB 700-1,500 (USD 84-180), higher than the price of RMB 700 (USD 84) that most consumers were willing to pay in a recent survey conducted in 30 cities and reported in the Chinese media. One major reason costs have not fallen is that there are 361 provincial and city cable TV operators nationwide, each of which demands customized STB products. This lack of standardized STB specifications means manufacturers cannot achieve economies of scale to drive prices down.</p> <p>Pay DTV programming is still limited and expensive, with just 38 pay DTV channels charging between RMB 20 to 60 (USD 2.40-7.20) per month each, compared to usually only RMB 12 (USD 1.45) for all 50 analogue TV channels.</p>
Piracy	<p>Piracy also remains a serious problem impacting the pay DTV market. Pirated VCD/DVDs are widely available in China. Given the wide range of content cheaply available through pirated VCD/DVDs, it is difficult to build a business case around pay DTV channels or VOD.</p>

To break through the chicken and egg problem of a limited user base and limited content, SARFT is pressing cable TV operators to carry out a 'Complete Transfer' of all cable TV users to DTV by subsidizing STBs. Although SARFT has sought the support of local governments to pay for this 'Complete Transfer', the costs of subsidizing STBs for all subscribers are prohibitive. In addition, without a clear pathway to new revenues once subs have STBs, it is unlikely any organization will be willing to step in and finance the subsidies.

11.1.1.3 Implementing the DTV Business Model in a Fragmented Market

The DTV business model is based on revenue sharing between DTV content producers, DTV channel operators, and cable network operators. For example, in CCTV's case, 50% of DTV revenue goes to cable TV operators, 40% goes to content providers, and 10% goes to the channel operators.

Figure 11.1c: CCTV's DTV Revenue Sharing Model



Source: CCTV

For cable TV network operators, this represents an opportunity to develop an important new revenue stream beyond the basic monthly subscription fees of approximately RMB 12-18 (USD 1.45-2.20) paid for traditional analog program broadcasting. These monthly fees along with value-added services currently offered such as broadband access and VOD currently contribute the lion's share of revenues. At Beijing Gehua Cable, for example, these two revenue streams made up 73% of revenues in 2003. A cable operators 50% share of DTV fees could become a significant new source of revenues as the market expands.

For DTV channel operators that only earn a 10% share of revenues, the outlook may be less attractive since another potential source of revenues is currently closed off. Under current regulations, advertising, which has traditionally been the main revenue source for analog TV broadcasting, is forbidden. According to CCTV, the biggest player in the TV advertising market, advertising revenue (RMB 6.38 billion or USD 769 million) accounted for 91% of total revenue from operations (RMB 7 billion or USD 843 million) in 2002. Other TV stations are also dependent on advertising as their primary source of revenue.

Whoever the beneficiaries are, implementing this business model in China's highly fragmented cable TV network market is a complicated task that has slowed the distribution of DTV programming. Although the number of cable TV operators has fallen from approximately 1,387 in 2001 according to SARFT to closer to 300 at the city and provincial level today, reaching this many operators is still a challenge especially given the small number of subscribers at stake in each market.

To distribute content on each of the 300 cable networks, DTV channel operators have to negotiate a separate revenue sharing agreement with each cable network. Since the market is so new, no industry standard has developed that would speed this process. For example, as the first licensed DTV channel operator, CCTV had signed revenue sharing agreements with 70 cable operators by September 2004. However, some cable operators, including Beijing Gehua Cable, did not agree to the revenue sharing terms and refused to broadcast CCTV's DTV programs over its networks.

Few companies are willing to invest in producing DTV programs due to the limited revenue from the small user base, while few TV subscribers are willing to pay for DTV programs as the content is not attractive. Gradual subscriber growth driven by SARFT's

aggressive SARFT targets will likely be needed for the market to reach a significant enough scale to take-off organically.

11.1.1.4 Growth Prospects for the DTV Industry

The addressable market for DTV in China is huge based on the current number of TV subscribers and overall population. China has approximately 330 million TV household subscribers and 120 million cable TV household subscribers out of a total population of 1.3 billion. The number of cable TV subscribers has grown at a strong pace in recent years from less than 80 million in 2000 to a SARFT target of 150 million by 2005.

SARFT is seeking to have all TV households shift to DTV and all TV operators broadcast DTV programs by 2015. If the industry can overcome the obstacles outlined above and reach these goals, DTV will represent a major opportunity creating new markets in recording & editing equipment and software, HFC network upgrades (including transmission & broadcasting equipment), and STBs (including CA, middle ware and components).

At this stage, it's too early to tell how quickly China will move towards the ambitious SARFT targets. However, data from the Academy of Broadcasting Science (ABS) under SARFT and other sources makes it possible to make rough estimates of the total size of these markets during the transition to DTV.

The ABS estimates that each TV station in China will need to spend RMB 50 million (USD 6 million) on new DTV recording and editing equipment and software. With 360 TV stations in China, this translates into a market of RMB 18 billion (USD 2.17 billion).

Upgrades to HFC cost cable operators an average of RMB 300 (USD 36) to RMB 600 (USD 72) per line (or household) according to the ABS. SARFT is targeting for China to have 150 million cable TV subscribers by 2005. If all of these subs are converted to DTV by 2015, the total HFC upgrade market will reach RMB 45 billion (USD 5.4 billion) assuming the average cost during the transition period will be RMB 300 as equipment prices fall over time.

The STB market is more difficult to forecast. To begin with, STBs are themselves a temporary solution for receiving DTV programs on current analogue TV sets before digital TV sets become more widely available. It is still unclear what share of DTV subscribers will ultimately use STBs or DTV sets. In addition, with technology standards not yet finalized, it is hard to predict what the price point for STBs will ultimately be. Assuming half of China's current 330 million TV users upgrade to DTV using a STB priced at RMB 700 (USD 84), the STB market would represent a RMB 115.5 billion (USD 13.9 billion) opportunity.

Table 11.1d: Forecast for DTV Products Market

Product	Market Size	Time Period
Recording & editing equipment/software	RMB 18 billion	2002-2010
HFC upgrade covering transmission & broadcasting equipment	RMB 45 billion	2002-2015
STB (including CA, middle ware and components)	RMB 115.5 billion	2002-2015

Source: www.dtv.cn, BDA

11.1.2 Key Players and the DTV Value Chain

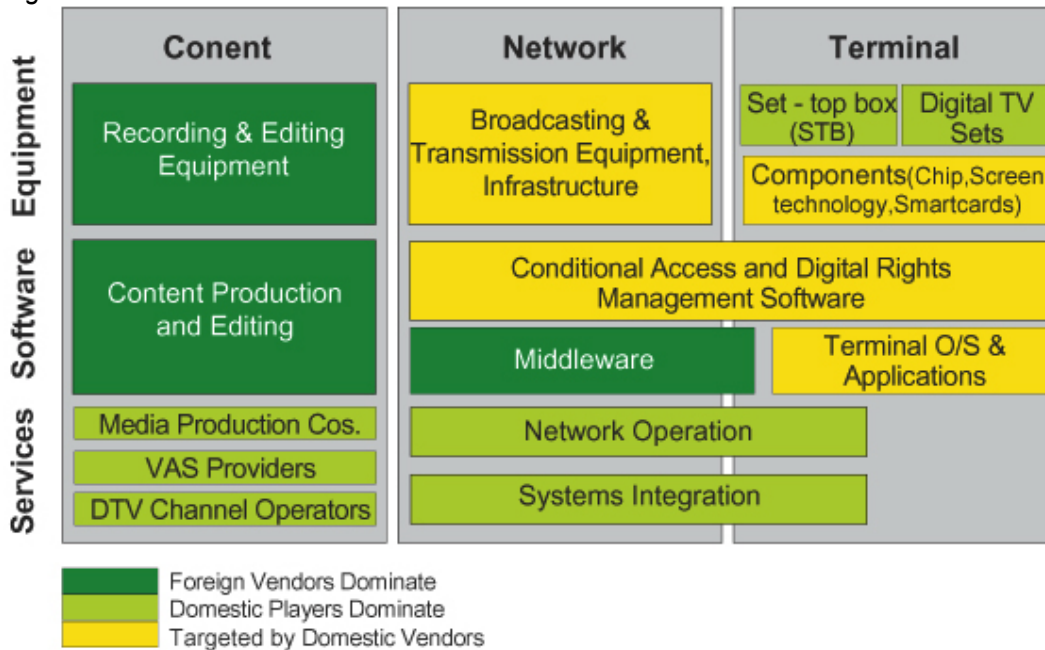
The DTV industry is comprised of a complex value chain of equipment, software and services companies covering content, networks, and terminals (see figure 10.1e).

Across the entire value chain, hundreds of players are active in the DTV sector. Foreign vendors lead the equipment and software markets. Leading foreign vendors in the DTV sector include Sony, Panasonic, Irdeto Access, and NDS.

Domestic players are particularly strong in this emerging market in services (some of which foreign players are not permitted to enter), STBs, and digital TV sets.

Domestic vendors are also starting to become more competitive in broadcasting/transmission equipment, Conditional Access (CA), and management software. Leading vendors in the DTV sector include Tsinghua Tongfang, Changhong, TCL, Hisense and subsidiaries of cable network operators. Meanwhile, some smaller domestic players have started to focus on specific areas like chip design, terminal O/S and applications.

Figure 11.1e: Structure of the DTV Value Chain



Source: BDA

The DTV channel operation market continues to be dominated by domestic companies since the market is heavily regulated and closed to foreign investment. To date, only five domestic companies have been licensed to act as DTV channel operators integrating DTV content and distributing it to network operators. More channel operators are expected to be licensed in the future as SARFT seeks to increase competition in the market.

Table 11.1f: Selected Players in the Chinese DTV sector

Area/Products	Foreign Vendors	Domestic Vendors
STB	Limited presence	Coship, DTVIA, Changhong, Kongka, SOYEA, Skyworth
Digital TV Set	Toshiba, Sony, Panasonic, Samsung	Changhong, Kongka, TCL, Hisense, Skyworth
CA	Irdeto Access, NDS, Canal +, Open TV	DTVIA, Novel Tongfang, Communicate, Digital Video Networks
Media/Content Production	Limited presence	Enlight Media, Hai Run Media Group
DTV Channel Operator	Prohibited	China Cable Television, China Home Cinema, China DTV Media (CCTV), Shanghai Media Group, Beijing All Media & Culture Group

Source: BDA

11.1.3 Investment Issues

11.1.3.1 Regulatory Policies for Foreign Investment

Foreign investment in DTV services is strictly prohibited. No foreign capital is allowed in DTV channel or network operation. Minority foreign shareholding will be permitted in content/media production in the near future. In equipment and software, there are no restrictions on foreign investment.

Private and foreign investment had been strictly prohibited in the media sector before the emergence of DTV. However, private domestic capital may be allowed in DTV channel operation pending approval by SARFT in 2005. The DTV sector may subsequently be opened to all forms of investment.

Figure 11.1g: Regulatory Policies for Investment

	Content Production	Channel Operation	Network Operation	Consumer
Example	CCTV Enlight Media	CCTV Shanghai Media Group	Beijing Gehua Cable Shanghai Oriental Cable	
Domestic Private Investment	Completely Open	Not allowed at present, but minor stake expected soon ¹	Minor Stake	
Foreign Investment	Production Cooperation Allowed ²	Prohibited	Prohibited	

¹ The policy to allow private domestic investors to take a minority in a DTV channel is expected to be implemented soon, according to remarks by a SARFT official reported in the media in August.

² The policy to allow foreign investment in a content production JV is expected to be implemented soon, according to a SARFT official quoted in the media in August. Currently foreign investment is allowed for production cooperation with certificated domestic content companies.

Source: SARFT, BDA

11.1.3.2 Growth Obstacles

Investments in the sector are likely to be challenging given the obstacles the overall industry faces as described above including disagreement over standards, weak market demand, a lack of content, high STB costs, piracy, and the challenges developing a DTV business model in a fragmented market.

11.2 VOD Industry

- *The Internet VOD market is expected to reach RMB 252 million (USD 30.4 million) in 2005. Although the market is still small, growth is expected to be strong, more than doubling from 2004 to 2005.*
- *Growth has been slowed by a limited willingness on the part of subscribers to pay for services. Currently VOD subs are believed to pay only RMB 4 (USD 0.48) per year on average.*
- *Domestic TV stations and movie producers are struggling to create attractive programs under government controls. Imported foreign content is strictly censored. Pirated DVD/VCDs are widely available in China for less than USD 1, posing a serious challenge to any VOD business case. Illegal VOD services selling pirated films/TVs also exist in China. The services can be extremely inexpensive or even free and often offer the newest popular domestic or foreign content. As long as such services are on the market, the sellers of licensed content will be unable to compete.*
- *The only opportunity for Internet VOD may exist in developing new business models that cut through the piracy issue, such as interactive applications like healthcare, education, and gaming.*

11.2.1 Key Sector Trends

The Internet VOD market is at an early stage, and few strong players have emerged so far. Telecom operators and video content companies have only recently started to concentrate on VOD services as a new revenue source.

Fixed-line telecom operators started focusing on broadband access services in 2002 and offered aggressive promotions to sign up users to their ADSL services. Although some subscribers are attracted to broadband simply by faster Internet access, fixed-line operators have also sought to expand the content and applications available to subscribers in order to attract more users. To achieve this goal, both China Telecom and Netcom have developed broadband portals aggregating multi-media content including VOD from a range of service providers.

Following the lead of China's mobile operators, both of which provide service platforms for SPs (China Mobile's Monternet and Unicom's Uni-Info), the fixed-line operators allow third-party service providers to bill for services provided through their portals.

China Telecom's broadband portal, ChinaVnet, has expanded nationwide and cooperates with 400 ICPs just one year after launching commercial operations nationwide on

September 15, 2003. China Netcom set up its broadband portal, Tiantian Online, with investment from IDG and Softbank this February.

In addition to operating broadband portals, China Telecom has also backed Internet content providers (ICPs) in an effort to encourage the development of content that will attract more users to broadband. Leading VOD ICPs established by China Telecom include 21cn.com and Hongbo Online.

Media companies including TV stations and program producers also regard VOD as a new distribution and revenue source for their video content. Leading TV stations and program producers including CCTV and Enlight Media have recently set up their own VOD portals.

The Internet VOD market has expanded together with the growth of broadband access services and subscribers. Online entertainment including VOD is fast becoming the number one reason for Internet usage. According to CNNIC’s December 2004 survey, there were 3.7 million frequent VOD users, up from 2.4 million two years ago. The VOD user base will continue expanding with the overall growth of Internet users and increased broadband penetration. China’s Internet users reached 94 million in 2004, the second highest in the world, according to CNNIC.

11.2.1.1 Obstacles to Market Development

Obstacles to the development of the Internet VOD market include limited broadband users, piracy issues and SARFT’s restrictions on the market entry of foreign players, which are expected to be eased gradually over the next few years.

Table 11.2a: Obstacles for VOD Market Development

Limited Broadband Users	•Although broadband growth is accelerating, the market remains small providing a limited addressable market for VOD.
Lack of Content	•Domestic TV stations and movie producers are struggling to create attractive programs under government controls. •Imported foreign content is strictly censored.
Piracy	•Pirated DVD/VCDs are widely available in China for less than RMB 8 (USD 1), posing a serious challenge to any VOD business case. •Illegal VOD services selling pirated films/TVs also exist in China. The services can be extremely inexpensive or even free and often offer the newest popular domestic or foreign content. As long as such services are on the market, the sellers of licensed content will be unable to compete.

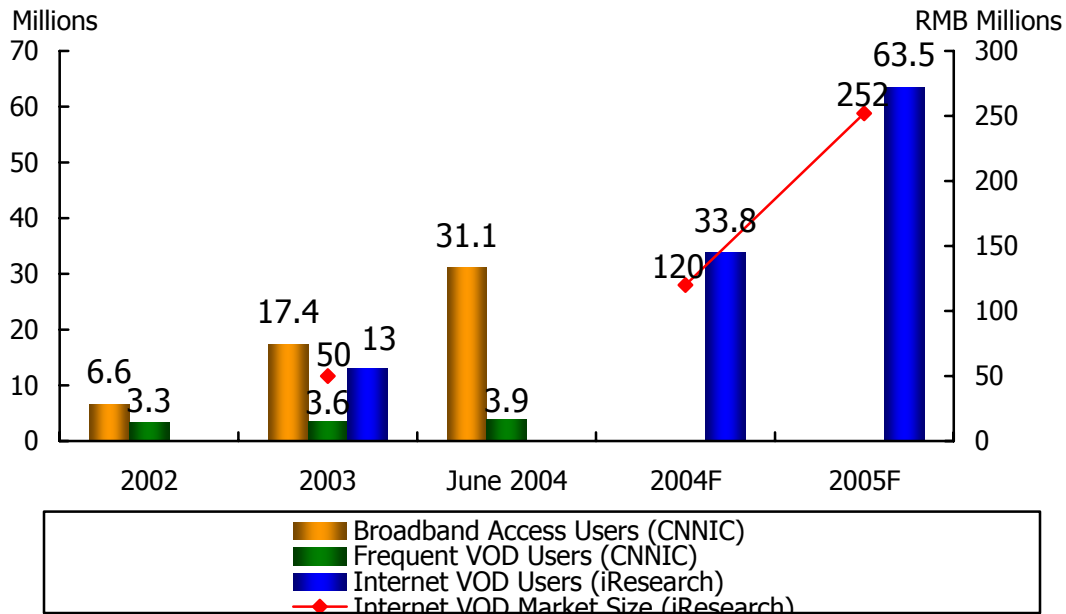
Restrictions on Market Entry

- SARFT limits VOD ICPs through a licensing regime.
- Currently, only 66 ICPs are licensed to offer online VOD.
- 65 of the licensed companies are media companies while only one telecom-related firm has been officially licensed, reflecting the ongoing regulatory battle between SARFT with its traditional oversight of the media business and the MII focused on telecom. The regulatory turf war slows investment in the area and is an obstacle to VOD's long-term development.
- In the future, SARFT will encourage more media companies to offer Internet VOD services and may eventually open the market to all telecom operators.

11.2.1.2 Growth Prospects of VOD Industry

The Internet VOD market is being driven by Internet user growth and increased broadband penetration. Internet VOD users are expected to increase significantly. The research organizations CNNIC and iResearch provide two alternative forecasts for the industries growth. Differences in the forecast are due to their different definitions of a VOD user. CNNIC's forecast is based on frequent users, while iResearch includes all users that have tried VOD services.

Figure 11.2b: VOD Industry Growth Prospects



Source: CNNIC, iResearch

Internet VOD market revenue (not including small, unofficial players) is expected to reach RMB 252 million (USD 30.4 million) in 2005, according to iResearch's forecast. Although the market is still small, growth is expected to be strong, more than doubling from 2004 to 2005.

Growth has been slowed by a limited willingness on the part of subscribers to pay for services. Currently VOD subs are believed to pay only RMB 4 (USD 0.48) per year on average.

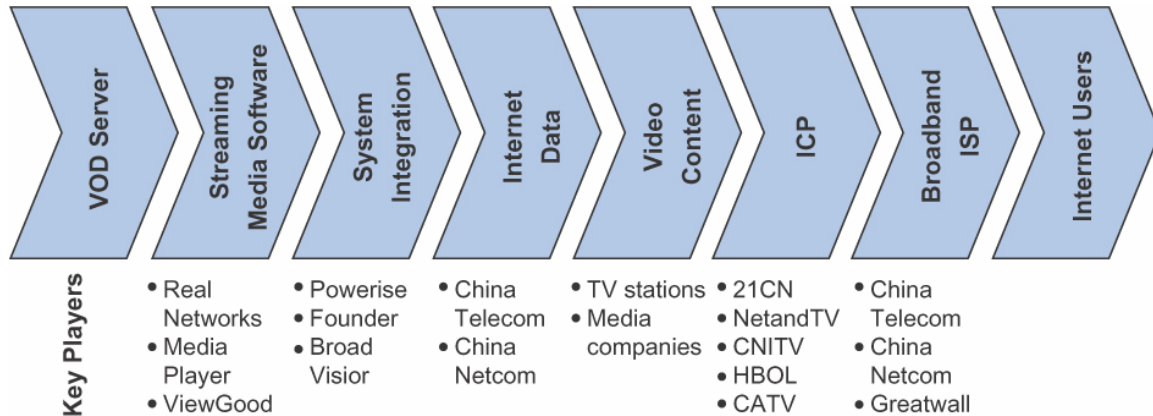
11.2.2 Key Players and VOD Value Chain

The leading VOD ICPs are relatively new, with most founded in 2002 and 2003, and are backed by local media companies and telecom operators, such as Guangdong-based 21cn.com and Shanghai-based CNITV, which were both set up in 2002. These ICPs mainly target audiences in coastal areas, where there are larger broadband access markets and more demand for VOD. There are many small ICPs in cities and counties, offering free or inexpensive downloading or VOD services, mostly using pirated programs.

Aside from the VOD operators described above and systems integration where there are a large number of small players, the VOD value chain is dominated by a handful of companies:

- *Streaming Media:* Streaming media software is dominated by Microsoft Media Player, Real Networks and Apple Quick Time. Two domestic software products, Viewgood and Herosoft, have taken some share, but remain minor players.
- *VOD Platforms and Systems Integrators:* Some small domestic companies focus on VOD platforms and system integration for ICPs and are seeing their businesses expand with market growth.
- *IDCs and Broadband ISPs:* The IDC and broadband ISP markets are dominated by telecom operators, with some small broadband Consumer Premise Network (CPN) operators like Greatwall Broadband. Regulatory controls restrict opportunities for new market entrants.
- *Video Content Providers:* The video content market is being gradually opened to private companies. However, foreign content continues to be strictly censored, limiting the entry of foreign players.

Figure 11.2c: Value Chain of Internet VOD



Source: BDA

11.2.3 Investment Issues

VOD is a regulated sector, and foreign investors face some barriers to entering the market. Foreign investors are allowed to set up Internet joint ventures (JVs) in China taking up to a 50% stake in the JV, with no geographic restrictions. However, Internet VOD service JVs must receive a license to ‘Broadcast Audio/Video Programming Online’ from SARFT. Licenses are strictly controlled by SARFT, which generally only issues them to TV stations and media companies. Among the 66 licensed websites on SARFT’s website, Tiantian Online is the only website operated by a telecom operator and was only licensed in May 2004. ChinaVnet is still waiting for approval, despite having a much longer history of offering video services than many licensed players. But licenses are expected to be issued to more players, as SARFT opens the market to companies with a telecom background.

Market growth is in part dependent on government policies to promote video content through copyright management, regulations on imported foreign content and Internet VOD licensing.

Overcoming customer preference for free or cheap, pirated content will also be difficult. As long as pirated content remains widely available in China, it will continue to be difficult to build a business case around VOD.

12 Software Outsourcing & IT Services

- *China's software exports, which include software outsourcing, are estimated to have totalled USD 3.2 billion in 2004 up from USD 2 billion in 2003 and USD 250 million in 1999.*
- *The rapid expansion of software outsourcing in China is the result of government support, the shifting of foreign companies' R&D centres to China, and demand from Japan, China's leading software export destination.*
- *The domestic industry continues to face significant obstacles including limited domestic demand, piracy and IPR issues, and the lack of skilled personnel.*
- *Given the small size of China's pure-play outsourcers today and these obstacles, China is unlikely to create a software outsourcing firm that can rival the Indian giants of the industry for some time to come. However, China's software exports are likely to continue their explosive growth and China will play an increasingly large role in software development globally.*

12.1 Key Sector Trends

12.1.1 Lack of Focus on Outsourcing

The Chinese software outsourcing industry is highly fragmented and lacks large players dedicated to outsourcing. Instead, the largest Chinese software firms sometimes engage in a wide variety of businesses in addition to software outsourcing, and pure-play outsourcers in China have yet to achieve scale.

Table 12a: Alternative Business Lines Pursued by Companies in China in Addition to Software Outsourcing

Business Line	Description
Hardware Distribution	Many Chinese IT companies began as hardware distributors and have since expanded into systems integration, software development and ultimately software outsourcing. Digital China is one example of a company that began as a distributor and now offers software outsourcing.
Corporate Network SI	Enterprise hardware systems integration includes setting up office/factory IT infrastructure. Low barriers to entry in this sector mean price competition is intense. In search of higher margins, companies engaged in this business may branch into software outsourcing.
Software/Hardware SI	In software/hardware systems integration projects, an SI customizes large pre-existing software systems, including Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) systems, and integrates hardware. There are higher entry barriers in the Software/Hardware SI sector since the projects require a degree of in-house software development, but intense competition has pushed many players to expand into software outsourcing.
Software Development	Software development is focused on the development of re-sellable software products rather than outsourcing projects. Some software development firms are currently expanding into software outsourcing, but software outsourcing firms require advanced project management skills to ensure client deadlines and specifications are met. This is a very different discipline to developing product software. As a result, software development houses sometimes have a difficult transition to outsourcing.

In many cases, the largest, most well known software groups in China will conduct several (or perhaps all) of the above IT business lines along with software outsourcing, displaying little focus compared to IT companies in more mature markets. Digital China is a classic example. A giant with revenues of RMB 15 billion (USD 1.8 billion), Digital China lacks a clear business focus, covering hardware distribution, hardware manufacturing, SI, software development and software outsourcing.

Other examples include UFSOFT and Kingdee, two of China's largest software companies, focusing originally on accounting and finance software development. In terms of software revenue, the two companies were ranked 24th and 30th respectively by the Chinese government in 2003. Competition in this field has increased significantly in recent years, and both companies are looking to diversify into other areas. Both Kingdee and UFSOFT have recently formed software outsourcing divisions and are targeting US businesses. However, both companies are primarily skilled in product-oriented software development processes, which will not necessarily transition smoothly to service-oriented software outsourcing. Success in this area will require focus on servicing clients and project management.

While most attention has focused on these big name companies, which have recently diversified into software outsourcing, the largest players in the industry in terms of outsourcing revenues are actually medium-sized pure-plays that are not as well known. These companies tend to be highly focused on outsourcing (90%+ revenues from outsourcing), often have strategic investment from Japanese firms, and have a number of key Japanese clients that provide a stable base of business. Examples include DHC, DMK, Sinocom and Venus Software (profiled in table 8d).

For the firms listed above and smaller outsourcing companies that have not yet reached this scale, raising capital can be a significant challenge. As private companies without fixed-assets, these companies have difficulty obtaining loans from China's state banks. Smaller firms are also less likely to receive support from the government both in terms of policies and government-funded projects.

Many Chinese firms have turned to their Japanese clients to raise needed working capital. Japanese firms have been eager to cement relationships with key vendors by making strategic investments, and many of the leading players have strategic investments from Japan.

12.1.2 Foreign Participation

Unlike India, where large Indian firms dominate the software outsourcing market, foreign companies moving their own software development operations to China are key drivers in China's outsourcing market.

Whether all of these development centers are performing software outsourcing in the traditional sense is debatable, since their main 'customer' may be their corporate parent

in their home market rather than a third party customer. However, the growth of foreign development centers is important for a number of reasons:

- Foreign software development centers exporting software back to their corporate parent will make up a large share of China's estimated USD 5 billion in software exports this year.
- Expertise developed at these centers will ultimately diffuse into the Chinese market improving the capabilities of Chinese software outsourcing firms, which foreign companies may make greater use of in the future.

The importance of foreign-owned software development centers is an indication of the limitations of existing Chinese software outsourcing firms. If better firms were available, a larger share of exports would be generated by Chinese firms.

12.1.2.1 Japanese Firms

Japanese firms have aggressively entered the China market, both in terms of the number and size of Software Development Centers (SDCs) and strategic investments. Japan is China's largest export market with 61% of exports destined for Japan. Although Indian and Western firms are expanding in China which will likely lead to a larger share of exports going to markets other than Japan in the future, Japan will most likely remain China's largest software export market for the foreseeable future.

A large share of these exports is generated by SDCs established by Japanese firms. Japanese companies turned to China for a number of reasons:

- *Geographic Proximity:* China and Japan are only a 2-3 hour plane flight apart.
- *Cultural/Linguistic reasons:* China's three northeastern provinces of Liaoning, Heilongjiang and Jilin were occupied by Japan from 1932 to 1945, and a large number of Japanese speakers reside in these provinces as a result. In recent years, there have been more Chinese from these areas studying in Japan than from the rest of China.
- *Cheap Labor:* China has obvious labor cost advantages compared to Japan. According to interviews conducted with software outsourcing firms in Dalian, the benchmark for the cost of a software engineer in Japan is JPY 1 million (USD 9,728)⁹ per person per month, while Chinese companies generally charge out their engineers to Japan at between JPY 220,000 (USD 2,140) and 250,000 (USD 2,432) per person per month.

Table 12b: Selected Japanese Corporations with Software Outsourcing Centres & Partnerships in China

NTT Data	NTT Data established a joint-venture subsidiary with DHC in Beijing, employing about 100 software developers. The main function of the JV is to complete software projects outsourced by NTT Group in Japan. However, the JV has recently started looking at conducting SI activities for companies in China as well.
Fujitsu	Fujitsu conducts outsourcing activities through its local joint-venture subsidiary, Beijing Fujitsu Software (BFS), which was established with CS&S in 1992.

⁹ Exchange rate is Yen 102.8 to USD 1.

NEC

NEC Solutions, a recent consolidation of previous NEC SI and NEC CASS, has close to 1,000 employees focusing on both SI activities in China as well as outsourcing for its parent company, NEC Japan.

According to Chinese outsourcing firms, their Japanese clients typically break large software projects into smaller pieces. Some of the work may be performed in-house while other portions of the project can be outsourced, often to more than one firm. By contrast, American companies more often outsource an entire project to an Indian outsourcing firm. This difference is in part a reflection of the more limited capabilities of Chinese firms compared to the Indian outsourcing giants. But the continuation of this business practice means Chinese firms have not had an opportunity to build up their software and project management skills on larger projects. This may continue to limit their ability to win business from western clients.

Japan is also doing a limited amount of Business Process Outsourcing (BPO) in Dalian, in much the same way the US does in India. A number of call centers have been set up in Dalian to handle customer support enquiries from Japan. These call centers employ Japanese living in Dalian as well as Japanese-speaking Chinese staff. However, due to the limited number of Japanese and Japanese-speaking Chinese in China, the development of call-center operations is likely to be difficult. BPO focusing on written Japanese may be viable, as it can take as little as three months for Chinese to develop an adequate level of Japanese reading proficiency to perform BPO, due to the similarity between the two languages.

12.1.2.2 Indian Firms

Indian companies have begun to move into China recently as the market begins to show promise. Although not yet major players in the market, they are likely to have a significant impact given their leading role in software outsourcing globally. In the meantime, Indian companies are extending their reach into Japan, which may threaten the position of Chinese firms.

Indian outsourcing firms are attracted to China for a number of reasons:

- *Following Customers.* As Indian outsourcers' Western clients have expanded in China, Indian firms have expanded their presence in China to better serve key customers. In many cases, the China operations focus on client interfacing plus a limited amount of localization with most actual development work executed in China. This may change with more development conducted in China as these companies grow their China operations.
- *Access to China's domestic market.* Although still at an early stage of development, China's domestic outsourcing demand is beginning to grow. Indian firms are also targeting this market in the long term.
- *Proximity to Japan* and access to skill sets (language, etc.) to better target Japan.
- *Access to low-cost software developers* as costs in India rise. There is speculation that China may undercut pricing in India in the longer term, and many firms may hedge their bets and move some work to China.

At least five major Indian outsourcers have already entered China, with most taking aim at both the domestic market and the export market in Northeast Asia. Infosys has even suggested that one-fifth of their software outsourcing contracts will be outsourced to software development centers in China in the future. Growth of Indian firms in China would clearly present a competitive challenge to Chinese outsourcers.

12.1.2.3 Western Firms

US and European companies have a smaller presence in the market. Their SDCs are often smaller than their Japanese counterparts.

In addition to conducting software development in-house, these companies may also act as a base for software outsourcing to Chinese companies.

- In some cases, the western firm will ‘borrow’ engineers from a preferred partner, who will then perform the development work in the foreign firm’s own development center.
- As western companies become more confident in Chinese outsourcing firms, they may then begin to formally outsource.

12.1.3 Governmental Initiatives

The software outsourcing industry in China has benefited from strong government support.

Table 12c: Software Outsourcing – Governmental Support

Action	Description
Targets for the development of the domestic software and SI industry ¹⁰	<ul style="list-style-type: none"> ▪ Increase software sales to RMB 250 billion (USD 30.1 billion) and raise Chinese companies’ market share to 60% by 2005. ▪ Increase software exports to RMB 41.5 billion (USD 5 billion) (expected to have been achieved in 2004). ▪ Develop key software companies with sales revenues of over RMB 5 billion (USD 602 million). ▪ Increase staff employed in the software industry to 800 000 people.
Tax incentives	<ul style="list-style-type: none"> ▪ Software companies are offered a 14% rebate on the standard Value-Added Tax (VAT) rate of 17%, making their effective VAT rate only 3%. ▪ Software companies are not required to pay income tax for their first two years of operation, and pay just 50% of the standard tax rate for the following three years. ▪ Software companies in key-government-designated fields are offered a 10% income tax rebate. ▪ No tax or duties are levied on imported software and hardware for internal company use.
Establishment of software export parks	<ul style="list-style-type: none"> ▪ Located in Beijing, Shenzhen, Shanghai, Tianjin, Dalian, and Xi’an. ▪ Offer preferential policies for human resources, technology, funding, sales, and exports.
Export & Import	<ul style="list-style-type: none"> ▪ Relaxed visa controls for foreign software experts entering and leaving the country. ▪ Special allowances in software import and export rules, including relaxed foreign exchange laws.¹¹

¹⁰ Issued by the central government in 2000.

Preferential Procurement	<ul style="list-style-type: none"> ▪ At any given price point, domestic companies are first in line in receiving contracts for government projects. ▪ At least 30% of all work in government projects must be carried out by domestic vendors.
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12.1.4 Growth Prospects

The rapid expansion of software outsourcing in China is the result of government support, the shifting of foreign companies' R&D centres to China, and demand from Japan, China's leading software export destination.

China's software exports, which include software outsourcing, are estimated to have totalled USD 3.2 billion in 2004 up from USD 2 billion in 2003 and USD 250 million in 1999.

12.2 Key Players

Table 12d: Selected Pure-Play Software Outsourcing Companies

Organisation	Est.	Co. Structure	Staff	Offices	Revenues
DHC www.dhc.com.cn	1996	Privately held (Shareholders: NEC, NTT Data, Hitachi Soft)	<ul style="list-style-type: none"> ▪ 1700 ▪ 95% in Software Development (SD) 	<ul style="list-style-type: none"> ▪ Tokyo ▪ Beijing ▪ Jinan ▪ Dalian 	<ul style="list-style-type: none"> ▪ RMB 280 million (USD 33.7 million) ▪ 76% from Software Outsourcing (SO)
	In 2002, DHC was ranked 1st in export value in China's 2002 exporters list. 100% of the software revenues are from Japan. Major customers include NEC, NTT Data, Hitachi Group, GE Group, Mitsubishi Electronics Group, Nomura Research Institute, and Fuji Xerox.				
HiSoft Technologies International www.haihuisoft.com.cn	1996	Privately held (Shareholders: JAFCO Asia, Intel Capital, Grantic Capital, IFC, China Hualu and Haida Shipping, management and the employees.)	<ul style="list-style-type: none"> ▪ 700 	<ul style="list-style-type: none"> ▪ Dalian (HQ) ▪ New York ▪ Atlanta ▪ Tokyo ▪ Osaka 	<ul style="list-style-type: none"> ▪ RMB 100 mm (USD 12 million) ▪ 95% from SO
	DMK was the first Chinese company to pass the SEI-CMM Level 5 Assessment (March, 2003). Rated as one of the top 30 IT companies with highest growth potential. First GE certified GDC in China (November 2002). In August 2004, the company announced a USD 20 million equity financing from the IFC, JAFCO Asia, Intel Capital and Granite Global.				
SinoCom www.chincom.com	1995	Public (HK. 00299) (Shareholders: Daiwa Securities SMBC, NEC Soft, Legend Capital, Public, and founders)	<ul style="list-style-type: none"> ▪ 960 ▪ 80% in SD 	<ul style="list-style-type: none"> ▪ Beijing ▪ Tokyo 	<ul style="list-style-type: none"> ▪ HKD 115 million (USD 14.7 million) ▪ 90% from SO
	Sinocom does BPO for Sun's technical support (6% of total revenues). 92% of the software outsourcing come from Japan. China contributes the remaining 8%. Major customers include NEC Software, Nomura, Daiwa, HP, SUN, IBM, and Hitachi.				
Venus Software www.vsc.com	1988	Privately held (Shareholders: NEC, NTT Data, East-China Computer)	<ul style="list-style-type: none"> ▪ 400< ▪ 80% in SD 	<ul style="list-style-type: none"> ▪ Shanghai ▪ Shenzhen ▪ Japan 	<ul style="list-style-type: none"> ▪ 50% of total revenues from SO ▪ 75% of SO from Japan

¹¹ This is critical for the software outsourcing industry, as software outsourcing firms must often pay a large foreign currency bond before beginning a project. Foreign exchange controls would complicate this process.

Venus Software was founded in 1988 with Japanese investment and conducts two main business lines SI and software outsourcing for Japanese companies. Customers include Fuji Xerox, NTT Group, NEC, Hitachi, Oki, Huawei, and Honeywell. Over 50% of software outsourcing revenues are from Japan, with the remainder from Chinese companies including Huawei.

12.3 Investment Issues

Despite the rapid growth, the software outsourcing market faces a number of key obstacles.

Table 12e: Main obstacles hindering the development of the Chinese outsourcing industry

Limited domestic demand	<ul style="list-style-type: none"> Chinese customers have a predisposition to buy hardware rather than software. Although businesses in China have made significant investments in their IT infrastructure, they have spent much less on software and services (like outsourcing).
Piracy	<ul style="list-style-type: none"> A key problem in the software market continues to be piracy – rampant illegal copying of software has choked revenue flow for software companies and stunted their growth. Although the pirating of packaged software is not a direct impact on software outsourcing, it has slowed the development of the overall software industry. IPR issues also directly impact software outsourcing as foreign companies are sometimes more willing to do development in China in their own centres than risk exposing their IP by outsourcing to a Chinese firm. One Shanghai-based software outsourcing firm reported that the first question they are asked by potential western clients are what systems they have in place to protect their clients IPR. According to company interviews, as much as 95% of all office software in China is pirated. Despite China's entrance into the WTO, Government initiatives to stop piracy have moved slowly.
Lack of skilled personnel	<ul style="list-style-type: none"> Although China produces more than 50,000 IT graduates every year, there is a lack of skills in some senior positions, particularly system designers, senior programmers and project managers. Due to the immaturity of the outsourcing market, senior personnel have had little exposure to non-domestic large/complex projects. Despite English being a top priority in the Chinese education system, China cannot compete in language-intensive outsourcing areas with countries where English is a native language such as India and Ireland.¹²

These obstacles mean that China is unlikely to create a software outsourcing firm that can rival the Indian giants for still some time.

In India, the top software outsourcer employs almost 30,000 people and has total revenues of more than USD 1 billion, with over 90% of resources devoted to software outsourcing. This stands in stark contrast to China's largest software group, Neusoft, which has 6,000 employees and total revenues of RMB 2.2 billion (USD 265 million), with only 10% of its revenue derived from software outsourcing. DHC, one of the largest pure-play software outsourcing firms in China, has just 1,700 employees and revenues of RMB 281 million (USD 33.9 million).

¹² Hiring staff with English fluency to efficiently conduct BPO activities would require increased salaries, limiting the efficiencies gained by outsourcing.

But even if China is not ready to create its first truly global software outsourcing company, strong growth in the export market, driven by the China operations of foreign companies, will make the country a major link in the global software value chain.

The biggest challenge to investing in software outsourcing in China may be identifying companies that have reached a sufficient scale to be ready to effectively deploy the new capital invested. Many outsourcing firms in China are very small scale with fewer than 100 employees. Some of the companies interviewed for this project reported that they did not expect any growth in their businesses in 2005. Larger players have more credibility when approaching potential clients and are likely to be able to grow more quickly consolidating business at the expense of smaller companies.

The most successful companies in the long term are likely to be those that can break out of the existing mold of servicing primarily Japanese companies. Chinese software outsourcing firms that are able to win business from Western firms and tap into emerging domestic demand are likely to become the leading players.

Overcoming any lingering fears that foreign clients have about IPR is likely to be a continuing challenge for Chinese outsourcing firms. Companies that effectively address this issue by adopting industry best practices for protecting company IPR are likely to be better positioned to win business from western firms.

13 Handset Design in China

- *The global handset value chain has become increasingly fragmented over the past few years with the rise of vertical technology vendors as well as the growing use of outsourced design and manufacturing by global original electronics manufacturers (OEMs).*
- *Companies that have sprung up as the value chain disintegrated include wireless semiconductor solutions provider Skyworks, Original Design Manufacturer (ODM) Pantech, module supplier Wavecom, and independent design houses such as Cellon. The rise of these vertical players in the value chain has opened up sources of technology and expertise previously inaccessible to domestic companies.*
- *As manufacturers push upstream and chipmakers move downstream, companies caught in the middle of the value chain face significant pressure. Module suppliers and independent design houses face a challenging future if they are unable to continue providing value to domestic vendors set on doing more R&D in-house.*

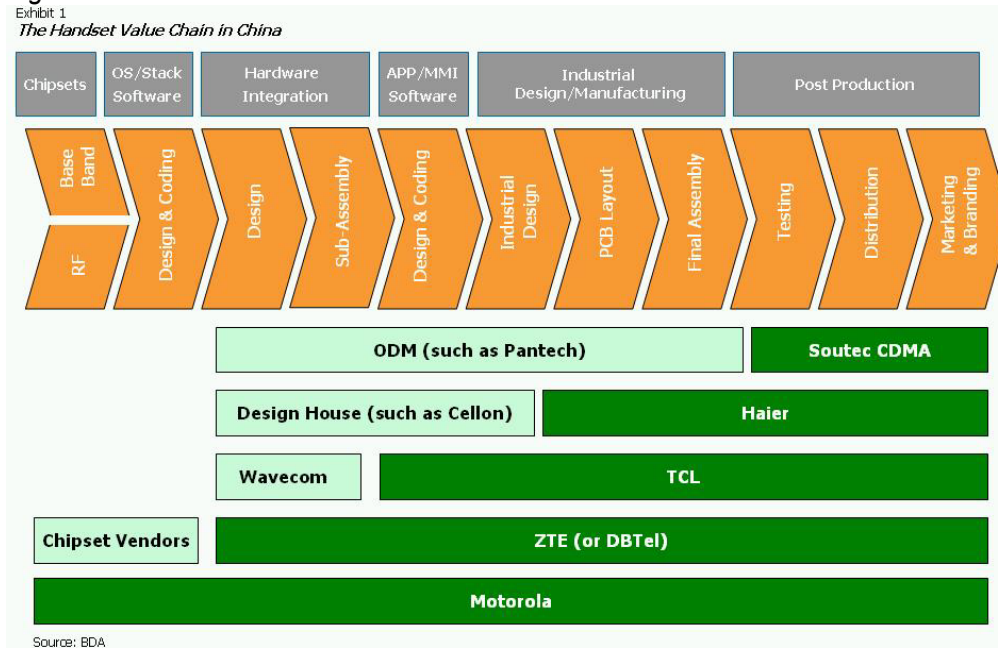
13.1 Key Sector Trends

13.1.1 The Handset Value Chain

The global handset value chain has become increasingly fragmented over the past few years with the rise of vertical technology vendors as well as the growing use of outsourced design and manufacturing by global original electronics manufacturers (OEMs). The disintegration of the handset value chain has opened up opportunities for Chinese domestic handset manufacturers such as TCL and Bird to compete more effectively with foreign vendors and challenge Motorola and Nokia's primacy in China.

Companies that have sprung up as the value chain disintegrated include wireless semiconductor solutions provider Skyworks, Original Design Manufacturer (ODM) Pantech, module supplier Wavecom, and independent design houses such as Cellon. The rise of these vertical players in the value chain has opened up sources of technology and expertise previously inaccessible to domestic companies.

Figure 13a: The Handset Value Chain in China



Note: most vendors conduct more than one of the above production models.

Source: BDA

13.1.1.1 Domestic Vendors Moving Upstream

Pressured by falling margins, some domestic vendors are pushing upward in the value chain in search of better profitability. While handset rivalries in the past centered on marketing and external design, domestic vendors are now competing in the R&D field. For example, TCL, which was highly dependent on module suppliers in the past, is moving up the value chain to work with chipset vendor TI and design house TTPcom. As a result, Wavecom has seen a cut in orders from TCL.

The key driver behind this trend is cost control. Module suppliers claim to be able to bring down the overall bill of materials for a handset as they consolidate component orders for their modules. However, as leading domestic vendors have achieved economies of scale, they are seeking to reduce costs further by integrating more basic components on their own without ceding margins further up the value chain to module suppliers.

13.1.1.2 Chipset Suppliers Moving Downstream

On the other hand, upstream chipset suppliers, such as TI and Infineon, are also moving downstream to work with domestic vendors on hardware integration and software development. They offer various services depending on the level of customers' in-house capabilities.

- For vendors with strong in-house R&D such as ZTE, TI only provides standard software tools and codes, so domestic vendors can then independently perform hardware integration and software development.
- For vendors with relatively weak in-house capabilities such as TCL, TI can provide hardware integration and other solutions.

In addition to chipset makers, other specialized semiconductor component suppliers such as Skyworks are also moving downstream to sell more integrated subsystems and total solutions to handset vendors.

- Skyworks has sold RF subsystems to domestic vendors Konka, Bird, Panda, Lenovo, ZTE and TCL. By using more integrated subsystems, vendors benefit from lower costs and the smaller size of PCBs (Printed Circuit Boards).
- Skyworks also sells total mobile phone solutions, with its customers in China including Capitel, CECT, Haier, Konka and Lenovo.

13.1.1.3 Implications for Design Houses and Module Suppliers

As manufacturers push upstream and chipmakers move downstream, companies caught in the middle of the value chain face significant pressure. Module suppliers such as Wavecom and independent design houses face a challenging future if they are unable to continue providing value to domestic vendors set on doing more R&D in-house.

Consolidation in the crowded design house sector is inevitable. The companies that survive will be those with low costs and strong R&D who can continue to provide value to domestic vendors even as they invest in their own R&D. Equally important will be developing stable customer relations with leading handset vendors, especially foreign makers. Many second tier design houses serve weak domestic handset vendors who are themselves at risk of being pushed out of the market amid consolidation.

13.1.2 Operators to Get More Involved in Handset Value Chain

In the traditional GSM handset market, operators China Mobile and China Unicom have taken a hands-off approach in distribution. However, with Unicom's launch of CDMA and China Mobile's more aggressive promotion of handsets supporting 2.5G services, operators have played an increasingly important role in handset distribution.

China Unicom purchases handsets directly from vendors and offers bundled packages of handsets and services. For example, ZTE, a major CDMA equipment vendor, has benefited from this shift and proved successful in the CDMA handset market by supplying directly to operators.

China Mobile is also getting more involved in the handset value chain by ordering customized handsets from vendors and setting up a dedicated terminal sales company. For example, China Mobile has started to promote "Gotone" and "M-Zone" branded handsets with customized, pre-installed Monternet services in Beijing.

The trend towards operators branding more handsets should be positive for design houses. As operators begin to use their own brand for more models, they set specifications for handsets and add complexity to handset design, which may increase the drive for some vendors to outsource. More importantly, in the long term, as operators place their own brand on handsets, they may seek to source handset designs directly from a design house rather than working with a branded OEM.

13.1.3 Impact of 3G

Companies with strong in-house R&D such as Huawei and ZTE should be very well positioned for the 3G handset market. Not a player in the 2G terminal market, Huawei has attached great importance to WCDMA 3G terminals. In June 2002, Huawei established a JV with NEC and Panasonic to jointly develop 3G terminals. Through the JV and in cooperation with other companies such as Infineon, Huawei launched a dual-mode GPRS/WCDMA handset. In addition to selling its own branded 3G handsets, Huawei is also seeking to sell 3G mobile phone solutions to domestic vendors given the strength of its R&D.

Although the 3G market will initially account for a small share of the overall handset market in China, it is likely to offer the highest margins, and success for ZTE and Huawei in this segment would put the companies in a strong position to grow their handset businesses.

3G will not have a significant impact on design houses in the short term because licenses have not yet been issued in China. Following the issuance of licenses, it will likely take operators at least 6-9 months to deploy networks. Only then will handsets be needed for commercial use. In addition, subscriber growth is likely to be slow initially, so demand for handsets will take time to develop. But in the long term, 3G may be a positive for design houses. Domestic vendors with weak R&D are likely to need to rely on design houses or other sources to develop 3G handsets. As 3G grows closer, design houses that are able to offer 3G solutions will be well positioned, since domestic vendors will likely struggle to develop 3G handsets on their own.

13.1.4 Export Market

To continue the success they have enjoyed in the 2G market, vendors with backgrounds in consumer electronics such as TCL will need to enlarge their scale in order to invest in R&D and maintain a competitive advantage. Therefore, it will be crucial for them to develop export markets to build greater economies of scale.

Growing exports by domestic vendors is a clear positive for design houses. As domestic vendors expand overseas, they increase the addressable market for the design houses that supply them. Furthermore, designing handsets for new markets to meet the different customer tastes could ultimately increase the design burden and drive demand for outsourced designs.

13.1.5 Continued Outsourcing Positive for Design Houses

Although many domestic vendors are investing in their own internal R&D and showing signs of improvement, the outsourcing trend is likely to continue among domestic vendors. One factor driving the outsourcing trend is the shortened product life cycles. In China's hyper-competitive market, product life cycles have been shortened from more than 24 months previously, to 6 to 12 months now. At the same time, vendors must maintain a sufficient portfolio of models in the market to appeal to narrowly segmented consumer tastes and keep up with the competition. For example, DBTel has at least 30 models in the market at any one time.

Outsourcing is a key to overcoming these competitive challenges. The use of module suppliers and design houses can significantly reduce a product's time to market allowing companies to keep large portfolios of competitive products with current features in the market. For example, for some domestic vendors, a new model's time to market can be reduced to 6 months by using a module supplier, compared to 18 to 24 months if developed in-house, according to industry interviews conducted by BDA.

Even as domestic companies improve their own R&D, they are likely to continue to outsource to fill out their product portfolio just as Motorola relies on ODMs for some models despite its considerable in-house design capability.

13.2 Key Players*Table 13b: Introduction to Leading Design Houses and Module Suppliers*

Company Name	Company Description
TechFaith	A leading wireless terminal solution (handset design and wireless module) provider and the largest handset design house in China with over 1,000 employees.
Cellon	A global independent design house with over 500 employees worldwide and R&D centers in the US, Canada, France, Korea, and China.
Yuhua	A Shanghai-based independent design house.

Source: BDA

Annex 1 Abbreviation List

3C	Communication, Computer, and Consumer Electronics
ABS	Academy of Broadcasting Science
ARPU	Average Revenue Per User
ASIC	Application Specific Integrated Circuit
AVMSC	National Audio, Video and Multimedia Standardization Committee
B2C	Business to Consumer
BOSS	Business Operation Supporting System
BPO	Business Process Outsourcing
CA	Certification Authority (security service); Conditional Access (DTV)
CAGR	Compounded Annual Growth Rate
CAS	Conditional Access System
CATR	China Academy of Telecom Research
CATV	Community Access TV (Cable TV)
CCP	Chinese Communist Party
CEO	Chief Executive Officer
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
CNITSEC	China Information Technology Security Certification Center
COD	Cash on Delivery
COSEP	China Offshore Software Engineering Project
CP	Content Provider
CPC	Central Party Committee
CPU	Central Processing Unit
CRM	Customer Relationship Management
CWCBSOE	Central Working Commission on Big State Owned Enterprises
DDN	Digital Data Network
DRM	Digital Rights Management
DTV	Digital TV
ERP	Enterprise Resource Planning
FDI	Foreign Direct Investment
FITE	Foreign Invested Telecom Enterprise
GAPP	General Administration of Press and Publication
GDP	Gross Domestic Product
GPRS	General Packet Radio Service
HDTV	High Definition TV
HFC	Hybrid Fiber Coaxial
HQ	Head Quarter
IC	Integrated Circuit
ICP	Internet Content Provider
IDH	Independent Design House

IDM	Integrated Device Manufacturer
IDS	Intrusion Detection System
IFC	International Finance Corporation
IP	Internet Protocol
IPO	Initial Public Offer
IPR	Intellectual Property Rights
IT	Information Technology
JV	Joint Venture
LBS	Location Based Services
MCU	Microcontroller (Single Chip Multicontroller)
MII	Ministry of Information Industry
MIS	Management Information System
MMOFPS	Massively Multiplayer On-line First Person Shooting
MMORPG	Massive Multiplayer On-line Role Playing Games
MNC	Multinational Company
MOC	Ministry of Culture
MOF	Ministry of Finance
MOS	Metal Oxide Semiconductor
MOST	Ministry of Science and Technology
NDM	Navigation Digital Map
NDRC	National Development and Reform Commission
NPC	National People's Congress
ODM	Original Design Manufacturer
OEM	Original Equipment Manufacturer
OTC	Over the Counter
PAS	Personal Access System
PCB	Printed Circuit Boards
PHS	Personal Handy Phone System
PKI	Public Key Infrastructure
POTS	Plain Old Telephone Service
PPP	Purchasing Power Parity
PRC	People's Republic of China
R&D	Research and Development
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
RMB	Renminbi
SAIF	SoftBank Asia Infrastructure Fund
SARFT	State Administration of Radio, Film, and TV
SARS	Severe Acute Respiratory Syndrome
SASAC	State-owned Assets Supervision and Administration Commission
SCIO	State Council Informatization Office
SCM	Supply Chain Management
SD	Software Development



SDC	Software Development Center
SDPC	State Development and Planning Commission
SDRC	State Development Reform Commission
SETC	State Economic and Trade Commission
SI	System Integration
SMS	Short Message Service;
SO	Software Outsourcing
SOE	State Owned Enterprise
SP	Service Provider
STB	Set-Top Box
US	The United States
USD	US Dollar
USO	Universal Service Obligation
VAS	Value Added Services
VOD	Video on Demand
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminals
WTO	World Trade Organization