

**Information and Communication  
Technology (ICT) for development of  
small and medium-sized exporters  
in East Asia: China**

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**IDE-JETRO**

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## Contents

|   |     |
|---|-----|
| Abstract .....  | 5   |
| I. Introduction .....   | 7   |
| II. The current IT market and IT use by SMEs .....  | 9   |
| A. Market data .....  | 9   |
| B. IT use by firms .....  | 15  |
| C. E-commerce.....  | 22  |
| D. Basic characteristics of IT use by firms and e-commerce .....                            | 25  |
| III. SME development in the IT revolution .....   | 27  |
| A. An overview of the role of SMEs in Chinese industry.....                                 | 27  |
| B. Case studies on use of e-commerce and SCM in various industries .....                    | 32  |
| C. Obstacles preventing SMEs from participating in international value chains .....         | 61  |
| IV. Government policies vis-à-vis SMEs, IT and international trade.....                     | 63  |
| A. IT policies in China's development strategy .....  | 63  |
| B. Policies to support SMEs .....   | 67  |
| C. Special measures to bridge the digital divide among companies.....                       | 71  |
| D. E-government for SMEs and trade promotion .....  | 76  |
| E. Incremental institutional improvements .....   | 80  |
| F. Policy recommendations.....  | 83  |
| V. The primary stage of regional networks .....   | 85  |
| A. Regional websites: overview .....  | 85  |
| B. Role of regional websites for SMEs.....  | 89  |
| C. Possibility for interregional linkages.....  | 90  |
| D. Summary of regional networks .....   | 96  |
| VI. Conclusions and recommendation .....  | 97  |
| A. Maintaining a balance between hardware purchases and software development.....           | 97  |
| B. Additional government efforts to encourage the transition to an information society..... | 98  |
| C. Effect of SME-export-promotion policies .....  | 99  |
| D. Elimination of institutional barriers in e-commerce .....                                | 100 |
| E. Raising the skills of SME human resources .....  | 100 |
| F. Possibilities for cooperation among regional networks.....                               | 101 |
| References .....  | 103 |



## Abstract

Over the past ten years, the most noticeable characteristic of China's industrialization is that the information technology (IT) sector has overtaken textiles, long the country's largest sector as well as the one with the highest growth rate. This rapid growth of China's IT industry can be attributed to the two critical strategies: First, the liberalization of investment and trade, which encouraged a large increase of foreign direct investment (FDI) into the IT sector. The Chinese government devised many policies to encourage transnational corporations (TNCs) to establish manufacturing bases in China and import capital and technology, two elements that China's IT industry lacked.

The second element was the increased popularity of IT, that is, the higher demand for IT products. Clearly, the rapid growth of the IT industry and the increasing demand for IT products reinforce each other. This is the fundamental reason for the success of China's IT development policy.

Also, closely tied to the spread of IT is the promotion of digitization by enterprises. Increased reliance on digitization by the management of small and medium-sized enterprises (SMEs) has created a large market for routers, servers, switches, broadband Internet and other IT products. SMEs have begun to see that IT products can be used not simply for processing or storing data on a single computer but also for managing the flow of information. The higher the level of digitization, the larger the demand for IT products by SMEs.



## I. Introduction

Over the past ten years, the most noticeable characteristic of China's industrialization is that the information technology (IT) sector has overtaken textiles, long the country's largest sector as well as the one with the highest growth rate. In 1995, China's IT industry produced goods valued at 253.61 billion *yuan*. Just seven years later, in 2002, the figure had more than tripled, to 1.143 trillion *yuan*.

The rapid growth of China's IT industry can be attributed to the following two critical strategies: First, the liberalization of investment and trade, which encouraged a large increase of foreign direct investment (FDI) into the IT sector. The Chinese government devised many policies to encourage transnational corporations (TNCs) to establish manufacturing bases in China and import capital and technology, two elements that China's IT industry lacked. The purpose of this was to allow Chinese companies to make inroads in world markets by exporting IT products. Also, China hoped that from the very beginning of its development its IT industry would mesh with the global system so as to ensure that information technology developed at the same pace as the rest of its industries. By the end of 2005, when import tariffs on IT products will be eliminated, a fiercely competitive IT market will have emerged, which should lead to a new boom in the IT industry.

The second element was the increased popularity of IT, that is, the higher demand for IT products. For example, between 2000 and 2002, the value of computer sales grew 35.5%, from 174.05 billion *yuan* to 235.84 billion *yuan*. In the same period, the percentage of homes with computers more than doubled, from 9.72% to 20.36%, and then to 32% by June 2004. Wireless telecommunication also grew quickly. The number of cellphone subscribers rose from 84.53 million in 2000 to 200 million in 2002 and 400 million in mid-2004. The number of Internet users also soared, from 9.02 million in 2000 to 59.1 million in 2002 and 87 million in 2004.

Closely tied to the spread of IT is the promotion of digitization by enterprises. Increased reliance on digitization by the management of small and medium-sized enterprises (SME) has created a large market for routers, servers, switches, broadband Internet and other IT products. SMEs have begun to see that IT products can be used not simply for processing or storing data on a single computer but also for managing the flow of information. The higher the level of digitization, the larger the demand for IT products by SMEs.

An ever-expanding IT market is the most important element of continued IT development. Because enterprises are increasingly using IT, the popularity of e-mail and its role as the main form of communication in international trade have further increased the demand for IT products and paved the way for a new, Internet-based business model. In a certain sense, the adoption of e-mail is the first step for SMEs to make the transition to digitization. At the same time, e-mail is being transformed into e-commerce. When an SME learns to use the Internet, first to search for information and potential customers and then finally to conduct business transactions, it is using IT. In this process, it will acquire the ability to use IT and will find a niche in the global economy. However, it takes time for SMEs to make the transition to digitization. During this process, there will be an ongoing demand for IT products.

Clearly, the rapid growth of the IT industry and the increasing demand for IT products reinforce each other. This is the fundamental reason for the success of China's IT development policy.



## II. The current IT market and IT use by SMEs

The rapid growth of the IT industry is necessarily predicated on increased domestic demand. From 1995 to 2002, the value of information and communications technology (ICT) production in China increased more than fourfold, from 308.29 billion *yuan* to 1.652 trillion *yuan*. In the same period, China's information infrastructure improved greatly, spurring continuous growth in demand for IT products.

The Chinese government aggressively promoted the transition to an information society. The declarations making 2000 the "Year of Government Online" or making 2001 the "Year of Enterprises Online" did much to promote the transition to an information society and encourage the spread of computer use. IT allows companies to lower their costs and raise their economies of scale. E-commerce, in turn, allows them to raise sales volumes, boost their market share and become more competitive.

### A. Market data

#### 1. Hardware market

China's computer market has grown rapidly in recent years. The ongoing transition to digitization in domestic telecommunications and in the financial sector, in addition to the enormous demand for IT applications for the home, has greatly promoted growth in hardware sales. In general, hardware constitutes the largest share of China's IT market, although demand for software and information services is also growing quickly.

Table 1 gives sales for various kinds of hardware products. Demand for computer hardware has shown sustained growth, with sales increasing from 111.55 billion *yuan* in 1999 to 158.41 billion *yuan* in 2002. From 1999 to 2002, sales grew at more than 12% per annum. In 2001, host computers, including mainframes, high-end computers, personal computers (PCs) and servers, had the largest market share, accounting for 42.6% of hardware sales. By contrast, peripherals and terminals accounted for 21.1% of such sales.

**TABLE 1**  
**GROWTH IN SALES OF COMPUTER HARDWARE IN CHINA, 1999-2002**  
(In billions of yuan)

| Product                   | 1999          | 2000          | 2001          | 2002          |
|---------------------------|---------------|---------------|---------------|---------------|
| Mainframes                | 58.60         | 68.87         | 78.92         | 88.82         |
| Peripherals and terminals | 31.17         | 27.26         | 30.09         | 31.92         |
| Applicable products       | 14.00         | 18.96         | 21.80         | 24.25         |
| Networking products       | 7.78          | 10.08         | 11.74         | 13.42         |
| <b>Total</b>              | <b>111.55</b> | <b>125.09</b> | <b>142.55</b> | <b>158.41</b> |

**Source:** State Information Centre/China Association of Information (SIC/CAI), “2003 China information yearbook”, Beijing, China Information Yearbook Press, 2003.

### a) The market for networking products

Increased demand for networking products in China has accompanied the transition to digitization. In recent years, the rapid transition to the information society, digitization at the community level, e-government, e-commerce and other uses for networks have expanded the market for networking equipment and products.

Most of the demand for networking products comes from the financial and telecommunications industries and government, which account for 70% of sales of these products. From 1997 to 2002, sales of the leading networking products increased by 50% (see table 2).

**TABLE 2**  
**SALES OF NETWORKING EQUIPMENT (1997-2002)**  
(x 100 million yuan)

|                   | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|-------------------|------|------|------|------|------|------|
| Routers           | 19   | 23   | 27   | 40   | 43.6 | 46.2 |
| Ethernet Switches | 25   | 30   | 35   | 42   | 57.2 | 62.8 |
| UNIX Servers      | n.a. | 29.9 | 39   | 52.1 | 68.4 | 76.2 |

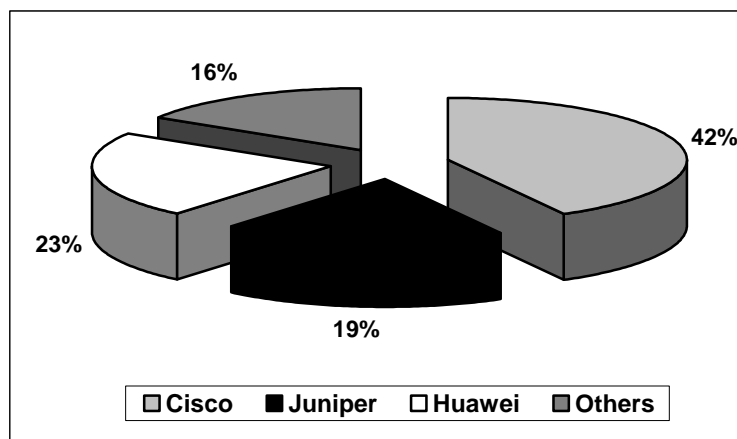
**Source:** China National Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

Two features of sales of networking equipment and products in China should be stressed. First, demand has increased rapidly. From 1997 to 2002, router sales rose from 1.9 billion *yuan* to 4.62 billion *yuan*, and sales of Ethernet switches from 2.5 billion *yuan* to 6.28 billion *yuan*. In addition, sales of UNIX servers increased from 2.99 billion *yuan* in 1998 to 7.62 billion *yuan* in 2002. Second, the best-selling networking products are now manufactured in China rather than abroad. However, foreign brands still continue to lead the market for high-end products.

#### i) Router market

Foreign manufacturers dominated the router market through 1998. Starting in 1999, industry customers have successively built or rebuilt their networks on a large scale. Routers have come into wide use, allowing the entry of mid-range and low-end models. Domestic enterprises have quickly upgraded their technology and become more competitive. Thus, by late 2002, routers made in China accounted for more than 40% of domestic sales.

**FIGURE 1**  
**LEADING ROUTER MANUFACTURERS IN CHINA (2002)**  
*(In percentages of sales)*



Source: China National Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

With the continuous development and growing sophistication of low-end routers, domestic router manufacturers have narrowed the gap in the core chips, Internet operating system (IOS) software and other technologies employed by Cisco and other foreign producers. Moreover, as domestic router manufacturers have learned to react more quickly to market changes and to provide solutions tailored to customers needs their market share has risen.

## ii) Switches

The transition to digitization in the financial, government and educational sectors, the Enterprise Online Project and the construction of a broadband network to connect China’s cities are among the factors that have spurred fast growth in the market for switches.

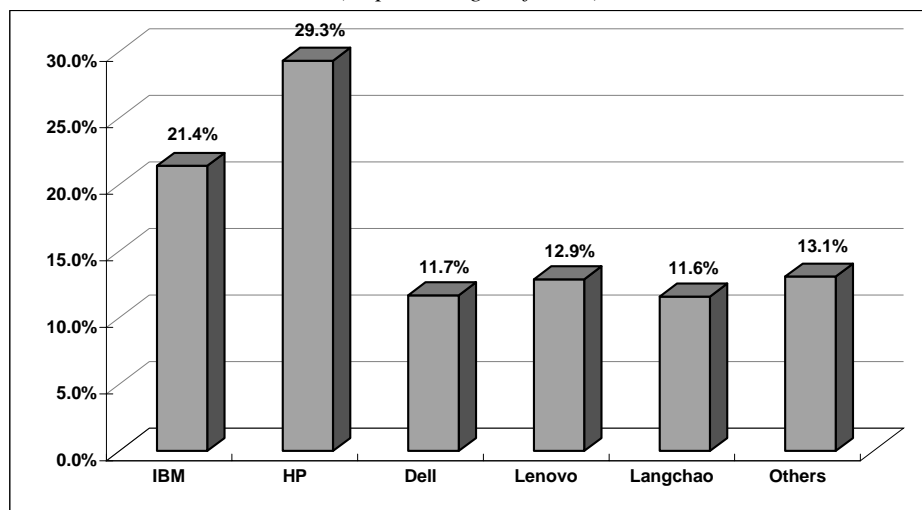
Sellers of midrange and low-end switches have focused on SMEs and home users. Domestic manufacturers mainly produce Ethernet switches for the midrange and low-end markets. One reason for this is that they are building up their technology base. Another is that a large number of SMEs are promoting their own online projects, which increases demand for midrange and low-end switches. Therefore, domestic manufacturers see SMEs as their most important customers for switches, especially because of SMEs’ important role in establishing small and medium-sized networks.

Cisco, 3Com and Avaya continue to dominate the market for advanced switches in China. The further development of network technology and the drop in prices for switches of a given number of gigabytes will inevitably lead to the emergence of 100 trillion gigabyte switches. This, in turn, will encourage the further growth of the market for switches.

## iii) Servers

Demand for servers, as the key element of information networks, is expected to increase. In 2002, China’s market for PC servers was valued at 6.76 billion *yuan*. In the light of expected tighter competition in the PC server market, domestic server manufacturers have increased their market share by improving their technology, products, distribution systems and service. Servers made in China now account for over 40% of sales. The leading domestic manufacturers are Lenovo (12.9% of the market) and Langchao (11.6%), while the main importers are Hewlett-Packard (HP) (29.3%), International Business Machines (IBM) (21.4%) and Dell (11.7%).

**FIGURE 2**  
**SERVER MARKET IN CHINA (2002)**  
*(In percentages of sales)*



**Source:** China National Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

Regarding which industries are driving demand, sales to the banking and insurance sectors have raised slowly, while demand for servers for e-government, education and enterprise digitization has driven growth in the server market.

By late 2003, imported networking equipment and products were mainly purchased by high-end users. However, domestic producers have now taken the lead in key software and hardware technologies, allowing them to provide more appropriate solutions than those offered by foreign suppliers. Hence, these producers have made a transition from “product orientation” to “application orientation”, thereby steadily increasing their market share.

## b) PC-related products

China’s computer market is growing rapidly. From 1996 to 2002, sales increased at an annual rate of over 20% (see table 3), as the widespread applications found for IT led to higher demand for PCs. In 2000, 6.69 million desktop computers were sold, with a value of 47.74 billion *yuan*. By 2002, these figures had increased to 9.07 million units, worth 59.24 billion *yuan*. The main reasons for increased PC demand are listed below:

**TABLE 3**  
**VALUE AND GROWTH RATE OF COMPUTER SALES IN CHINA (1996-2002)**

| Year                     | 1996  | 1997   | 1998   | 1999   | 2000   | 2001   | 2002   |
|--------------------------|-------|--------|--------|--------|--------|--------|--------|
| Sales (billions of yuan) | 92.00 | 130.00 | 148.00 | 172.00 | 174.05 | 203.36 | 235.84 |
| Growth rate (%)          | 49.60 | 41.30  | 13.90  | 16.20  | 25.00  | 16.80  | 16.00  |

**Source:** State Information Centre/China Association of Information (SCI/CAI), “China information yearbook”, Beijing, China Information Yearbook Press, various issues.

First, higher school enrolment in China has spurred growth in the PC market. China’s Ministry of Education has introduced a plan to give 90% of the students in the country access to the Internet within five to ten years. This will greatly expand the market for PCs.

Second, the rapid expansion of the Internet and e-government in China has also encouraged higher PC sales.

Thirdly, home-computer sales are booming. For example, PC penetration in urban households soared from 2.6% in 1997 to 20.63% in 2002. For Beijing, Shanghai and Guangzhou the figures were 55.54%, 47.25% and 44.7%, close to the level of industrialized countries (see table 4).

**TABLE 4**  
**PCS PER 100 URBAN HOUSEHOLDS**

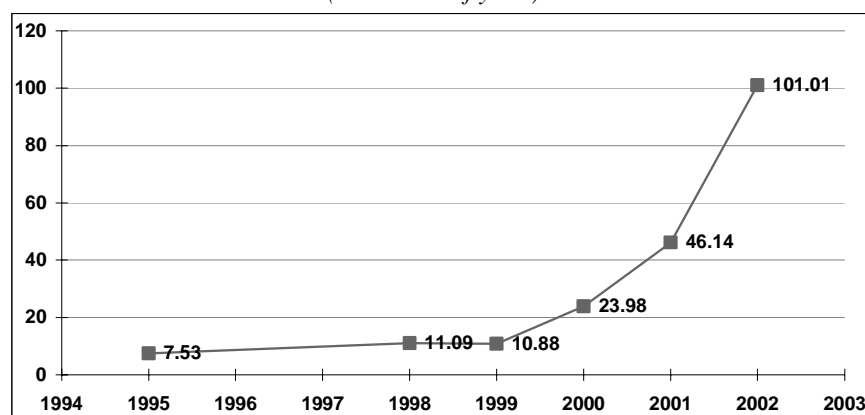
|            | 2000 | 2001 | 2002  |
|------------|------|------|-------|
| Nationwide | 9.7  | 13.3 | 20.63 |
| Beijing    | 32.1 | 45.3 | 55.54 |
| Shanghai   | 25.6 | 37.6 | 47.25 |
| Jiangsu    | 10.7 | 12.7 | 19.72 |
| Zhejiang   | 14.0 | 20.0 | 27.27 |
| Guangdong  | 25.8 | 34.6 | 44.70 |

**Source:** State Statistical Bureau, “China statistical yearbook”, Beijing, State Statistical Press, 2001, 2002, 2003.

Fourth, computer exports have risen sharply, from 7.53 billion *yuan* in 1995 to 101.01 billion *yuan* in 2002 (see figure 3).

China’s PC market continues to be dominated by domestic manufacturers, whose market share has in fact increased. In 2002, Lenovo, Great Wall and Founder were the top three manufacturers of PCs. The structure of the market for PCs and related products has changed dramatically in recent years, with surging demand for more sophisticated products. Laptops have seen rapid growth and become an important factor in the expanding computer market. In 2002, 805,000 laptops were sold, up 39.8% from 2001.

**FIGURE 3**  
**VALUE OF COMPUTER EXPORTS FROM 1995 TO 2002**  
(In billions of *yuan*)



**Source:** State Information Centre/China Association of Information (SIC/CAI), “China information yearbook”, Beijing, China Information Yearbook Press, various issues.

The main reasons for the rapid growth in laptop sales were, first, lower prices; second, the growing popularity of wireless Internet access, which made laptops more attractive for Internet users; and third, the increasing transition to digitization. In coming years, as technological progress continues to drive prices down, laptops should become even more popular.

**TABLE 5**  
**PC SALES IN CHINA, 2000-2002**  
(In thousands)

|             | 2000  | 2001  | 2002  |
|-------------|-------|-------|-------|
| Desktop PCs | 6 200 | 7 281 | 9 077 |
| Laptops     | 419   | 576   | 805   |
| PC servers  | 163   | 201   | 235   |

**Source:** State Information Centre/China Association of Information (SIC/CAI), “2003 China information yearbook”, Beijing, China Information Yearbook Press.

### c) Cellphones

China’s mobile-phone market is also quickly expanding. Although foreign enterprises have performed strongly, the breaking of China’s leading mobile telephony provider into several companies has further spurred growth in the industry.

From 1999 to 2002, the number of cellphone subscribers increased several times over. For example, in 2002, there were 61.39 million new subscribers, up from 17.96 million in 1999. Moreover, cellphone exports have also soared, totalling 59.81 million phones in 2002, a 37.9% increase over 2001. In 2002, cellphones accounted for 5.5% of all export revenue on electronics and IT products.

**TABLE 6**  
**NEW CELLPHONE SUBSCRIBERS AND CELLPHONE PRODUCTION**  
(In millions)

|                           | 1999  | 2000  | 2001   | 2002   |
|---------------------------|-------|-------|--------|--------|
| New cellphone subscribers | 17.96 | 41.97 | 59.54  | 61.39  |
| Production of cellphones  | 22.68 | 83.51 | 106.22 | 131.55 |

**Source:** On the basis of information from Ministry of Information and Industry [online] <<http://www.mii.gov.cn>>

In 2002, 30 manufacturers produced 115.09 million Global System for Mobile Communications (GSM) cellphones, of which 52.39 million were for export. And 18 manufacturers sold 6.70 million code division multiple access (CDMA) phones, including 2.72 million for export. China’s rapid economic development has further increased demand for mobile phones. Whereas in 2002 there were 206 million mobile-phone subscribers, for a penetration rate of 16.19%, by August 2004 the number of subscribers had risen about 50%, to 315 million (MII, 2004).

Although China has the world largest telecommunications network and the largest number of cellphone users, the cellphone penetration rate remains low. In July 2004, 30 of every 100 persons had cellphones, compared with more than 60 in both Japan and Korea. Hence, there is still strong potential for growth in the cellphone market.

## 2. Software market

Software sales have climbed year after year, rising from a mere 13.8 billion *yuan* in 1998 to 50.74 billion *yuan* in 2002. In the same period, sales of software services have increased from 18.7 billion *yuan* to 46.86 billion *yuan*. In 2002, the value of software products, services and exports totalled 110 billion *yuan*. The results of a recent survey indicated that software sales would reach 210 billion *yuan* by the end of 2004 (SIC/CAI, 2004, p.29).

Government and institutional purchases of legal copies of software products and the stronger protection of intellectual property rights are the two key policy-related factors that explain higher software sales. Software services are the largest category of software-related sales, followed by software exports, which, nonetheless, have remained low. In 2001, although software exports totalled only 60 billion *yuan*, exports were growing rapidly. In 2002, the value of software exports was double that of 2001.

**TABLE 7**  
**SOFTWARE SALES IN CHINA**  
(In percentages billions of yuan)

|                   | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|-------------------|------|------|------|------|------|------|------|
| Software products | 11.2 | 13.8 | 18.2 | 23.8 | 33.0 | 50.7 | 82.0 |
| Software services | 14.8 | 18.7 | 23.9 | 32.2 | 40.6 | 46.9 | 78.0 |
| Software exports  | -    | -    | 2.1  | 3.3  | 6.4  | 12.4 | 16.6 |
| Growth rate (%)   | -    | 25.0 | 36.0 | 34.0 | 34.0 | 38.0 | 61.0 |

**Source:** State Information Centre/China Association of Information (SIC/CAI), “2002 China’s information yearbook”, China E-Commerce Yearbook Editorial Commission; “2003 China E-commerce yearbook”, Beijing, China E-Commerce Yearbook Publisher, 2003.

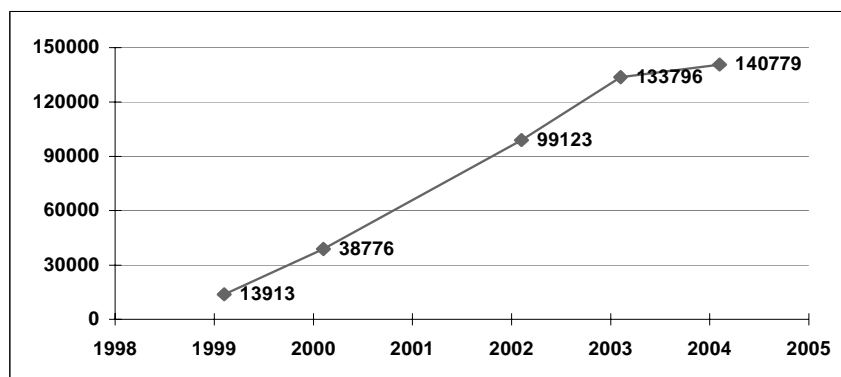
The rapid growth in software sales in recent years has been closely linked to the broader range of applications found for IT products. The declaration of 2000 as the Year of Government Online and of 2001 as the Year of Enterprises Online, along with other projects to encourage growth in the software market, has been a boon for software sales due to the use by government and companies of software pre-installed on computers. In addition, this has permitted enterprises specializing in such software to grow rapidly. For example, 500 new enterprises specializing in software for installation on computers prior to sale were established, with sales of 23.45 billion *yuan* on such software in 2001.

## B. IT use by firms

Enterprises are increasingly relying on the Internet for communication and negotiations, eschewing traditional office automation (OA) techniques. Hence, they are buying IT products that can give them Internet access. In fact, to a certain extent, firms are buying IT-related products solely because of their need to connect to the Internet.

A firm is said to be “online” when it uses a computer network to improve its production and operations tasks. Being “online” can also be viewed as a significant indicator of an enterprise’s degree of digitization. In a narrow sense, being connected to a network means being connected to the Internet, while a broader definition of connectivity also encompasses intranets (whether local area networks [LANs] or wide area networks [WANs]). The number of Chinese firms that are “online” has continued to grow quickly in recent years. Figure 4 shows the growth in the number of registered Internet net addresses in China ending in “com” or “com.cn”.

**FIGURE 4**  
**REGISTERED INTERNET ADDRESSES ENDING IN “.com” OR “.com.cn”**



**Source:** China Internet Network Information Centre (CNNIC), “Statistical survey report on the Internet development in China” [online] July 2004 <<http://www.cnnic.org.cn>>.

Each year from 1999 through 2002, the State Economic and Trade Commission conducted an in-depth survey of firms’ use of IT-related products and services. This volume uses the 2002 survey to analyze firms’ use of these products and services and, particularly, to predict the potential effect of aggregate demand on growth in the IT industry. In 2002, 570 questionnaires were completed and returned.

### 1. Use of networking equipment by firms

Of the 570 firms surveyed, 366 (64.2%) had an intranet, and the number had increased each year. An additional 20.2% were installing an intranet and 12.3% planned to do so. Only 3.3% of the firms reported having no plans to establish an intranet. Hence, there is a clear trend among firms to use intranets.

Most of the intranets in place or being constructed operated at high speeds. In terms of backbone bandwidth, 44.9% of the firms’ had a backbone bandwidth operating at between 100 and 1,000 Mbps; 25.1% at between 1,000 Mbps and 1 Gbps; and 1.4% at between 1 and 10 Gbps. These three groups accounted for 71.4% of the intranets operated by the firms surveyed. In terms of desktop bandwidth, 40.5% of the firms had intranets running at 100 Mbps, and 19.5% of the firms operated intranets at between 10 and 50 Mbps, giving these two categories a total of 60% (see tables 8 and 9).

**TABLE 8**  
**TYPES OF BACKBONE BANDWIDTH INSTALLED BY FIRMS**

| Backbone bandwidth | [1G,10G] | 1000M | [100M,1000M] | [2M,100M) | [56K,256K] |
|--------------------|----------|-------|--------------|-----------|------------|
| Number of firms    | 8        | 143   | 256          | 29        | 6          |
| %                  | 1.4      | 25.1  | 44.9         | 5.1       | 1.1        |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.



**TABLE 9**  
**TYPES OF BANDWIDTH USED BY FIRMS**

| Bandwidth       | 100M | [10M,50M] | [1M,2M] | 56K | Unknown |
|-----------------|------|-----------|---------|-----|---------|
| Number of firms | 231  | 111       | 8       | 3   | 50      |
| %               | 40.5 | 19.5      | 1.4     | 0.5 | 8.7     |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

The fact that more than 60% of the firms had computers connected to an intranet shows the degree to which intranet systems have taken hold. Slightly more than 32% of the firms had connected at least 90% of their computers to an intranet.

## 2. Demand for IT products and Internet-related applications

Advances in Internet technology and the surge in its use have prompted ever-larger numbers of enterprises to connect to the Internet. Eighty-nine percent of the firms surveyed in 2001 had Internet access, compared with 98.6% of those surveyed in 2002. Most firms have connected to the Internet by all available means.

Dial-up connections were the preferred way of accessing the Internet. In 2001, 50% of the firms used this method, although the figure declined to 43.77% in 2002. The next most common method was dedicated lines, the use of which rose from 25% in 2001 to 36.83% in 2002. Asymmetric digital subscriber lines (ADSL) ranked third, as the use of this technology soared from 2% in 2001 to 26.51% in 2002. Integrated services digital network (ISDN) connections ranked fourth, accounting for 16% of the firms surveyed with Internet connections. Optical fibre and others had smaller market shares —4.45% and 5.26%— although these methods were becoming increasingly popular.

**TABLE 10**  
**HOW ENTERPRISES IN CHINA CONNECT TO THE INTERNET**

| Year | Dial-up | Dedicated line | Cable | ISDN  | ADSL  | Optical fibre | Others | Did not reply |
|------|---------|----------------|-------|-------|-------|---------------|--------|---------------|
| 2001 | 50.00   | 25.00          | 0.005 | 16.00 | 2.00  | -             | 2.00   | 9             |
| 2002 | 43.77   | 36.83          | 1.600 | 16.01 | 26.51 | 4.45          | 5.26   | -             |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

**Note:** Because some of the firms connected to the Internet in more than one way, the totals are greater than 100%. “Other methods” includes dedicated line and digital data network (DDN), among others.

The number of computers owned by a firm is a function of its size. The 2002 survey found that 67% of the firms had fewer than 100 computers connected to the Internet, and most large firms (accounting for 22% of the surveyed firms) had between 100 and 450 computers connected with Internet.

A survey of the 100 firms that have invested most heavily in IT-related products found that managers had an average of 0.7 computers; 44.86% of the managers of these firms had to share a computer and only 30.7% had their own computer. Since computers help managers become more efficient, the fact that on average these managers had less than one computer each shows the potential for growth in this market.

**TABLE 11**  
**LEADING COMPANIES THAT LAUNCHED NEW IT PRODUCTS IN 2002**  
*(In percentages)*

| Product  | Lenovo | IBM  | Dell | Founder | SUN | HP   | CISCO | 3Com | Nortel |
|----------|--------|------|------|---------|-----|------|-------|------|--------|
| PCs      | 41.4   | 14.9 | 16.1 | 8.0     | n/a | 4.6  | n/a   | n/a  | n/a    |
| Servers  | 9.1    | 40.3 | 7.8  | 2.6     | 6.5 | 31.2 | n/a   | n/a  | n/a    |
| Switches | n/a    | n/a  | n/a  | n/a     | n/a | n/a  | 48.4  | 18.9 | 5.3    |
| Routers  | n/a    | n/a  | n/a  | n/a     | n/a | n/a  | 80.2  | 2.2  | 3.3    |

**Source:** State Information Centre/China Association of Information (SIC/CAI), “2002 China’s information yearbook”, Beijing, China Information Yearbook Press.

Data on the make of IT-related products recently purchased by firms indicate that Lenovo, IBM, Dell and Founder are the leading suppliers of PCs, while IBM, HP, Lenovo, Dell and SUN are the leading sellers of servers, and Cisco, 3Com and Nortel dominate the market for switches. In addition, Cisco has a near monopoly of the router market, with 80.2% of sales.

Regarding database software, more than 70% of the firms used products sold by SQL and Oracle. In the firewall segment, 39.2% of the firms used firewalls made by Cisco, followed by Check Point and Net Screen, each of which had 17.2% of the market.

### 3. Management information systems

After years of investing in IT hardware and software, most firms in China had a basic information system in place and had worked out problems related to internal “information islands”. In 2002, 321 firms, or 56.32% of the firms surveyed, considered implementing a financial management information system their top priority. As shown in table 12, the other information management systems (IMs) they hoped to implement, in order of preference, were systems for OA (49.47%), human resource management (38.95%), enterprise resource planning (ERP) (32.46%), manufacturing resource planning II (MRPII, 28.77%), supply chain management (SCM, 18.95%) and customer relationship management (CRM, 18.25%) (see table II.12).

**TABLE 12**  
**BUSINESS INFORMATION SYSTEMS CONNECTED OVER AN INTRANET**

| Type of system       | Enterprises | Enterprises with an intranet | %     |
|----------------------|-------------|------------------------------|-------|
| OA                   | 371         | 282                          | 49.47 |
| Financial management | 543         | 321                          | 56.32 |
| HR management        | 406         | 222                          | 38.95 |
| MRPII                | 282         | 164                          | 28.77 |
| ERP                  | 313         | 185                          | 32.46 |
| SCM                  | 226         | 108                          | 18.95 |
| CRM                  | 222         | 104                          | 18.25 |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

**Note:** Percentages are for all surveyed enterprises whose information system is available on their intranet. For MRPII, ERP, SCM and CRM, firms whose systems are either fully in place or under construction were included.

Real-life applications of SCM systems are not yet widely used in China. In a survey of 100 firms, only 7% reported having fully deployed SCM systems, 43% reported having partially deployed such systems, while the remaining 50% said that had not begun to do so.

Introducing an SCM system requires the involvement of managers and of the research and development, design, purchasing, production, warehouse and distribution departments. Also, for an SCM system to be connected to a firm's suppliers and sellers, it is important to secure interconnection between different business procedures throughout an SCM system.

At present, most firms use the four major functions of SCM, i.e., purchases management, warehouse management, sales management and supplies management, and only 18.9% use the channel management subsystem (see table 13).

**TABLE 13**  
**SCM FUNCTIONS USED BY SMES**  
(In percentages of companies surveyed)

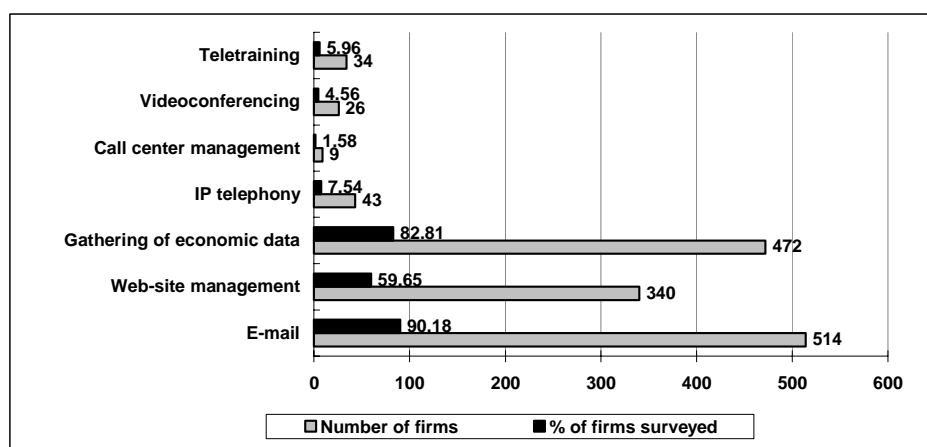
|                                    |      |
|------------------------------------|------|
| Purchases management               | 81.1 |
| Warehouse management               | 75.7 |
| Sales management                   | 70.3 |
| Supplier management                | 64.9 |
| Quality Control                    | 29.7 |
| Transportation management          | 27.0 |
| Monitoring of outsourced processes | 18.9 |
| Channel management                 | 18.9 |

**Source:** China E-Commerce Yearbook Editorial Commission, "2003 China E-commerce yearbook", Beijing, China E-Commerce Yearbook Publisher, 2003.

#### 4. How firms use the Internet

According to the same survey, enterprises used the Internet for three main purposes: e-mail (90.18%), information gathering (82.81%) and website maintenance (59.65%). Only a few firms used it for IP telephony (7.54%), teletraining (5.96%), videoconferencing (4.56%), call centre management (1.58%) or other purposes (see figure 5 and table 14).

**FIGURE 5**  
**HOW FIRMS USE THE INTERNET**



**Source:** China Internet Network Information Centre (CNNIC), "2002 China Internet development report", Beijing, Posts & Telecom Press, 2003.

**TABLE 14**  
**HOW FIRMS USE THE INTERNET**

| Use  | Number of enterprises | %     |
|--|-----------------------|-------|
| E-mail   | 514                   | 90.18 |
| Website management   | 340                   | 59.65 |
| Gathering of economic, policy, technical, legal and market information | 472                   | 82.81 |
| IP telephony   | 43                    | 7.54  |
| Call-centre management   | 9                     | 1.58  |
| Videoconferencing  | 26                    | 4.56  |
| Teletraining   | 34                    | 5.96  |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

Moreover, even fewer firms —only 20, or 3.5% of the sample— took full advantage of the Internet and used it for tasks such as searching for information, applying specialized business systems, transmitting data, coordinating e-commerce transactions, handling CRM, selling products, setting up WANs by means of virtual private networks (VPNs), recruiting new employees, disseminating company-related news and handling electronic data interchange (EDI) operations.

## 5. Other aspects of Internet use

Influenced by the emergence of OA techniques and Internet navigation, firms have gradually made the transition to digitization by purchasing IT-related products and services. Furthermore, greater IT use across society has allowed firms to reap the benefits of greater operational efficiencies. This, in turn, has led them to buy even more IT products and services.

Two characteristics of IT investment by firms need to be stressed: First, most of this investment has been for hardware products. One study on IT investment found that the 638 firms surveyed had invested a total of 2.36 billion *yuan* in hardware, for an average of 3.70 million *yuan* per firm, up 8.2% over a five-year period. Hence, firms have substantially increased their purchases of IT-related products.

As shown in table 15, in 2002 hardware investment totalled 1.156 billion *yuan* (51% all IT investment), while investment in software totalled 533 million *yuan* (24%) and investment in website construction came to 249 million *yuan* (11%).

**TABLE 15**  
**BREAKDOWN OF INVESTMENT IN DIGITIZATION BY**  
**REPRESENTATIVE FIRMS IN 2000**

|                                   | Hardware | Software | Website construction | Consulting fees | R & D | Total |
|-----------------------------------|----------|----------|----------------------|-----------------|-------|-------|
| Amount (millions of <i>yuan</i> ) | 1 156    | 533      | 249                  | 97              | 222   | 2 362 |
| % of total IT investment          | 51       | 24       | 11                   | 4               | 10    | 100   |

**Source:** China E-Commerce Yearbook Editorial Commission, “2002 China e-commerce yearbook”, Beijing, China E-Commerce Yearbook Publisher, 2002.

Table 16 gives a breakdown of major IT purchases by firms. PCs, servers, routers and printers accounted for the lion's share of hardware purchases, while the main categories of software purchases were networking applications, office suites and financial programs. Specialized OA applications for manufacturing accounted for only a fraction of IT sales.

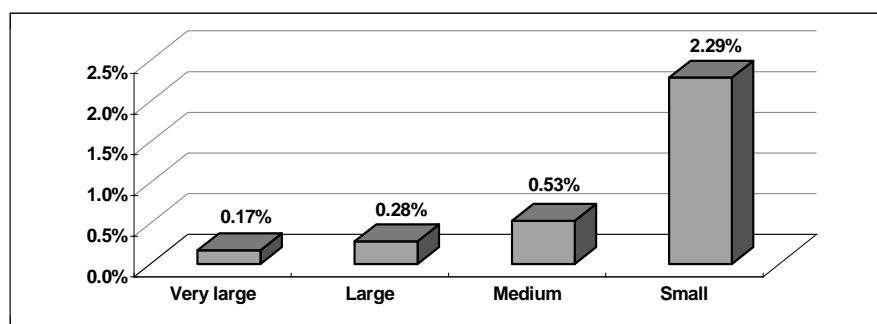
**TABLE 16**  
**BREAKDOWN OF MAJOR IT PURCHASES BY**  
**REPRESENTATIVE FIRMS IN 2001**

|                                   |        |
|-----------------------------------|--------|
| Servers                           | 3 130  |
| PCs                               | 58 447 |
| Printers                          | 18 914 |
| Router                            | 1 322  |
| Networking packages               | 355    |
| Office suites                     | 6 161  |
| Financial software packages       | 2 331  |
| Manufacturing automation software | 815    |

**Source:** China E-Commerce Yearbook Editorial Commission, "2002 China E-commerce yearbook", Beijing, China E-Commerce Yearbook Publisher, 2002.

Second, even though on the whole small firms' investment in IT continues to be low, this investment has represented a heavier burden for small firms than for large ones. From 1995 to 2000, total IT investment by small firms accounted for only 0.21% of all IT investment. Because SMEs generally have little capital, the ratio between their investment in IT and e-commerce and their total assets is generally higher than the ratio for large enterprises. Medium-sized enterprises, for example, have generally invested an amount equivalent to 0.53% of their total assets in IT, more than double the figure for large enterprises. For small firms, the ratio of IT investment to total assets is 2.29%

**FIGURE 6**  
**INVESTMENT IN IT/TOTAL ASSETS, FIRMS OF VARIOUS SIZES**



**Source:** China E-Commerce Yearbook Editorial Commission, "2003 China E-Commerce Yearbook", Beijing, China E-Commerce Yearbook Publisher, 2003.

Present purchasing trends for IT-related products point to continued growth in the IT hardware market, which will naturally require higher output of IT hardware.

## C. E-commerce

E-commerce is a new form of commerce. Its main components are online buying and selling of goods and services and e-payments. E-commerce transactions require a modern logistics system.

The growth and geographical expansion of digitization have accelerated the spread of e-commerce. In turn, e-commerce has not only played an active role in transforming the economic system and in making it more efficient but it has also had a profound effect on the structure of industry and led to the creation of new jobs. To a certain extent, e-commerce is also the driving force behind the retooling of traditional industry and advances in technology.

### 1. Trends in e-commerce

Since late 1995, when the Internet began to be adopted by the general public, it has gradually touched all aspects of society. Around the same time, a variety of commercial websites engaged in e-commerce and Internet companies emerged, leading to accelerated growth of e-commerce in China. Since 1997, a vast range of e-commerce sites have emerged and the Internet has been used increasingly for advertising. Beijing, Shanghai and other cities launched e-commerce projects in 1998. B2C portals such as <http://www.8848.com> first came online in 1999, and since then online purchases have become increasingly common. In the same year, other innovations such as e-companies, e-government, e-administration, online tax payments, online education and telediagnosis were introduced. Starting in 2000, e-commerce began to develop in earnest in China.

As shown in table 17, e-commerce is expanding quickly in China. The number of continually operating e-commerce websites rose from 575 in 2000 to 1,533 in 2002. Sales volume on e-commerce transactions has risen 3.5 times, from 77.16 billion *yuan* in 2000 to 355.6 billion *yuan* in 2003. B2B accounts for over 97% of total electronic sales, making it by far the dominant form of e-commerce in China.

**TABLE 17**  
**VOLUME OF E-COMMERCE TRANSACTIONS, 2000-2003**

|   | 2000         | 2001         | 2002         | 2003         |
|---|--------------|--------------|--------------|--------------|
| E-commerce websites                                   | 1 147        | 3 391        | 3 804        | n.a.         |
| Continually operating websites                        | 575          | 1 320        | 1 533        | n.a.         |
| Volume of e-commerce sales (billions of <i>yuan</i> ) |              |              |              |              |
| B2B   | 76.77        | 107.5        | 178.4        | 346.4        |
| B2C   | 0.39         | 1.3          | 2.5          | 9.2          |
| <b>Total</b>  | <b>77.16</b> | <b>108.8</b> | <b>180.9</b> | <b>355.6</b> |

**Source:** China E-Commerce Yearbook Editorial Commission, "China E-Commerce Yearbook", Beijing, China E-Commerce Yearbook Publisher, various issues.

### 2. How firms use e-commerce

A 2002 State Economic and Trade Commission survey on how firms use e-commerce found that most enterprises have websites, which have become the preferred means of establishing two-way connections and communicating with the public. There has been remarkable growth in the number of public websites. Eight-four percent of the firms surveyed had established public websites, 12% were in the process of doing so and only 4% had no plans to do so.

With the transition to an information society, enterprises began to see a causal link between having a website and growth. The Internet has allowed firms to increase sales abroad, undertake cooperative research, raise their market share and design production programmes. The survey showed that the top five uses for websites were to provide information on new products and services (73.5%), disseminate company-related news (70.5%), gather customer information (48.9%), provide after-sale service (25.4%) and take purchase orders (20.9%). In addition, 16.8% of the firms used the Internet to conduct online sales, 12.1% to make purchases and 7.7% to obtain supplies or conduct other types of online transactions. This points to a certain convergence between traditional firms and Internet-based firms (see table 18). Lastly, some firms also used the Internet to recruit employees, issue calls for bids, conduct official business from a distance, oversee the fulfilment of contracts, receive and send e-mail, raise their public profile or set up bulletin board systems (BBSs), among other uses.

**TABLE 18**  
**WAYS IN WHICH FIRMS USE WEBSITES**

| Use                                     | Number of enterprises | %    |
|---|-----------------------|------|
| Disseminate company news                | 402                   | 70.5 |
| Disseminate product/service information | 419                   | 73.5 |
| Gather customer information             | 279                   | 48.9 |
| Take orders                             | 119                   | 20.9 |
| Make online purchases                   | 69                    | 12.1 |
| Make online sales                       | 96                    | 16.8 |
| Order supplies                          | 44                    | 7.7  |
| Provide after-sale services             | 145                   | 25.4 |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

However, there is a significant disparity between the importance enterprises place on digitization and their actual use of e-commerce. Currently, firms are setting up websites more to raise their public profile than to conduct online purchases and sales. According to the survey (table 19), only a small number of firms (1.05%) have fully implemented e-commerce operations, a few firms (16.48%) have partially implemented such operations, while most firms lack the capability to conduct e-commerce transactions.

**TABLE 19**  
**PENETRATION OF E-COMMERCE**

| Capability of conducting e-commerce translations | Number of enterprises | %     |
|--|-----------------------|-------|
| Fully in place                                   | 6                     | 1.05  |
| Partially in place                               | 96                    | 16.84 |
| Not in place                                     | 468                   | 82.11 |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

In sum, most of China’s leading enterprises have an intranet in place, which they use to partially address the problem of how to allow information to be shared internally. In addition, most firms are able to use the Internet to send and receive e-mail, search for information and

manage websites. The remaining firms use networks solely to manage production and other operations, but for the most part they have not taken advantage of the opportunities offered by e-commerce.

### 3. Obstacles to adoption of e-commerce by SMEs

Fewer than 10% of all Chinese enterprises conduct e-commerce transactions. For China's more than 15 million SMEs, the percentage was even lower. Small scales of production and a lack of capital prevent them from establishing their own websites. Triangulation (e.g., B2B-e-commerce-website) has become the main mechanism through which SMEs conduct e-commerce transactions.

In 2001, the China Centre for Information Industry Development (CCID) conducted a survey on e-commerce penetration in 10 industries and sectors, including information, petrochemicals, manufacturing equipment, construction and materials, textiles, medical and pharmaceuticals, home appliances, automobiles, agriculture and foreign trade. One hundred firms from each industry or sector were selected, for a total of one thousand firms. Eighty percent of these firms had fewer than 80 employees and annual revenues of no more than 100 million *yuan*. All of them were registered at B2B websites. They were also among the first firms to engage in B2B transactions. A summary of the survey results is given below:

#### a) Differences among industries

The degree of e-commerce penetration differs greatly from one sector to another. Electronics manufacturers and foreign-trade firms were found to view having a website as very important: 85% of the foreign-trade firms and 80% of the electronics manufacturers had their own websites, followed by firms in the automotive industry, 55% of which had websites. Fewer than 25% of the firms in the remaining sectors operated websites—for instance, only 15% in the case of textile firms.

#### b) Volume of online trade

The volume of transactions by SMEs using the B2B model was quite low. As shown in table 20, for some 80% of the firms, both total sales and total purchases were less than 500,000 *yuan*, and more than 50% of the firms had not carried out any online transactions. Only 14.7% of the firms' had conducted sales with a total value of 500,000 *yuan* or more.

**TABLE 20**  
**ONLINE TRADING BY 1,000 FIRMS IN 2000**

| Value of online purchases<br>(x 10,000 <i>yuan</i> ) | % of firms<br>surveyed | Value of online sales<br>(x 10,000 <i>yuan</i> ) | % of firms<br>surveyed |
|--|------------------------|--|------------------------|
| 0  | 55.9                   | 0  | 52.9                   |
| ≤10  | 26.5                   | ≤10  | 26.5                   |
| >10-50   | 17.6                   | >10-50   | 5.9                    |
| >50-100  | 0                      | >50-100  | 8.8                    |
| >100-500   | 0                      | >100-500   | 5.9                    |
| <b>Total</b>   | <b>100</b>             | <b>Total</b>                                     | <b>100</b>             |

**Source:** China E-Commerce Yearbook Editorial Commission, "2002 China E-Commerce Yearbook", Beijing, China E-Commerce Yearbook Publisher, 2002.



### c) **Usefulness of B2B websites**

The survey found that enterprises did not view the contributions of B2B websites as important; only 11.8% saw them as very useful, 67.6% saw them as somewhat useful and 20.6% felt they were of no use at all.

## **D. Basic characteristics of IT use by firms and e-commerce**

This overview of demand for IT-related products and e-commerce in China allows four general conclusions to be drawn.

First, the hardware and software markets have experienced rapid growth. Hardware sales, for instance, have increased at an annual rate of over 12% and even exceeded 20% during several years. Moreover, software sales rose at an annual rate of more than 35%. However, for an economy as large as China's, computer hardware and software sales continue to be rather low. In 2002, computer-related sales represented only 4.1% of GDP. Given the prospect for continued strong economic growth in China, as the country continues to make a transition to an information society, hardware and software sales will likely increase even more.

A second, albeit obvious, feature of China's IT market is the leading role of hardware, with over 70% of all IT-related sales, compared with just 11% and 16% for software and information services. Increased demand for IT products by businesses and homes has been directly responsible for the rapid growth in IT output. Continued rapid growth in demand for IT-related products should lead to further growth in China's IT industry.

Third, the ever-rising investment in IT-related products has greatly raised the level of digitization. Once firms have Internet access, they use it mainly to gather information and raise their profile. Many firms are engaging in e-commerce. OA, human resource management and financial management are the most important results of the digitization of business information. By contrast, the use of SCM is still too limited for it to enhance firms' efficiency.

Fourth, although Chinese firms are only beginning to turn to IT and e-commerce, the use of these innovations is spreading fast.



### **III. SME development in the IT revolution**

SMEs play a crucial role in China's economic development. As of December 2003, 194,274, or 99%, of the 196,222 State-owned or privately owned industrial enterprises with annual sales exceeding 5 million yuan were SMEs. These firms accounted for 60.7% of sales, 57.8% of total assets, 75.7% of employment and conducted 60% of all transactions (Economy Daily, 22 July 2004).

#### **A. An overview of the role of SMEs in Chinese industry**

It is well known that China has a large number of SMEs in a wide range of industries and that SMEs play a vital economic and social role. Because of their importance in providing employment, promoting market competition, spurring technological innovation, meeting various market needs and forming a rational system of industrial organization, SMEs cannot be supplanted by large enterprises. Furthermore, China could not continue to expand at its current rapid pace without SMEs.

##### **1. Definition of SMEs**

SMEs are often defined in terms of number of employees or volume of sales. China has a relatively complex system for classifying industrial enterprises, and two methods are most often used, depending on the industry. One method classifies companies according to their production capacity and is most suitable for enterprises that make relatively simple products such as steel. In this classification method, small enterprises are defined as those with an annual production of 100,000 tons. The second method classifies enterprises according to the original value of their fixed assets; e.g., in the instruments industry, enterprises with fixed assets originally valued at less than 10 million *yuan* are classified as small. Hence, although no single method can be used to classify SMEs in China, in practice enterprises with fewer than 500 employees are considered small. The limit for medium-size enterprises is somewhat less clear-cut, but this category is generally considered to refer to enterprises with from 500 to 3000 employees. By contrast, in other countries enterprises of this size are often considered large. It should also be noted that before 1998, national statistics agencies gathered industrial data on enterprises at the village level or above that had independent accounting. Subsequently, these agencies have gathered data on both State-owned and non-State-owned enterprises with annual sales exceeding 5 million *yuan*.

(In statistics publications, these two types of enterprises are referred to as industrial “SOEs” and “large non-SOEs”.)

Given that the present analysis is based on data on enterprise size from national statistics agencies, and in consideration of China’s specific conditions, the category of SMEs as used herein covers a much broader range of enterprises than that covered by definitions in other countries.

## 2. The role of SMEs in the industrial economy

For this analysis of the role of SMEs, such indicators as number of enterprises, number of employees, value of output and exports and investment have been selected for different categories of enterprises from 1999 to 2002, in order to highlight these enterprises’ changing role.

The period from 1999 to 2002 witnessed the rapid expansion of Chinese industry, with an average growth rate of 9.3% per annum.<sup>1</sup> Industry growth was much higher than GDP growth, underscoring the fact that China is still in the industrialization stage.

### a) Number of enterprises and employees

New enterprises have continued to be created at a brisk pace. From 1999 to 2002, the number of small enterprises rose from 139,798 to 158,234, that is, by 13.19%, while the number of medium-sized enterprises increased by 1.39%, from 14,371 to 14,571, and that of large enterprises by 11.29%, from 7,864 to 8,752.

Industrial employment declined in this period. Employment at large enterprises dropped 11.72% of the entire workforce, from 21.59 million to 19.06 million, and the number of persons employed by medium-sized enterprises declined by 15.54%, from 9.52 million to 8.04 million. By contrast, employment at small enterprises rose by 4.27%, from 26.95 million to 28.1 million. This shows that small enterprises are the main engine of job creation.

### b) Value of output and exports

In 1999, output by small enterprises was 2.841 trillion *yuan*, accounting for 43.86% of total industrial output; that of medium-sized enterprises was 921 billion *yuan* (14.22%); and large enterprises accounted for 2.715 trillion *yuan* (41.92%). By 2002, however, the value of output by small enterprises was 4.218 trillion *yuan*, or 42.12% of all industrial production; that of medium-sized enterprises, 1.320 trillion *yuan* (12.87%); while large enterprises accounted for 4.719 trillion *yuan* of output (46.01%). Hence, SME output declined slightly.

Small enterprises account for a relatively high share of industrial exports. In 2002, they accounted for 960.18 billion *yuan* in exports, or 47.88% of total industrial exports, compared with 267.51 billion *yuan* (13.34%) for medium-sized enterprises and 777.83 billion *yuan* (38.78%) in the case of large enterprises.

### c) Investment

Two categories of data, namely, long-term investment and net fixed assets, are listed in table 21. The long-term investment made by enterprises in a particular year reflects the capital accumulation difference among industrial enterprises of different sizes. An enterprise’s net fixed assets are its actual physical capital. This category indicates the amount of capital owned by enterprises of different sizes.

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<sup>1</sup> Specifically, the growth rate in these years was 8.5%, 9.8%, 8.7% and 10.2%.

**TABLE 21**  
**ECONOMIC CONTRIBUTION OF ENTERPRISES OF VARYING SIZES**  
*(In billions of yuan)*

|               | <b>Firms<br/>(number of)</b> | <b>Workers<br/>(millions)</b> | <b>Value of<br/>output</b> | <b>Exports</b> | <b>Long-term<br/>investment</b> | <b>Net value of<br/>fixed assets</b> |
|---------------|------------------------------|-------------------------------|----------------------------|----------------|---------------------------------|--------------------------------------|
| <b>Small</b>  |                              |                               |                            |                |                                 |                                      |
| 1999          | 139 798                      | 26.95                         | 2 841                      | n/a            | n/a                             | 1 347                                |
| 2000          | 141 161                      | 26.79                         | 3 388                      | n/a            | n/a                             | 1 463                                |
| 2001          | 148 269                      | 26.59                         | 3 477                      | 784.62         | 99.44                           | 1 404                                |
| 2002          | 158 234                      | 28.10                         | 4 218                      | 960.18         | 111.85                          | 1 540                                |
| <b>Medium</b> |                              |                               |                            |                |                                 |                                      |
| 1999          | 14 371                       | 9.52                          | 921                        | n/a            | n/a                             | 657                                  |
| 2000          | 13 741                       | 8.62                          | 999                        | n/a            | n/a                             | 649                                  |
| 2001          | 14 398                       | 8.32                          | 1 172                      | 216.83         | 68.87                           | 699                                  |
| 2002          | 14 571                       | 8.04                          | 1 320                      | 267.51         | 72.43                           | 748                                  |
| <b>Large</b>  |                              |                               |                            |                |                                 |                                      |
| 1999          | 7 864                        | 21.59                         | 2 715                      | n/a            | n/a                             | 2 933                                |
| 2000          | 7 983                        | 20.19                         | 3 184                      | n/a            | n/a                             | 3 168                                |
| 2001          | 8 589                        | 19.51                         | 4 029                      | 623.07         | 490.77                          | 3 441                                |
| 2002          | 8 752                        | 19.06                         | 4 719                      | 777.83         | 496.47                          | 4 097                                |

**Source:** National Bureau of Statistics of China (NBS), "China industry economy statistical yearbook", Beijing, State Statistical Press, various issues.

**Note:** Industrial output in 1990 constant prices.

Official statistics indicate that small enterprises have relatively little capital. In 2002, small enterprises made 111.85 billion *yuan* in long-term investment, equivalent to 22.53% of the investment made by large enterprises (496.47 billion *yuan*). From 1999 to 2002, the value of small enterprises' net fixed assets increased by 14.33%, from 1.374 trillion *yuan* to 1.540 trillion *yuan*, although as a percentage of the net fixed assets of all firms, it declined from 27.28% to 24.12%. At the same time, the value of large enterprises' net fixed assets rose from 2.933 trillion *yuan* to 4.097 trillion *yuan*, or by 39.69%, easily eclipsing the rate for small enterprises. Large enterprises' share of all net fixed assets increased from 59.41% to 64.17% in the same period. In 2002, average net fixed assets for small enterprises was 54,804 *yuan*, while that of large enterprises was 214,953 *yuan*, almost four times the figure for small enterprises. This underscores the mostly labour-intensive nature of small industrial enterprises and their crucial role in job creation.

### 3. Regional distribution of SMEs

The uneven geographical distribution of industrial establishments in China is attributed to such factors as population distribution, transportation and history.

China's industrialization process started in the coastal regions, which attained a level of relatively advanced economic development due to the high concentration of industrial plants there. Later, the central government attempted to encourage the channelling of resources to the country's mid-western areas so as to accelerate industrial development there. However, this effort, consisting of administrative measures such as the Inland Industrialization Plan (1960-1975), did not meet with success. After 1978, amid China's accelerated transition to a market economy, the eastern coastal regions began to experience faster economic development and to account for an increasingly large percentage of output. The coastal areas had reached the stage of economic takeoff after only twenty years.

At the regional level, the Yangtze Delta, the Pearl River Delta and the Round Bohai Bay region boast relatively high levels of industrialization. Yangtze Delta includes the provinces of Shanghai, Jiangsu and Zhejiang; the Pearl River Delta comprises Guangdong Province; and the Round Bohai Bay region encompasses Liaoning, Hebei, Shandong, Beijing and Tianjin. In 2002, industrial output for these three regions was 7.252 trillion *yuan*, or 70.70% of China's total industrial output. Moreover, 30.952 million industrial workers, or 56.07% of the national total, were employed in these regions, which exported goods worth US\$ 280.69 billion, or 86.21% of the national total. This underscores the fact that China's industrial output is highly concentrated in the coastal regions, whose competitiveness can basically be seen as a yardstick for that of the entire country.

**TABLE 22**  
**REGIONAL BREAKDOWN OF INDUSTRIAL ENTERPRISES'**  
**ECONOMIC INDICES, 2002**  
(In billions of *yuan*)

| Geographic area   | Enterprises<br>(number of) | Industrial<br>workers<br>(thousands) | Output | Exports<br>(US\$ millions) | Investment | Net Fixed<br>Assets |
|-------------------|----------------------------|--------------------------------------|--------|----------------------------|------------|---------------------|
| Nation            | 181 557                    | 55 206                               | 10 257 | 325 596                    | 562.90     | 6 082.03            |
| Yangtze Delta     | 53 429                     | 11 534                               | 3 135  | 99 913                     | 124.78     | 1 208.22            |
| Pearl River Delta | 22 619                     | 6 444                                | 1 753  | 11 846                     | 344.73     | 6 157.80            |
| Round Bohai Bay   | 37 000                     | 12 974                               | 2 364  | 62 315                     | 1 44.95    | 1 529.15            |
| Other             | 68 509                     | 24 254                               | 3 005  | 44 905                     | 248.44     | 2 728.88            |

**Source:** National Bureau of Statistics of China (NBS), "2003 China industry economy statistical yearbook", Beijing, State Statistical Press, 2003 and "2003 China statistical yearbook", Beijing, State Statistical Press, 2003.

**Note:** Investment refers to total capital formation and investment in innovation during the year in question.

Yangtze Delta has a relatively complete industrial network and a high degree of economic competitiveness. In 2002, it had a population of 136.53 million, or 10.63% of the country's total. Its 53,429 industrial enterprises were 29.4% the total for the country, while its 11.53 million industrial workers represented 20.89% of the nationwide total, and its 3.135 trillion *yuan* in industrial output was 30.56% of the national total. The region's industrial exports, totalling US\$ 99.91 billion, were 22.17% of China's total, and its net industrial fixed assets, valued at 1.208 trillion *yuan*, represented 19.87% of the national total. Hence, with just over 10% of the country's population and 20% of its workers and industrial investment, Yangtze Delta accounted for 30% of China's industrial output and exports.

The Pearl River Delta mainly consists of Guangdong Province. With 78.59 million inhabitants, or 6.12% of the country's total population, Pearl River was the country's smallest region. Its industrial output was high relative to its population. It had 22,619 enterprises (12.5% of the country's total) and 6.44 million workers (11.67%). Its industrial output, 1.753 trillion *yuan*, accounted for 17.09% of the national total, while its industrial exports, valued at US\$ 118.46 billion, accounted for 36.38% of the nation's total. However, its industrial investment and net fixed assets accounted for only 10.12% and 7.97% of the nationwide total.

The Round Bohai Bay region is larger than either Yangtze Delta or Pearl River Delta. In 2002, its three provinces and two municipalities had a population of 224.5 million, or 17.48% of China's total population, and even more inhabitants than Yangtze Delta. Its 37,000 enterprises represented 20.4% of the country's total. Its 12.97 million workers accounted for 23.50% of the country's workforce. Its industrial output was 2.364 trillion *yuan* (23.05% of the national total),

while its exports were US\$ 62.32 billion (19.14%), and its industrial investment was 144.95 billion *yuan* (25.75%). Finally, its net fixed assets were valued at 1.529 trillion *yuan* (25.14%).

By contrast, the Round Bohai Bay region accounted for a higher percentage of industrial input than of output. For instance, the region had 25.14% of the nation's net fixed assets, compared with just 23.05% of industrial output and 19.14% of exports. Thus, its industrial productivity and export competitiveness were relatively weak.

#### 4. SMEs' role in industrial production

Because of rapid economic development and stiff competition, the structure of Chinese industry is constantly changing. The changing economic structure also means that there are no clear records of the entry of new enterprises into the market or of their growth and exit. At the same time, as the country is undergoing an economic transformation, the competitiveness of enterprises that frequently change hands is also variable. This explains the difference between the structure of industry in China and that of other countries or regions of the world.

The evolution of SMEs' share of output and employment in Chinese industry from 1996 to 2002 is given in table 23. These figures show, first, that output and employment by small enterprises initially decreased, from 48.46% in 1997 to 40.07% in 2000, and then bounced back slightly, to 41.12% in 2002. Similarly, their share of employment declined from 53.39% in 1996 to 46.42% in 1999 before increasing to 50.91% in 2002. Second, the share of output and employment corresponding to medium-sized enterprises has declined continuously. Third, small enterprises account for a higher percentage of total employment than of total output.

**TABLE 23**  
**PERCENTAGE OF SMES' PRODUCT VALUE AND LABOUR FORCE**  
(In percentages)

|                                 | 1996  | 1999  | 2000  | 2001  | 2002  |
|---------------------------------|-------|-------|-------|-------|-------|
| <b>Small enterprises</b>        |       |       |       |       |       |
| Output                          | 48.10 | 43.87 | 44.75 | 40.07 | 41.12 |
| Employment                      | 53.39 | 46.42 | 48.19 | 48.86 | 50.91 |
| <b>Medium-sized enterprises</b> |       |       |       |       |       |
| Output                          | 15.91 | 14.22 | 13.19 | 13.50 | 12.87 |
| Employment                      | 17.23 | 16.39 | 15.51 | 15.29 | 14.58 |

**Source:** National Bureau of Statistics of China (NBS), "China industry economy statistical yearbook", Beijing, State Statistical Press, various issues.

**Note:** Output is calculated on the basis of constant 1990 prices. Figures for 1996 and 1997 include industrial enterprises at above the village level with independent accounting; starting in 1998, they include SOEs and non-SOEs with annual sales exceeding 5 million *yuan*.

As mentioned, the particular circumstances related to China's economic transformation make it difficult to determine whether the percentage of small enterprises in the economy as a whole has risen or fallen. Still, the statistics used for this study indicate that SMEs are playing an increasingly pivotal role in job creation. In China, a country with a vast territory and continuously rising demand, it is nearly impossible for large enterprises to become monopolies. This leaves ample room for SMEs to emerge and thrive. Of course, different technological requirements in different industries and SMEs' varied degree of integration into the global economy affect how individual SMEs perform.

## B. Case studies on use of e-commerce and SCM in various industries

### 1. Introduction

There are three main stages of network utilization by enterprises in China. The first is the basic, or preparatory, stage of IT utilization, such as the implementation of OA or financial management information systems or the construction of internal ERP systems. In the second stage, the enterprise begins to use these networks. For the most part this consists in the development and implementation of such network functions such as information exchange, product promotion and the first steps to use SCM/ERP. The third stage is e-business, when there is coordination or e-trade among enterprises.

Most SMEs in China are still at the initial stage of IT use, although some have begun to use networks to exchange information. And since very few enterprises can conduct e-business transactions, only a small percentage of business is conducted online.

According to a market survey conducted in September 2001 (see table 24), enterprises that engage in e-business are more likely to search for and disseminate information over the Internet. Approximately 73% of small enterprises use the Internet to search for information and 65% use it to disseminate information, slightly lower than the figures for large enterprises. However, the number of small enterprises that handle payments online is much lower than that of large ones. No obvious differences were found between small and large enterprises in IT use for personnel management and financial management. Relatively fewer enterprises of all categories use IT for supply chain integration than for other applications.

**TABLE 24**  
**USES OF E-BUSINESS BY ENTERPRISES OF VARIOUS SIZES**  
(In percentages)

| Main use of e-business    | Size of enterprise |        |       |
|---------------------------|--------------------|--------|-------|
|                           | Large              | Medium | Small |
| Website construction      | 80.4               | 57.1   | 46.2  |
| Information gathering     | 76.5               | 74.6   | 73.1  |
| Information dissemination | 82.4               | 65.1   | 65.4  |
| Procurement               | 33.3               | 36.5   | 23.1  |
| Sales                     | 60.8               | 49.2   | 38.5  |
| Payments                  | 31.4               | 12.7   | 7.7   |
| Personnel management      | 41.2               | 15.9   | 34.6  |
| Financial management      | 41.2               | 27.0   | 34.6  |
| Supply chain integration  | 9.8                | 7.9    | 11.5  |
| Distribution channels     | 15.7               | 20.6   | 19.2  |

**Source:** State Information Centre/China Association of Information (SCI/CAI), “2002 China information yearbook”, Beijing, China Information Yearbook Press, 2002.

To examine in greater depth how SMEs apply IT for export promotion, this section will focus on SMEs in Yangtze Delta, the region in China with the most dynamic economic development. In addition, the region’s relatively high degree of openness gives enterprises there a greater capacity to apply IT. Shanghai is the most important city in the region. Six groups of SMEs were selected. Their locations can be seen in figure 7. The case studies are:



- A small import and export company in Shanghai;
- Silk firms and the related industrial cluster in Wujiang;
- Software-export enterprises in Hangzhou;
- Appliance manufacturers in Cixi;
- An IT-industry cluster in Suzhou;
- An electronics-industry cluster in Ningbo.

**FIGURE 7**  
**GEOGRAPHIC DISTRIBUTION OF CASE STUDIES**



Source: Prepared by the author.

## 2. Xinmin Textile Technology

Xinmin Textile Technology Co. Ltd., which specializes in textile products made of silk, is located in the town of Shengze, near the city of Wujiang, in Jiangsu Province.

### a) Textile-industry cluster in Shengze

One of China's most famous silk-manufacturing clusters, Wujiang has a reputation for "producing tens of thousands silk garments every day and for providing clothing for everyone". Wujiang has long specialized in making silk textiles. By late 2003, the silk-textile industry in Wujiang employed 116,040 persons, an increase of 87.29% over the 61,958 employed in 1999. Sales were 33.197 billion *yuan*, nearly three times the figure for 1999, 11.15 billion *yuan*.

The town of Shengze is the hub of production and commerce for the silk-textile industry in Wujiang.<sup>2</sup> A silk-textile industry cluster with distinct advantages has emerged, centred on Shengze and spanning four adjacent towns. Production has branched out from silkworm silk to hundreds of kinds of silk in four major categories, including intertexture silk, synthetic silk and synthetic fibre. In 2003, Shengze had a population of some 230,000 and a per capita GDP of US\$ 3,800. About 90% of the town's output was in the silk-textile industry. There are more than 1,200 silk manufacturers and a well-developed supply chain. The steps in the production chain are: filature, weaving, printing and dyeing, finished product, in an optimal industrial network based on research and development (R&D), production, distribution, export and logistics. This work organization has made Shengze China's largest centre of production of silk textiles.

**TABLE 25**  
**STATISTICS ON WUJIANG'S SILK INDUSTRY CLUSTER**

| Index                                       | 1999    | 2000    | 2001    | 2002    | 2003    |
|---|---------|---------|---------|---------|---------|
| 1. Enterprises                              | 687     | 907     | 1 177   | 1 689   | 2 024   |
| 2. Workers                                  | 6 1958  | 62 143  | 68 801  | 103 368 | 11 603  |
| 3. Main products                            |         |         |         |         |         |
| - Silk fabric (x 10,000 metres)             | 78 553  | 131 360 | 217 248 | 368 518 | 492 801 |
| - Printed and dyed fabric (x 10,000 metres) | 168 517 | 210 517 | 206 714 | 224 971 | 267 476 |
| - Polyester (tons)                          | 74 867  | 180 617 | 431 716 | 515 264 | 438 128 |
| - Synthetic fibre (tons)                    | 135 070 | 151 758 | 175 385 | 147 366 | 310 337 |
| 4. Income on sales (billions of yuan)       | 11.15   | 12.86   | 15.10   | 24.30   | 33.20   |

Source: Prepared by the author.

## b) SCM by Xinmin Textile Technology

Xinmin Textile Technology is a stock company with a complete industrial supply chain. Accounting is kept independently for each of Xinmin's six subsidiary factories. Hence, Xinmin is a medium-sized enterprise composed of several small enterprises. Its registered capital is 38.47 million *yuan*, or US\$ 4.6 million.

As seen in table 26, Xinmin Textile Technology is a multifaceted enterprise that specializes in chemical-based fibres and silk fabrics. Its secondary products include reagents, prints and dyes, clothing and embroideries. Annually it produces 42 million metres of silk fabric, synthetic silk and synthetic fibre, 75 million metres of printed and dyed fabrics, 80,000 tons of synthetic fibre, 500,000 garments and 8,000 tons of textile reagents. It owns a complete industrial supply chain that includes cutting, threading, weaving, dyeing and assembling the finished product. Annual sales rose from 260 million *yuan* in 2000 to 398 million *yuan* in 2003, that is, by 53.1%.

<sup>2</sup> In the early days of the Ming Dynasty, Shengze, Suzhou, Hangzhou and Huzhou were renowned as the "Four Silk Capitals" of China.

**TABLE 26**  
**INTERNAL INDUSTRIAL SUPPLY CHAIN AND NUMBER OF**  
**WORKERS AT XINMIN TEXTILE TECHNOLOGY**

|                        |              |
|------------------------|--------------|
| Enterprise             | Workers      |
| Filature               | 500          |
| Chemical-fibre weaving | 300          |
| Silk weaving           | 1 000        |
| Printing and dyeing    | 300          |
| Reagents               | 70           |
| Garments               | 600          |
| <b>Total</b>           | <b>2 770</b> |

**Source:** Prepared by the author.

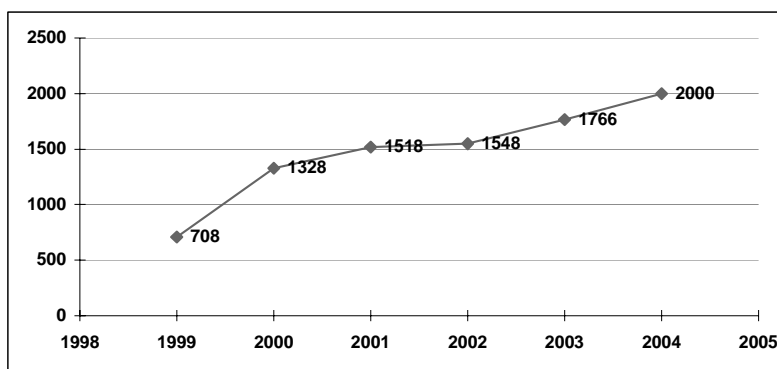
Xinmin is a labour-intensive enterprise. Eighty-seven, or 3.22%, of its employees, have at least an undergraduate degree. The extent of use of information management techniques inside the company is relatively low, with only 60 PCs and limited OA resources. Staff in the finance and marketing departments has their own PCs. The computers in the managing department have Internet access for communication with persons outside of the company. The finance department, however, only has an intranet.

Nevertheless, Xinmin has not completely switched over to digitized supply chain management. Internal matters such as production plans, procurement, production and inbound and outbound logistics are still handled in meetings and over the telephone, although e-mail, IP telephony and instant messaging are now increasingly being used for SCM, saving time and money while improving efficiency in interdepartmental communications. In particular, e-mail and IP telephony have reduced fax and telephone charges by about 30%.

### c) The use of e-business for exporting

Xinmin received an export license in 1993. Exports now represent about 50% of sales, with export volumes increasing dramatically in recent years —from US\$ 7.08 million in 1999 to US\$ 17.66 million in 2003. It was predicted that exports would total US\$ 20 million (figure 8) in 2004.

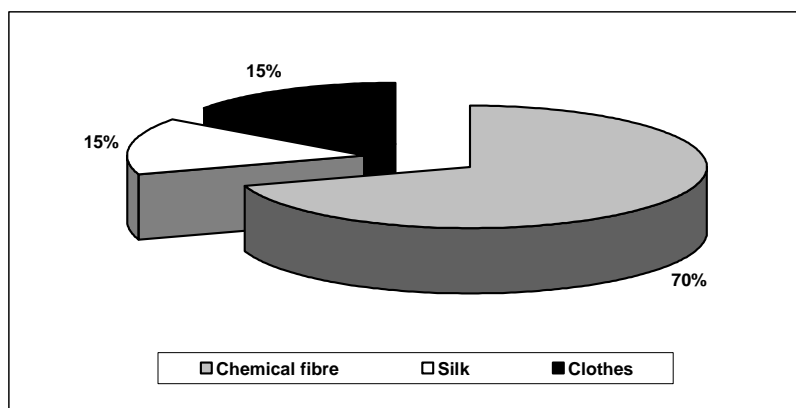
**FIGURE 8**  
**EXPORTS BY XINMIN TEXTILE TECHNOLOGY**  
*(In millions of U.S. dollars)*



**Source:** Prepared by the author.

The reason for this rapid increase in exports lies mainly in China's low labour costs, which give textile exporters a comparative advantage. Textiles have traditionally been China's leading industry. Moreover, silk goods are the most competitive of Xinmin's products. As shown in figure 9, 15% of Xinmin's exports are silk fabrics; 70%, chemical-based fibre cloth; and 15%, clothing.

**FIGURE 9**  
**XINMIN'S EXPORT MIX**



Source: Prepared by the author.

Ninety percent of Xinmin's textile and clothing exports go to the European Union. Xinmin contacts new customers mainly at global textile and garment fairs, including two each in Europe, Hong Kong (China), and China. These fairs bring together both Chinese and foreign buyers, allowing Xinmin to meet directly with both old and new clients and make new business contacts. Although meetings last only 20 to 30 minutes, they allow trust to be enhanced between Xinmin and its clients. Clients can later enter Xinmin's website (<http://www.xmtex.com>) for more information on the company and any new products it has introduced. This underscores the importance for enterprises to have their own websites to expand their customer base.

Xinmin uses its website to post information on new products and on technology-improvement projects. Hence, the website is mainly used for advertisement. The company has joined Zhejiang Chemical Fibre Net to enhance its access to information. It does not yet conduct e-business transactions.

As a manufacturer, Xinmin has assumed a wait-and-see approach to e-business. When its major clients require it to do business over the Internet, Xinmin will introduce an e-business system in line with its clients' preferred purchasing methods.

#### **d) Government policies to promote e-business**

Enterprises assume that the more advanced the level of e-government, the faster e-business will progress. They also assume that the introduction of online customs applications, among other forms of electronic administration, will lead exporters to substantially enhance their degree of digitization.

Customs requirements play a pivotal role in international trade, and involve such parties as brokers, banks and shipping and insurance companies. National import and export authorities such as trade inspectors also play a role in customs matters. The introduction of e-customs procedures naturally leads to a higher level of digitization and efficiency among enterprises.

In China, inspection authorities are presently using electronic data interchange (EDI), which allows exporters to download forms from the Internet and then complete and return them by e-mail. Inspection authorities have digitized documents to allow exporters to submit them online 24 hours a day, whereas in the past inspection procedures were conducted only once a day. This appears to have greatly streamlined import and export procedures.

However, for e-trading facilities for SMEs to be established, the public needs to support e-commerce development facilities. Hence, in Shengze, to encourage the further development of the silk industry cluster, the municipal government is promoting e-business as the most important medium for wholesale transactions in the future, as it believes that the development and spread of IT will promote the transformation of China from a country with “brick-and-mortar” markets to virtual ones. Due to their financial constraints, SMEs have not begun to use e-business. Therefore, there is an urgent need for local governments to aggressively promote this new form of conducting business.

The Shengze municipal government has invested 7.5 million *yuan* in the construction of an e-business platform, which will constitute the cornerstone of more than 20 subsystems such as ERPs for SMEs, information-enhancement systems and an internal information system for the Oriental Silk Market, among others. The purpose is to raise the level of digitization of Shengze’ silk industry and meet SMEs’ need to find more ways to take advantage of e-business.

The e-business platform for the Oriental Silk Market in Shengze (<http://www.silkcapital.com>) opened in April 2004. It has two basic functions: it serves as a regional e-business service hub for the silk industry, which was recently expanded to include the textile industry, and it provides a modern logistics platform that gives “one-stop” service for SMEs.

#### **e) Obstacles to IT use by Xinmin**

An examination of IT and e-business use by Xinmin and by the Shengze silk cluster overall indicates that online trading is hindered by the following factors:

First, Chinese textile enterprises are still accustomed to traditional business practices as summed up, for example, in the saying “with transactions, you swap goods for cash in hand”, which describes the main way of doing business at the Shengze silk market. Online commercial credit systems have not yet gained acceptance in China due to business’s distrust of e-business and wariness at the possibility of being cheated. This is a built-in constraint.

Second, the main result of the emergence of sites for online purchasing and the spread of financial software has been increased OA. The lack of computerization in SCM is closely linked to the small-scale production in labour-intensive nature of industry, which formed very serious competition for both demanders and suppliers. Nevertheless, the widespread adoption of e-mail is the most obvious form of IT utilization in the silk industry.

Third, e-business has not been adopted as a channel for exporting silk textiles, as trade fairs continue to be the main method for expanding the export market. Any increase in the volume of textiles traded over the Internet will require importers to take the initiative, since the adoption of e-business by clients would force exporters to enhance their e-business capabilities.

Fourth, one of the reasons for the lack of acceptance of e-business by traditional textile enterprises is the high cost of trading online. For example, the EDI centre of the Canton Trade Fair enterprises charges 10,000 *yuan* a year for registration and 6,000 *yuan* a year for network membership. In other words, what is purported to be an e-business platform has actually become a front for a government agency to charge hidden fees. Furthermore, enterprises have not found that registration with an e-business platform leads to higher export volumes or increased sales opportunities.

Fifth, there are limitations stemming from the payment system. China's online bank settlement system has not yet been connected to the export-document service system. And customs authorities are not linked electronically to the banks that handle foreign currency, which precludes online settlements and tax payments.

### **3. Software export cluster in Hangzhou**

#### **a) New characteristics of software industries**

In recent years, the trend toward digitization, networking and miniaturization in IT has led to a greater need for software products and services, which, in turn, has spurred rapid growth in China's software industry.

The ability to provide assistance has become an important selling point in the software market and has driven recent growth in the software industry. Firstly, this is because the market for services is growing at a faster pace than the market for software products themselves, especially as the informatics market gains an increasingly large share of the software and related-services market. Moreover, as software becomes more complex, providing assistance has become indispensable. And companies are increasingly promising to provide assistance over the Internet, which has led to the creation of new software-service markets. Secondly, competition among software makers at the product level has been replaced with competition based on the ability to provide assistance and solutions to problems. This marks a momentous change for the software industry. At present, with clients' software needs going beyond software products themselves and extending to trouble-shooting, merely selling software does not suffice. The complexity involved in implementing ERP and SCM systems means that products and assistance with using them have become inseparable elements when software firms are making sales.

In addition, the development of Internet-related software and the provision of Internet-based services have resulted in the rapid development of the informatics industry. With the spread of pre-installed software on various types of equipment and products, the variety of software products has increased, leading to even greater growth in the software industry.

#### **b) Basic characteristics of software-exporting enterprises in Hangzhou**

The three main centres of China's software industry are Beijing, Shenzhen and Hangzhou. An examination of SME exports shows that software exports from Hangzhou have increased greatly in the last three years, turning this city into an important hub of the software industry.

There are three salient features of software exports from Hangzhou. First, most software exporters were established after 2002. Second, software enterprises are small, with an average of about 100 employees, making them typical information-intensive small enterprises. Third, exports of software products and services have increased dramatically.

Interviews were conducted at three small enterprises specializing in software for export. All three were set up between 2001 and 2003. Table 27 lists their names and websites.

Handsome International was founded in August 2002 by Hangzhou Handsome Electronics Group, a software developer that focuses on financial applications such as security and banking. It also sells software to funding institutions. Handsome was established to meet increasing demand for outsourcing from the software industry in the United States and Japan. The company targets the international software market. Hence, Handsome is a small export-oriented software provider. The number of employees at Handsome grew from 15 in 2002 to 102 in June 2004, and sales rose from US\$ 0.12 million in 2002 to US\$ 1.2 million at the end of 2004.

**TABLE 27**  
**NAMES AND WEBSITES OF THREE SOFTWARE ENTERPRISES**

| <b>Name</b>  | <b>Website</b>             |
|--|----------------------------|
| Hangzhou Handsome International Software Co., Ltd.<br>(Handsome International)   | www.hsinternational.com.cn |
| Zheda Innovation UniverseSoft Co., Ltd.<br>(UniverseSoft)                        | www.zdus.com               |
| Zhejiang Innovation Fuji Technology Co., Ltd.<br>(SIF: Software Innovation Fuji) | www.sifinic.cn             |

**Source:** Prepared by the author.

UniverseSoft was established in late 2001 by four professors and fifteen graduate students at the State Street Technology Centre located at Zhejiang University. This centre had been developing software for the United States-based State Street, a large financial concern. State Street required software-consulting services to meet the large demand of its development team. However, the high turnover of graduate students made it difficult for the technology centre to continually meet clients' software needs. UniverseSoft has been able to recruit software engineers and conduct a large number of software development projects. UniverseSoft was set up earlier than was Handsome and its staff has grown from 15 at the end of 2001 to 170 in June 2004. Its exports increased from US\$ 500,000 in 2002 to US\$ 1 million in 2003 and were expected to reach US\$ 2.5 million by 2004.

SIF, a joint venture that specializes in making software for export to Japan, was founded by Zheda Innovation, which owns 65% of the company's equity, and Fuji Electric of Japan, which holds the remaining 35%. Fuji Electric intended for the joint venture to develop software on commission and lower its costs, since software development is expensive in Japan. For its part, Zheda hoped to expand software sales in China as well as to export software. SIF is a small enterprise oriented to making software exclusively for Japanese outsourcing projects. Its main tasks are writing and testing software codes. By the end of June 2004, after only one year in business, SIF had 60 employees and sales during its first year were expected to reach US\$ 1.3 million.

**TABLE 28**  
**SIZE OF SOFTWARE FIRMS IN HANGZHOU**

| <b>Firm</b>  | <b>Employees</b> |             |             | <b>Sales (US\$ millions)</b> |             |             |
|--------------|------------------|-------------|-------------|------------------------------|-------------|-------------|
|              | <b>2002</b>      | <b>2003</b> | <b>2004</b> | <b>2002</b>                  | <b>2003</b> | <b>2004</b> |
| Handsome     | 15               | 80          | 102         | 0.12                         | 0.36        | 1.2         |
| UniverseSoft | 40               | 80          | 170         | 0.50                         | 1.00        | 2.5         |
| SIF          | -                | 5           | 60          | -                            | -           | 1.3         |

**Source:** Prepared by the author.

**Note:** Numbers of employees are as of June 2004. Sales for 2004 are predictions from the respective firms.

### **c) Technological capacity of Hangzhou's software enterprises**

Software makers provide three types of products and services: First, they sell downloadable software applications that run, for instance, on the Windows operating system. Second, they provide solutions—for example, the development and installation of system software tailored to meet a specific business need, including financial applications, applications for government offices, etc. Third, they provide testing and other services.

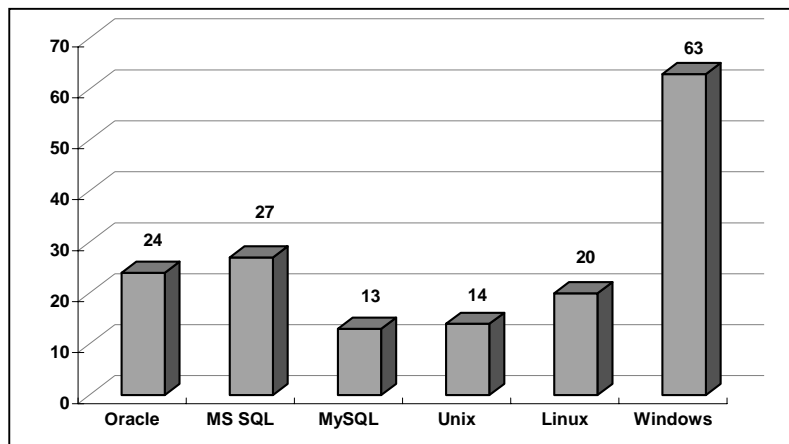
In the United States, most software applications are currently being developed by the likes of Microsoft, Hewlett-Packard and Oracle. By contrast, Hangzhou's small software exporters mainly focus on providing solutions and, especially, services, and they are relatively more competitive and experienced in developing services software.

**i) Technology used by Handsome International**

Handsome has expertise with the following technologies:

- OPEN
  - Java C# VB.net
  - Application Framework
    - Struts ASP.NET WA(NEC)
  - App Server
    - Weblogic Websphere Resin
- Appli
  - C/C++ Delphi
  - Crystal Report
- DB:
  - Oracle MS SQLServer
- UML

**FIGURE 10**  
**OPERATING SYSTEMS AND DATABASES IN WHICH HANDSOME'S**  
**ENGINEERS HAVE EXPERTISE**  
*(Number of engineers)*



**Source:** Hangzhou Handsome Electronics Co., Ltd, Get Close to Handsome, Hangzhou, Zhejiang, 2004.

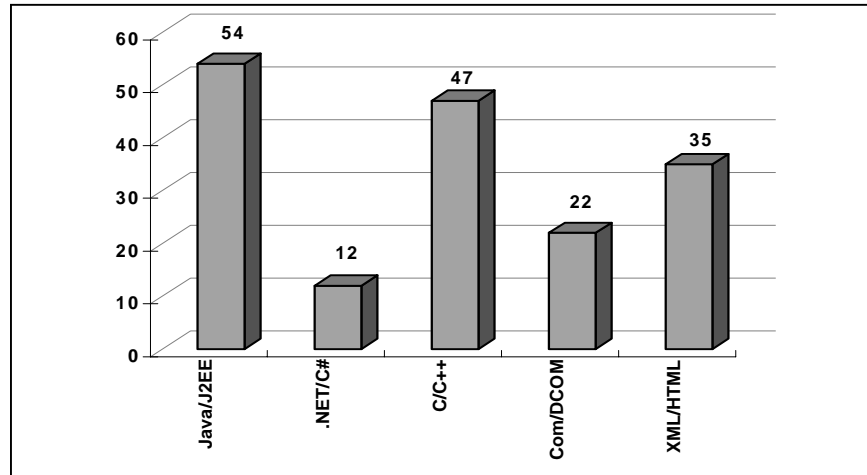
From October 2003 to March 2004, Handsome was commissioned by the Japanese Government to design water and wastewater management, gas management and financial management systems. It also collaborated with Nokia on the development of the third generation (3G) platform and with the Japan-based NEC Electronics on the development of an ERP system.

Figure 10 shows the basic structure of software developed by Handsome's software engineers. In operating system and database applications, the company has focused on programs



running on Windows, whereas in programming languages/frameworks, it has specialized in Java/J2EE, C/C++, XML/HTML.

**FIGURE 11**  
**PROGRAMMING LANGUAGES/Frameworks IN WHICH HANDSOME'S**  
**ENGINEERS HAVE EXPERTISE**  
*(Number of engineers)*



**Source:** Hangzhou Handsome Electronics Co., Ltd, Get Close to Handsome, Hangzhou, Zhejiang, 2004.

## ii) Successful technology development by UniverseSoft

UniverseSoft has a great deal of expertise in software R&D. Moreover, it has set a high standard for global collaborative efforts in engineering software applications and in project management.

The programming languages it uses include Java, C/C++ and Visual Basic, and it writes programs for the AIX, Linux and Windows operations systems. The database platforms it uses include IBM DB2, Oracle and Microsoft SQL Server. Its application development platforms and tools include IBM's WebSphere Application Server, WebSphere Portal Server, Websphere Studio, VisualAge C/C++, Rational Rose and Rational Robert and Microsoft's Visual Studio.NET.

The company's success underscores its skill at developing software technology. One of its success stories is its reengineering of the Lattice system. Lattice is an equity trading and execution system developed by State Street in the mid-1980s. Although Lattice was a "legacy" system, and thus, difficult to operate and maintain, it was of critical value to State Street. UniverseSoft completely rebuilt the system with state-of-the-art technologies and provided it with new, enhanced features. Hence, the system has experienced something of a rebirth. As of November 2002, US\$ 13.1 billion in equity had been traded with this system. UniverseSoft's skill in redesigning this system boosted its reputation with State Street.

## d) IT utilization by software enterprises

Since software enterprises specialize in IT-related services, they are able to make full use of IT innovations in their daily work. This enhances their ability to use the Internet and to take full advantage of technological breakthroughs.

**i) PC use**

All staff at the Hangzhou software enterprises have PCs, and programming teams have testing instruments and servers for software development. All the enterprises have broadband access. However, to ensure security in software development—that is, to protect information on development methods and customer data—and prevent virus attacks, the companies' intranets do not have Internet access, although individual PCs do have such access.

**ii) Websites**

The software enterprises in Hangzhou have not greatly stepped up their efforts to promote business through websites. Their websites mainly serve to showcase the companies and allow them to project a positive image. However, software makers' websites are different from those of other types of enterprises in three ways: First, the content is updated more frequently—once a week on average—with information on software product developments. Second, software makers provide online customer support on their websites and software engineers answer questions and help clients solve minor problems in real time. Also, some software packages are available for downloading from these websites. Third, software enterprises have set of these websites to ensure that they are listed on Google, and hence, for advertising purposes. On occasion, this has created business opportunities for these companies. For example, a Brazilian company commissioned Handsome to develop software for it after entering the company's website. Generally, however, software enterprises rarely find new clients over the Internet.

**iii) How software is exported**

The second major surge in outsourcing of major software products for Europe, the United States and Japan came in 2002. Globally, 75% of software is in English and about 10% is in Japanese.

The geographic shift in software production has made China's Yangtze Delta an important player. In particular, the Hangzhou district has carried out many software projects for Japanese firms. The first surge in software outsourcing from Japan occurred from 1992 to 1993, when software enterprises in Dalian and Beijing were major contractors. The reason for the shift to Yangtze Delta lies mainly in the rapid economic development of the region, which is becoming an important centre of economic activity in China as well as a production base for the global economy. In the light of this shift, Japanese enterprises increased their investment in the region. Moreover, software applications made by Hangzhou enterprises are geared to the domestic market, which enables them to also adapt software for foreign firms entering the Chinese market. For these reasons, Hangzhou has emerged as a leading player in the current phase of global software outsourcing.

Software products are now exported over the Internet. Before broadband technology had sufficiently matured, companies had to send documents to their clients by fax or courier. This was expensive and time-consuming, as well as risky, since documents could be lost en route. The situation was even more complicated in the case of time-sensitive documents, since sending correction by courier could mean losing valuable time. The use of the Internet ensures that information can be shared and updated in a timely fashion and allows software versions to keep pace with changes in clients' requirements.

**iv) Data exchange with XML**

Since Chinese software makers find EDI expensive, they use the extensible mark-up language (XML) format to exchange data over public networks.

### v) Videoconferencing

Software enterprises mainly use e-mail and IP telephony to communicate with their clients, for example, to confirm technology standards and report on progress in software development. Videoconferencing, an important medium for coordinating tasks with clients, is conducted on public networks over an encrypted line. UniverseSoft and SIF hold videoconferences with their clients each week to discuss any problems with software projects.

### vi) Product deliveries and payments

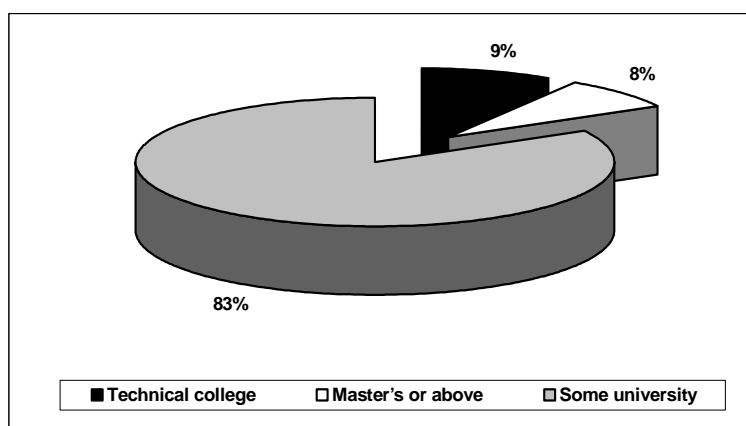
Hangzhou firms export software and deliver packages of codes and documents over networks. If a client does not require installation and on-site training for a software package, receiving it in this manner and then testing it online is very convenient. When a client needs installation and training, the software maker will send personnel to work on-site. Clients are required to pay one month after the online transfer, using traditional international payment methods.

## e) Competitive advantages of and incentives offered by Hangzhou software makers

Clearly, the first competitive advantage is the low cost of labour, the software industry's highest expense. Software engineers are paid one-fifth of what their counterparts in the United States and Japan earn. In general, engineers at Hangzhou software makers are relatively young, and most are university graduates. The software industry here is dominated by young people.

Figure 12 shows the human resource structure of Handsome, where employees' average age is 26. Eighty-three percent of its engineers are university graduates, although only 8% have a master's degree.

**FIGURE 12**  
**EDUCATIONAL LEVEL AMONG HUMAN RESOURCES AT**  
**HANDSOME INTERNATIONAL**



Source: Prepared by the author.

Second, demand in China is expected to grow considerably. By transferring software-development operations to Hangzhou and conducting business with Chinese software enterprises, foreign firms become more familiar with China's software industry and market, thus positioning themselves to take advantage of future demand in China.

Third, the software-development and language skills of Chinese engineers are steadily improving. In addition, the firms here have upgraded their IT-related infrastructure.

India was the main beneficiary of the first global surge in software outsourcing. Today, however, with China's reforms in higher education and its larger number of university graduates, Chinese workers have greatly improved their skills in English and have acquired experience in software development. China's software-development technology is gradually approaching the level found in developed countries. For example, Hangzhou software makers are more skilled in developing software for the Japanese market than are their Indian counterparts.

Moreover, Hangzhou's software industry has close ties with university computer and software departments. Even small and medium-sized software firms are frequently in contact with universities, from which they recruit top graduates in software development. This has given firms in Hangzhou strong skills in high-end software development. UniverseSoft, for example, has carried out many software development and maintenance service projects for State Street. Joseph Antonellis, State Street's chief information officer, insists that his company's programme with UniverseSoft is not primarily about cost savings, although he acknowledges that lower costs are one of the advantages. He also notes that graduate students are paid a salary and that UniverseSoft "is not a sweatshop".

#### **f) Ways of increasing market share**

Software developers find it very difficult to increase their market share. Unlike other goods, software requires customers to have a certain amount of technology already in place. Except for entertainment software, most software products enjoy a relatively high degree of customer loyalty. Once customers have become accustomed to a given line of software products, they will not easily switch brands. Moreover, the purchasing decisions of new customers are often influenced by more experienced customers. Hence, advertising is always more important than product performance, and sometimes even more important than price.

However, once a firm has established a market presence and earned a reputation as a software developer, it can be assured of a relatively stable customer base. Software clients in Hangzhou can be divided into three categories:

- IT firms, especially telecommunication concerns, which have a high degree of expertise with using IT;
- financial firms;
- government agencies that need software and related services for public administration.

In general, most industrial manufacturers have little demand for software products and related services.

The client base of Hangzhou's three software exporters indicates that these firms have penetrated the foreign software market in the following ways: first, by attending IT trade fairs and forums to contact potential clients and promote their products and services; second, by working on commission for foreign clients in international bids for software-development contracts; third, by relying on a network of agencies and former employees to win contracts for development projects. UniverseSoft, for example, built up its client base through the contacts it made at the State Street Technology Centre at Zhejiang University. State Street set up the centre with the intention that it would be in part an R&D lab and in part an application outsourcer.

Another example is SIF. Chinese software engineers in Japan promoted SIF in Japan, and software engineers familiar with the Japanese market have been recruited to help the company expand its market there.

Except for a small number of software projects contracted online, Chinese software developers generally follow traditional business practices, that is, they deal with their clients in person. Although communication is carried out online during the software development process, face-to-face communication is required to establish cooperation-based partnerships and long-term business relationships. In sum, Internet-based communication has become an established business practice, but not all business can be conducted over the Internet.

#### **g) Main obstacles faced by software exporters in Hangzhou**

Hangzhou software developers point to two distinct hurdles: first, the quality of university education in real-life program development, which requires software makers to spend six months to a year training university graduates; second, the dearth of software engineers fluent in Japanese, to handle the large number of Japanese software outsourcing projects.

#### **h) Main lessons from Hangzhou's software exporting business**

Hangzhou's experience exporting software provides several useful lessons.

##### **i) National and local government promotion policies**

Clause six of Document No. 18, titled Several Policies to Encourage the Development of the Software Industry and Integrated Circuit Industry, issued by the State Council of China on 24 June 2000, gives software enterprises established in China certain income-tax exemptions. Under this guideline, newly established software developers may qualify for full exemptions "for two years and partial exemptions for three years" after the year in which they first turn a profit. Moreover, in 2002, the central government issued Action Plans for the Prosperity of the Software Industry and stated that software-export bases would be encouraged so as to promote the domestic software industry.

Hangzhou municipality has implemented the guidelines giving tax breaks to software exporters and supports their attempts to build up capital. In addition, software parks have been set up where land is leased at a discount to software developers.

##### **ii) Improved infrastructure through IT application**

In the last five years, sizeable government investment projects in communications and broadband infrastructure have accelerated the spread of the Internet. In Hangzhou, 100 MB of bandwidth has been made available to communities, 10 MB to buildings and 1 MB to households.

Moreover, the completion of new highways in the Yangtze Delta has made transportation in the region easier. The Zhejiang Province highway was lengthened from 344 km in 1998 to 1,307 km in 2002.

Basic transportation and communications statistics are listed in table 29. From 1998 to 2002, Zhejiang's long-distance optical fibre network was extended from 5,374 km to 14,959 km, for an 80% increase and the number of telephones per 100 persons increased from 20.5 to 78.4 (180%).

**TABLE 29**  
**TELECOMMUNICATIONS SERVICES IN ZHEJIANG**

|   | 1998   | 2000    | 2001    | 2002      |
|---|--------|---------|---------|-----------|
| Data communications services users      | 18 105 | 34 221  | 38 335  | 37 489    |
| DDN users                               | 12 931 | 24 984  | 29 574  | 28 852    |
| ChinaFru users                          | 1 106  | 5 827   | 6 247   | 6 802     |
| Internet users (millions)               | n/a    | n/a     | 2.06    | 3.16      |
| Registered users                        | 37 729 | 454 376 | 835 295 | 1 455 589 |
| Long-distance optical fibre cable (km)  | 5 374  | 6 978   | 9 863   | 14 959    |
| Telephones:                             |        |         |         |           |
| Per 100 persons                         | 20.5   | 45.5    | 62.3    | 78.4      |
| 1) Urban areas                          | 51.1   | 64.1    | 76.3    | n/a       |
| 2) Rural areas                          | 9.9    | 21.5    | 26.7    | n/a       |
| 3) Mobile                               | 3.7    | 11.8    | 24.1    | 32.4      |
| Highways (km)                           | 344    | 627     | 774     | 1 307     |
| Hangzhou                                |        |         |         |           |
| Internet subscribers                    | n/a    | n/a     | 182 780 | 213 004   |
| Mobile telephone subscribers (millions) | n/a    | n/a     | 1.93    | 2.76      |

**Source:** Zhejiang Statistical Bureau, “Zhejiang statistical yearbook”, Beijing, China Statistics Press, various issues.

### iii) Increased availability of human capital

The software industry is human-capital intensive. In essence, to export software is to export human capital. The growth of Hangzhou’s software-export industry can be attributed to local human-capital accumulation. A large number of software makers have been lured here by the availability of science and engineering majors at nearby universities. In addition, software engineers have been recruited from many universities throughout China.

University enrolment continues to climb. Between 1998 and 2002, new enrolments at Zhejiang’ universities increased by 415%, from 36,668 to 152,470. Graduate enrolments rose from 2,155 to 6,111, a 283% increase. Since more persons are now attending university, human-capital accumulation is accelerating.

Regarding the supply of software engineers, on the one hand, many computer and software schools located here have a tradition of training software engineers; on the other, many science and engineering majors have an excellent background in computer science and can easily transfer their knowledge to software development. For example, Handsome’s software developers come from a variety of fields: about 50% majored in electronics or computer science, while others come from engineering fields such as chemical instruments, optical instruments, industrial automation, industrial chemistry and refrigeration.

**TABLE 30**  
**EVOLUTION OF HIGHER EDUCATION IN ZHEJIANG**

| Year | New Enrolees  |                 | Graduating students |                 |
|------|---------------|-----------------|---------------------|-----------------|
|      | Undergraduate | Graduate school | Undergraduate       | Graduate school |
| 1998 | 36 668        | 2 155           | 24 296              | n/a             |
| 1999 | 59 300        | 3 216           | 30 561              | 1 578           |
| 2000 | 93 516        | 4 130           | 32 477              | 1 600           |
| 2001 | 120 195       | 5 577           | 37 230              | 1 882           |
| 2002 | 152 470       | 6 111           | 48 431              | 2 645           |

**Source:** Zhejiang Statistical Bureau, “Zhejiang statistical yearbook”, Beijing, China Statistics Press, 2002 and 2003.

To a certain extent, China has acquired notable comparative advantages in the software sector of the technology industry.

#### iv) Close international ties

China's tie with foreign countries has been strengthened by the large number of Chinese who study and work abroad, and then return to set up companies or take jobs. Software enterprises have closer ties with the international market than do other types of firms. Chinese students abroad bring software outsourcing and high-end software development to Chinese software firms.

Table 31 shows the number of students abroad and returning to China from 1997 to 2002. The number of returning students increased from 7,130 to 17,945 between 1990 and 2002, for a nearly threefold increase. During the same period, the number of students abroad increased from 2,950 to 125,179, that is, more than 40 fold. The large numbers of students abroad point to closer economic ties between China and the rest of the world in the future.

**TABLE 31**  
**FOREIGN STUDY**

| Year | Students |           |
|------|----------|-----------|
|      | Abroad   | Returning |
| 1997 | 22 410   | 7 130     |
| 1998 | 17 622   | 7 379     |
| 1999 | 23 749   | 7 748     |
| 2000 | 38 989   | 9 121     |
| 2001 | 83 973   | 12 243    |
| 2002 | 125 179  | 17 945    |

**Source:** National Bureau of Statistics of China (NBS), "2003 China statistical yearbook", Beijing, China Statistics Press, 2003.

## 4. The case of Cixi electronics firms

### a) General description of enterprises in Cixi

Hongyi Electronics and Singfu Electric Group are located in Cixi city, in Zhejiang Province. Situated 138 km from Shanghai, Cixi has enjoyed relatively strong industrial growth since the early 1990s. From 1991 to 2001, industrial output here climbed from 3.228 billion *yuan* to 29.055 billion *yuan*, a ninefold increase. Per capita GDP rose from US\$ 508 in 1991 to US\$ 2,944 in 2003.

Cixi's industrial cluster, which turns out a variety of home and other types of electric appliances, has expanded quickly. At the workshops that line the roads, local and transplanted workers produce small electric appliances to be exported all over the world. A total of 502 SMEs accounted for direct exports worth US\$ 1.638 billion in 2003.

Hongyi Electronics and Singfu Electric are labour-intensive enterprises that specialize in electric appliances. As medium-sized firms, they hire a relatively large number of workers. At the end of 2003, Hongyi employed 1,740 workers and Singfu 1,500. Some 40 to 50 SMEs in the surrounding area make similar products, although on a smaller scale.

**TABLE 32**  
**NAMES AND WEBSITES OF TWO ENTERPRISES IN CIXI**

| Name                             | Ownership | Website        |
|----------------------------------|-----------|----------------|
| Cixi Hongyi Electronics Co., Ltd | Private   | www.cxhy.com   |
| Singfu Electric Group            | Private   | www.singfu.com |

**Source:** Prepared by the author.

Private enterprises in Cixi, including Hongyi and Singfu, have grown rapidly. The two firms were established after 1994. Spurred by China's rapid economic development, their once-small output of electrical and electronic products quickly grew.

### **b) Hongyi Electronics**

Hongyi Electronics specializes in power plugs. Between 1994 and 2003, it raised its registered capital from US\$ 140,000 to US\$ 3.46 million. Because of the continuous expansion of the company's exports, its number of employees has also grown, from 1,160 in 2000 to 2,180 by mid-2004. Hongyi uses plastic materials from the Republic of Korea and Japan and copper materials from Jiangsu at its assembly plants located in the surrounding area.

**TABLE 33**  
**HONGYI ELECTRONICS: BASIC DATA**

|   |   |
|---|---|
| Product                                     | Power plugs                               |
| Workforce                                   | 1,740                                     |
| Sales                                       | 393.91 million <i>yuan</i>                |
| Number of PCs                               | 30  |
| Percentage of PCs connected to the Internet | 100                                       |
| IT techniques used internally               | OA, ERP, personnel and finance management |
| Supply chain management (SCM)               | Partially implemented                     |
| Website function                            | Product publicity                         |
| Frequency of website updates                | Weekly                                    |
| E-business platform                         | Constructed by a third party              |
| Online trading                              | Less than 5% of sales                     |

**Source:** Prepared by the author.

Hongyi has made inroads in overseas markets by establishing ties with international dealers. All of Hongyi's products are exported to Europe, where supermarkets such as B&Q, OBI, IKEA and CARREFOUR are long-standing buyers of its products. Unlike other exporters, Hongyi has not adopted the original equipment manufacturer (OEM) model. Instead, the power plugs it exports to Europe bear its brand name, Hongyi. The company has about 60% of the market for power plugs in Europe.

#### **i) IT use and its effects**

Hongyi has an assembly-line production system and has set up a computerized IMS. All of the company's 30 PCs have Internet access. The ratio of PCs to employees is relatively low at Hongyi, mainly because of small size of the managerial staff.

Since 2002, Hongyi has invested more than 3 million *yuan* to implement an ERP system to manage the entire production process and daily operations. The ERP system covers all of the



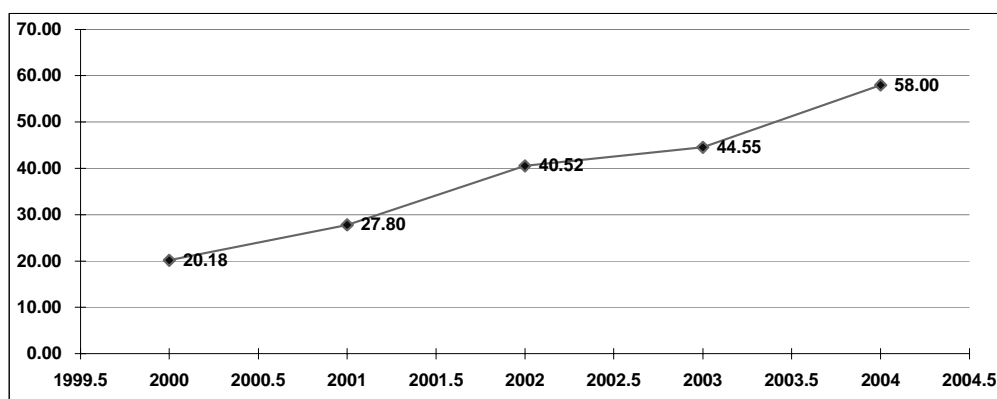
company's departments. Since the company exports 100% of its output, its internal information system is linked to the Customs Bureau, which electronically monitors product location and the status of imports and exports. Computers are used to manage all aspects of the production process: importation of raw materials, electronic customs procedures, inbound and outbound logistics, delivery of materials at the warehouse, online authorizations from managing departments, production, storage of semi-finished products, inspection, assembly. This rigorous implementation of the ERP system has allowed the company to reduce the inventory time of raw materials and semi-finished products and streamline the export process, thus improving efficiency.

In addition, IT is used to manage the company's finances, human resources and client relationships.

## ii) Export expansion and e-business

Hongyi's export volume has increased continuously, rising from US\$ 20.18 million in 2000 to US\$ 44.55 million in 2003, and was expected to surpass US\$ 58 million in 2004 (figure 13).

**FIGURE 13**  
**EXPORTS BY HONGYI ELECTRONICS**  
(In millions of U.S. dollars)



Source: Prepared by the author.

Hongyi has used a two-pronged strategy to boost its exports; first, attending trade fairs such as the Electric Appliance Exhibition in Chicago, where it meets with existing clients and makes new contacts; second, using the Internet to verify prices of export products and then inquiring with existing clients on their needs by e-mail. Although there are many ways in which the Internet can be used to facilitate communication, Hongyi uses it solely to trade with long-standing clients. Hongyi has found that price information can be obtained on the Internet to speed up transactions by reducing the time devoted to negotiating. In addition, the Internet has increased transparency regarding commodity prices and thus lowered transactions costs.

Hongyi began doing business online in 2002, when it recognized that the Internet was destined to become the normal channel for conducting transactions related to importing and exporting. It hired an outside company to construct its e-business platform so as to publicize its products and promote sales. It participates in online bids held each year by European appliance brokers, giving its quotes by the required deadlines and then confirming them by videoconference. Still, its online sales are relatively small, with e-business accounting for less than 5% of total sales.

### c) Singfu Electric Group

Singfu, a conventional OEM manufacturer, was founded in 1993 with a registered capital of 63.8 million *yuan*. Its main products include radiators, heaters and electric fans. It is the largest radiator manufacturer in China, with total sales of 150 million *yuan* in 2003. Its overall sales nearly tripled in three years, from 77 million *yuan* in 2000 to 231.1 million *yuan* in 2003.

Singfu adopted OA techniques relatively early, introducing computerized financial management in 1996. This was the company's first foray into IT. The most important ways Singfu uses IT are listed below:

The company's relatively large number of PCs (159) are used for daily tasks related to office, financial and human resources management.

It began using manufacturing resource planning II (MRPII) techniques in 2000, to automate real-time management of manufacturing: order reception, procurement, production and inbound and outbound logistics. The company purchased specialized software for the appliance manufacturing industry and then adapted it to its own operations.

**TABLE 34**  
**SINGFU ELECTRIC GROUP. BASIS DATA**

|   |   |
|---|---|
| Product                                     | Heaters, electric fans, radiators         |
| Workforce                                   | 1,500                                     |
| Sales                                       | 231.1 million <i>yuan</i>                 |
| Number of PCs                               | 150                                       |
| Percentage of PCs connected to the Internet | 100                                       |
| IT techniques used internally               | OA, ERP, personnel and finance management |
| Supply chain management (SCM)               | No  |
| Website function                            | Product publicity                         |
| Frequency of website updates                | Weekly                                    |
| E-business platform                         | No  |
| Online trading                              | No  |

**Source:** Prepared by the author.

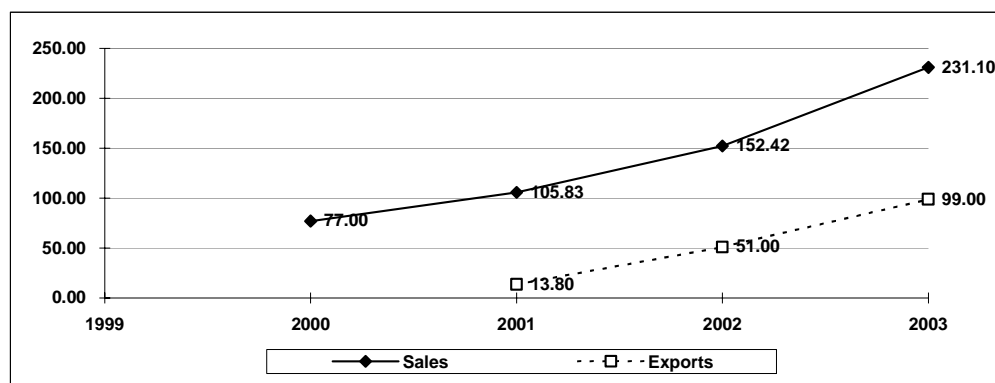
In addition, Singfu has developed its own website. Four engineers in its IT division perform the required maintenance. This gives the company a strong capacity to solve problems related to Internet use.

The company's intranet is mainly used for inter-office communication, while the external network is used to publicize products and communicate with brokers.

Like Hongyi, Singfu has expanded its export volume in traditional ways, namely, through trade fairs and recommendations from existing clients. Singfu also advertises on prominent websites such as Asian Sourcing Net. Europe, the United States, Russia and Australia are its main export markets.

Singfu does not have an e-business platform. The company's main Internet application is e-mail, which it uses both to promote exports and to conduct business communication within China.

**FIGURE 14**  
**SINGFU APPLIANCE SALES AND EXPORTS**  
*(In millions of yuan)*



Source: Prepared by the author.

#### d) **Obstacles faced by Cixi electronics firms in using IT**

Cixi appliance makers face three main obstacles in using IT.

##### i) **Inefficiencies**

Since Cixi's enterprises consider that promoting and using IT is an important way to improve the skills of their management and raise profits, they have made large investments in IT equipment and built LANs and WANs. A review of the use of IT products in Cixi shows the rate of adoption by SMEs is relatively high. However, efficiency in use is less impressive, as computers are often used only for word processing and e-mail.

##### ii) **Failure to implement SCM**

Regarding the use of the Internet for internal information management, companies have begun using OA and IT techniques for finance and personnel management all while stressing ERP. Most importantly, their manufacturing divisions have implemented resource information management. However, SCM techniques are missing from most business IMSs. Neither Hongyi nor Singfu yet has complete SCM systems, preventing them from using internal IT techniques in tandem with SCM.

##### iii) **Reluctance among potential clients**

The failure of e-business to catch on is due to a lack of trust among enterprises. The online sales that do take place are with existing clients; hence, the Internet is not being used to create new business opportunities.

## 5. The case of the Ningbo electronics cluster

#### a) **Geographical advantages of interviewed firms**

A primary development strategy of local governments in the past ten years has been to attract enterprises and promote export growth by setting up what are known, variously, as "export processing zones", "economic and technological development zones", "advanced and new-technology development zones", "bonded zones" and "free trade zones".

In view of SMEs' greater export capacity and the effect of government efforts to promote exports, four SMEs in the Ningbo Bonded Zone were selected to take part in a field survey. Ningbo is one of fourteen coastal cities that China opened to the outside world starting in 1984. Located 320 km from Shanghai, it is one of Zhejiang's major industrial production bases and centres of economic activity. The bonded zone was created in November 1992 on a 2.3 km<sup>2</sup> tract of land. It is used for import and export-processing, international trade, bonded storage and trade shows. Ningbo's Export Processing Zone was established in March 2002 on a 3-km<sup>2</sup> piece of land. Today the bonded zone and export-processing zone are jointly managed in a 6-km<sup>2</sup> compound. The two zones are responsible for implementing a policy known as "exempting [goods] from certification, tax and bonding requirements" and another known as "within borders but outside customs". By the end of 2002, more than 4,000 enterprises, including 684 foreign firms, had set up in the zone, bringing US\$ 2.6 billion in investments.

Ningbo, an export-processing zone, is mainly made up of clusters of export-oriented IT and precision-machinery firms. Since June 2004, electronic customs applications have been used by all export firms in the bonded zone. Hence, exporters may connect by network to the Customs Bureau and conduct import and export procedures online using an EDI system.

## b) Basic description of the interviewed firms

All of the firms in question are small IT manufacturers that have been in business for a relatively short time. Table 35 lists their basic characteristics. Except for Online Monitoring, a private high-tech firm, they are all owned by Taiwanese investors.

**TABLE 35**  
**NAMES AND WEBSITES OF PARTICIPATING ENTERPRISES**

| Name                           | Foundation Time | Labour Force | Website           |
|--------------------------------|-----------------|--------------|-------------------|
| Yeongyang Technology Co., Ltd. | 2000            | 385          | www.yycase.com    |
| NUTEK                          | March 2002      | 375          | www.nutek.com.tw  |
| Bridge Technology Co., Ltd.    | May 2001        | 180          | www.wantec.com.tw |
| Ningbo Online Monitoring       | June 2001       | 60           | www.zjnblne.com   |

**Source:** Prepared by the author.

**Note:** Number of workers is as of June 2004.

All four firms specialize in electronics-related products. Yeongyang Technology, a maker of computer cases for large PC manufacturers, has adopted the OEM model. NUTEK makes car alarms. Both Yeongyang and NUTEK export 100% of their output. Bridge Technology, which produces power supplies according to clients' special design and other specifications, exports 95% of its products. Thus, the Taiwanese-owned firms are oriented to the international market. Most of the products made by Ningbo Online Monitoring, a privately owned manufacturer of electronic devices such as transformers and online malfunction-detection systems, are sold domestically.

The technology used in Ningbo's products is relatively advanced. Of its 60 staff members, 52 have undergraduate degrees or above and 7 are technical-school graduates. Online is a high-tech R&D firm and manufacturer of specialized equipment such as filters and transformers. The Taiwanese parent companies of Yeongyang, NUTEK and Bridge brought operations to the Ningbo Bonded Zone to reduce land and labour expenditures and to receive tax exemptions. From the perspective of the market and international business cooperation, these

Taiwanese firms are part of industrial supply chains of foreign enterprises; hence, they are large-scale producers of straightforward items. For example, 60% of the car alarms produced by NUTEK and 80% of industrial power supplies produced by Bridge Technology are exported to the United States.

The three Taiwanese enterprises are small, labour-intensive operations based on a typical assembly-line organization of production. At Yeongyang, the percentage of the total workforce with an undergraduate degree or higher is 12.7%, compared with 11.7% at NUTEK and 16.7% at Bridge. The use of IT at these small enterprises is an extension of their parent firms' management systems. The degree of automation of production and use of IT for management by Taiwanese SMEs is very high.

### **c) Yeongyang Technology**

This firm manufactures computer cases using traditional metal-punching and plastic-injection techniques. As a maker of PC parts, it is classified as an IT-industry manufacturer.

Yeongyang has an advanced system for managing operations with IT, including a complete IMS as well as an SCM system.

#### **i) IT use**

A special IT division with six engineers is in charge of the IMS. Two hardware engineers are responsible for ensuring that the PCs, servers, network and telephone system operate correctly; two software engineers are in charge of intranet and Internet development and maintenance; and system management engineers make necessary changes to and conduct backups of network server data as well as performing maintenance on the UNIX system.

Unlike other firms that hire outside companies to manage their networks, Yeongyang has its own engineers who manage the company's networks according to its needs.

- ***Server Systems***

Yeongyang has set up six server systems, as described below:

- A proxy server, which authorizes internal PCs to connect to the Internet. The purpose of this setup is to prevent virus infections.
- A mail server, which handles incoming and outgoing e-mail.
- An intranet server (composed of a release server and a database server), for the firm's OA. Basic documents and statistical reports from each division are stored here. This system automates internal document flow.
- An Internet server, for projecting the enterprise's image to the outside world, publicizing its products and ensuring smooth communication with clients.
- A UNIX system server, which serves as the firm's ERP system, coordinating work in the production, warehouse and finance departments, among others.
- A monitoring-system server, which supervises and controls data distribution.

- ***PC penetration rate and intranet***

All of Yeongyang's 120 PCs are connected to the Internet, and all management staff have PCs for their daily tasks. The degree of OA is very high and adjustments have been made to the OA system to make it more flexible. The company makes the most of its ERP and SCM. A management network has been installed. Bulletins and news on the firm are frequently updated on the intranet home page. Work is supervised online, and a record is kept of the staff's leaves of absence.

**TABLE 36**  
**IT USE AT YEONGYANG TECHNOLOGY**

|   |                               |
|---|-------------------------------|
| Workforce                                   | 342                           |
| Sales                                       | 60.08 ( <i>million yuan</i> ) |
| Number of PCs                               | 120                           |
| Percentage of PCs connected to the Internet | 100%                          |
| IT techniques used internally               | ERP                           |
| SCM   | Yes                           |
| Website functions                           | Product publicity             |
| Frequency of website updates                | Daily                         |
| E-business platform                         | No                            |
| Online trading                              | No                            |

**Source:** Prepared by the author.

- **Software selection**

To ensure compatibility, Yeongyang has the same ERP system as the company's head offices in Taiwan (Province of China). All of its financial —and human resource— management software as well as the programs it uses to connect to customs are purchased in China.

- ii) **Website**

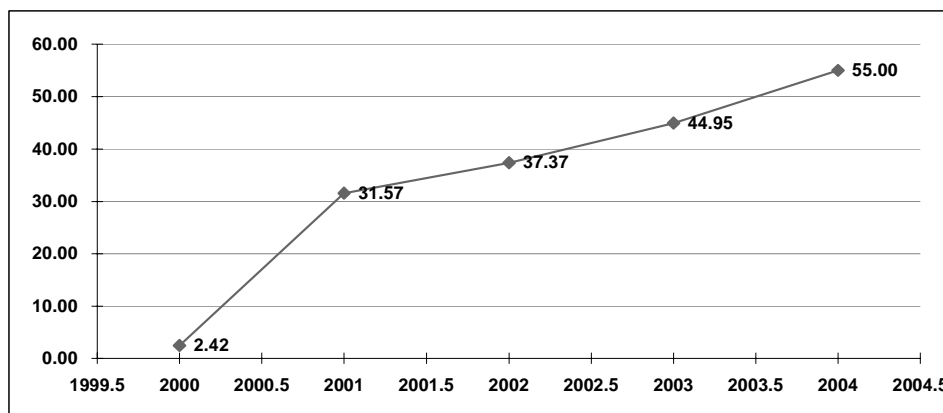
Yeongyang's website is modelled on the type of websites used in Japan and Korea, with interactive product displays to facilitate browsing by clients. The website's basic purpose is to raise the profile of the enterprise and its products.

- iii) **Exports and e-business**

Yeongyang was initially created to export all of its computer-case production to some of the world's largest PC makers. Now, however, it is gradually promoting its own brand and entering the Chinese market.

Figure 15 shows that Yeongyang' export volume increased from 31.57 million *yuan* in 2001 to 44.95 million *yuan* in 2003 and was expected to total 55 million *yuan* in 2004. Fifty-five percent of its output goes to Europe and 25% to North and South America, in particular, Brazil.

**FIGURE 15**  
**EXPORT OF TECHNOLOGY BY YEONGYANG**  
(In millions of *yuan*)



**Source:** Prepared by the author.

Yeongyang does not have an e-business platform, nor does it plan to establish one, because of its already strong client base and its distrust of online payments. The company finds that the ability to contact its clients by e-mail serves its purposes for now.

#### d) Ningbo Online Monitoring

This firm specializes in research on and production of online monitoring devices for critical electric-power systems. Its products are used for inspecting and repairing government-owned electricity grids.

##### i) Direct IT application

The firm primarily uses software, computers and telecommunication cables to conduct complete diagnostics of electricity equipment such as transformers over the Internet with data-processing servers. The purpose of this is to automatically detect transformer defects online. The company's equipment allows the remote monitoring centres of power plants and online monitoring companies to conduct remote monitoring and maintenance over the Internet.

By developing and using integrated circuits, software and sensors and by integrating various technologies, the enterprise has created a new technology. Hence, Ningbo is directly applying IT, especially the Internet, by producing equipment and providing technological services.

**TABLE 37**  
**IT USE AT NINGBO ONLINE MONITORING**

|   |   |
|---|---|
| Product                                     | Online transformer monitoring equipment |
| Workforce                                   | 60                                      |
| Sales                                       | 14.5 ( <i>million yuan</i> )            |
| Number of PCs                               | 43                                      |
| Percentage of PCs connected to the Internet | 100%                                    |
| Internal use of IT techniques               | Yes                                     |
| SCM   | No                                      |
| Website functions                           | Company and product publicity           |
| Frequency of website updates                | Weekly                                  |
| E-business platform                         | Being built by an outside company       |
| Online trading                              | 30% of sales                            |

**Source:** Prepared by the author.

Ningbo makes extensive use of IT equipment such as computers and a range of software products in conducting R&D and in producing transformers and online monitoring equipment. Its website is used solely to publicize the company and its products, not to allow clients to communicate Ningbo.

##### ii) Reasons for using e-business

Ningbo Online's sales —mostly to the domestic market— have climbed quickly, from 5.73 million *yuan* in 2001 to 14.5 million *yuan* in 2003. In China, the electric-power grid is managed at the regional level. Ningbo Online's first market was East China, where the firm is located. It has gradually expanded to grids in the northwest and north.

Ningbo Online has expanded its markets by attending exhibits and trade shows. It is China's only producer of online transformer monitoring equipment. The only two other manufacturers of this type of equipment in the world are in the United States and in Canada.

The United States firm is Ningbo Online's main competitor in China. The only time Ningbo has negotiated a sale over the Internet was in 2003, when it sold a transformer-monitoring device to a Singaporean enterprise for US\$ 50,000.

That Ningbo Online is one of only three manufacturers of transformer monitoring devices in the world means that it is in a niche market. Moreover, its competitive advantages —its advanced technology and prices —have allowed Ningbo Online to expand domestic sales rapidly and helped it win the contract with the Singaporean firm.

During the early stages of a sale, the company mainly does business in face-to-face meetings and over the phone. The Internet is used only to finalize orders.

#### **e) Lessons from IT use by Ningbo's electronics manufacturers**

The first lesson is that firms should set up a complete IMS so as to improve their management, with OA being just one component of the overall system. Moreover, daily management tasks can be increasingly automated through the implementation of ERP and SCM systems, allowing firms to make the most of their PCs, servers and similar equipment.

Second, firms that export using the OEM or original design manufacturer (ODM) models mostly rely on traditional export channels rather than the Internet to find new markets. Hence, true e-business procedures are used very seldom. Only niche markets with a very small number of quality manufacturers are suitable for certain e-business transactions.

Third, electronic customs applications will greatly encourage export enterprises to use IT, eventually making it impossible to do business without computers or an Internet connection. This will spur growth in the IT market, further encourage enterprises to enhance their capacity to use IT products and make management more efficient.

### **6. The case of Suzhou IT firms**

Suzhou Jiangsu's IT industry has experienced rapid growth in the last decade, due to three factors. First, FDI —mainly from the United States, Japan, Europe, Republic of Korea and Taiwan (Province of China)— has been used to establish scores of IT-related companies. Suzhou has been the preferred location of manufacturing bases for IT transnationals in China. Second, these transnationals mainly produce for export and thus are important links in the global IT chain, and have turned Suzhou into an important global manufacturing base. Third, the local firms set up by transnationals in Suzhou need to raise the local content of their inputs so as to cut costs. Therefore, in addition to the SMEs that were already in transnational supply chains and that followed transnationals to Suzhou and set up factories there, there are local SMEs that serve as component outsourcers for transnationals. This has promoted the development of local SMEs and the transfer of technology to them.

Suzhou attracted US\$ 2.84 billion of FDI in 1998, and its exports were valued at US\$ 5.65 billion. By 2002, Suzhou received US\$ 4.81 billion in fresh FDI, compared with US\$ 18.52 billion in exports. Also in 2002, Suzhou's foreign-owned enterprises produced 193.31 billion *yuan* in goods, or 55.78% of all industrial output in Suzhou. As most FDI has flowed into the IT sector, this sector's products account for the largest share of Suzhou's export mix.

#### **a) General description of Suzhou IT firms**

Table 38 lists the three IT enterprises that were interviewed. Taiwanese-owned Sampo and BenQ make only high-value-added products, such as Sampo's liquid crystal display (LCD) televisions, LCD multimedia displays and digital videodisc (DVD) players. BenQ's product line



includes web-based, wireless and broadband devices, computer peripherals, optronic instruments and multimedia players. Neither company is large.

**TABLE 38**  
**NAMES AND WEBSITES OF IT COMPANIES IN SUZHOU**

| Name of firm                | Workforce | Website              |
|-----------------------------|-----------|----------------------|
| Sampo Electronic Technology | 1 500     | www.sampotech.com.tw |
| BenQ (IT) Co. Ltd           | 7 600     | www.BenQ.com.cn      |
| Suzhou Victory Technology   | 1 200     | www.victory-tech.com |

**Source:** Prepared by the author.

Sampo and BenQ apply IT in management as an extension of their parent companies' systems. Their internal information management (OA, financial software, HR management, etc.), business information management and organizational methods mirror the high degree of digitization of Taiwan (Province of China) enterprises.

Sampo is an example how IT is applied by Taiwanese firms. The ERP system was established first. It consists of modules that manage inventories, orders, production and manufacturing, purchasing and administrative matters. The core of the system is the finance module, while an Oracle application serves as the hub of the ERP system. Sampo's servers in Taiwan (Province of China) are connected to Suzhou by dedicated line. Both the subsidiary and the parent company use the same IMS. In fact, this is the model most Taiwan (Province of China) companies follow to simplify management tasks.

Sampo's IT products require thousands of different materials and components from around the world. Sampo uses computers to update its information, manage inventories and ensure punctual delivery of its products. Sampo also relies on videoconferencing to oversee the operation of its SCM and facilitate long-distance communication. The company has a large number of computers (100), which are used for communication and management. Twenty percent of its computers have Internet access through a firewall. Sampo normally makes orders for materials from overseas over the Internet. However, some overseas orders are sent by fax because of the lack of security with Internet transmissions. E-business operations are handled by the parent company in Taiwan (Province of China). Hence, Sampo uses the Internet to process purchases but it uses traditional methods for sales. To raise its employees' ability to use IT and enhance efficiency, Sampo requires new employees to receive training.

BenQ has a 600,000-m<sup>2</sup> plant in Suzhou, with an annual capacity of 8 million keyboards, 4 million scanners, 20 million CD-ROM drives and 5 million cellphones. The manufacturing facilities are well known in the IT industry.

A few aspects of BenQ's use of IT are worth noting. Because BenQ is itself an IT company, its operations are highly digitized. The plant is equipped with 3,000 PCs, which are employed in every aspect of production management. The high level of digitization has undoubtedly raised the company's competitiveness while enabling it to process customer information quickly and accurately and without disruptions. BenQ receives orders for exports from TNCs. It keeps tabs on its supply-chain operations by exchanging visits with its suppliers. In addition, imports and exports are handled online. Since the export orders for BenQ's Suzhou plant are received at the parent company, the plant communicates with customers through it, which enables customers to access information such as date of shipment, date of export, name of shipping company, date of arrival and destination. The fact that clients can follow this process

online ensures transparency. BenQ's website is maintained at an e-commerce centre where online orders are received. At [www.BenQ.com.cn](http://www.BenQ.com.cn), customers can see the company's products and place orders as well as enter payment information. Sixty percent of BenQ's products are now manufactured under the OEM or ODM model for IBM, HP, Dell and Motorola, while the remaining 40% are sold under the company's own brand name. The e-commerce platform is mainly for sales of products sold under its name. In addition, the website has a product forum for end customers to give feedback. This helps the company improve product quality and after-sale service. Since only 20% of the company's sales are generated through the e-commerce platform, there is much room for growth in e-commerce transactions.

Unlike Suzhou's local IT firms, Sampo and BenQ are at the high end of the high-tech industry and they use digitization for management much more than do local companies. Still, the level of digitization by these companies merely reflects the business methods of their parent firms in Taiwan (Province of China).

## **b) IT use by Suzhou Victory Technology**

Suzhou Victory Technology is a locally owned electronics manufacturer. It once made electronic components for Peacock TV, also in Suzhou. After Peacock formed a joint venture with Philips, it no longer needed Victory's components. Hence, Victory set out to find new customers, especially foreign-owned subsidiaries of IT transnationals.

Unlike Sampo and BenQ, Victory is fully locally owned, and its uses digitization in management much less intensively than they do. The company is working hard to learn to use IT in order to make its management more efficient and bring down costs including costs related to SCM by foreign-owned companies. Local enterprises such as Victory provide a more accurate picture of how most of Suzhou's SMEs use IT than do the TNC subsidiaries located here.

### **i) Suzhou's place in the global IT supply chain**

Victory has been part of the global IT industry's supply system since 1995. The main reasons for which it entered the IT industry chain were, firstly, with the large amount capital that foreign IT firms have invested in Suzhou, some TNCs have stepped up their purchases of local components. In addition, Victory has been transformed from a State-owned enterprise into a joint-stock company. This has forced the company to become more efficient and competitive, in order to win components contracts with TNCs. Victory specializes in circuit boards for foreign-owned companies located in the Yangtze River Delta area.

Victory has 25 medium- and high-speed surface mount technology assembly lines and 22 printed circuit board assembly and inspection lines. It produces circuit boards for some 100 transnationals, including Epson, Philips, Sharp, BenQ, Logitech, Samsung, Sony, Mitsubishi and Panasonic.

The firm has a class-10000 and a class-1000 clean room for more demanding assembly tasks, such as those involving laser scanners, DVD players, video telephones, CD-ROM drives, DVD players, computer sound cards and motherboards and cellphone circuit boards.

Victory is an outsourcer for large IT and telecommunications equipment firms. The products it assembles include televisions, mice, scanners, digital cameras, PCs and circuit boards for ICT products. For example, it assembles mice for Dell and circuit boards for Sony digital video cameras. While Victory is a part of the supply chain of several transnationals, it also outsources products to eighteen companies that form a smaller local supply chain.

## **ii) Enhanced capacity to use IT**

Of Victory's 200 PCs, 100 are used for management and the rest for product testing. In March 2004, the company began to launch its ERP and SCM systems, transferring information storage from individual PCs to the Internet to allow resources to be shared. Also, its PCs are being transformed from simple OA tools to components of its networked management system. Only the ERP and SCM systems can help management attain its goal of "zero storage and zero bugs". By outsourcing circuit boards for transnationals firms, Victory has raised its capacity to use IT to a level approaching that of the transnationals that contract it. Victory plans to have complete ERP and SCM systems in place by the end of 2005.

## **iii) E-commerce and the expansion of exports**

Victory Technology has not established an e-commerce platform because most of its customers are located in the Yangtze River Delta. The company's strategy is to expand its market by visiting customers and enhancing its reputation for quality. In addition, it contacts new customers by attending electronics shows such as those held in Las Vegas, Hanover and Hong Kong (China). The company has preferred to use conventional e-commerce techniques rather than turning to B2B to increase its business.

The bulk of Victory's clients are local outsourcers that work for foreign companies, whereas foreign IT manufacturers in Suzhou are mostly oriented to exporting. For the most part, Victory exports only indirectly; its direct exports totalled only 2.09 million *yuan* in 2003. Like other firms in Suzhou, Victory uses its website mainly for advertising and for launching new products.

## **iv) Main obstacles to further enhancing IT use**

The first constraint is related to human resources. The limited education of the company's original workers prevents them from adjusting to computer-based operations and management. Although the company hires more than 20 graduates a year to improve its technology and management, it cannot quickly dismiss workers with a lower educational level. The only solution is for it to improve the quality of its human resources by hiring new, better-educated employees.

Second, Victory's IMS is closely tied in to those of the transnationals for which it outsources. The company's warehouse is a part of the transnationals' SCM systems. Hence, one aim of the ERP and SCM systems currently being implemented is for the entire staff to adapt to a new management model and thus change their deep-seated views of production and management.

Lastly, e-commerce is especially suitable for transactions with existing customers. The spread of e-commerce as a method to expand business with foreign and domestic customers will depend on the degree to which potential buyers become convinced that they can use such a system safely.

## **c) Evaluation of e-commerce by enterprises in Suzhou**

The government's overall effort on many fronts has greatly raised enterprises' level of digitization, especially in terms of OA, ERP and SCM. However, few transactions are conducted over the Internet. Given the current state of development in China, there are a couple of reasons for the slow growth of e-commerce. First, enterprises do not have a high degree of confidence in negotiating over the Internet, which makes it difficult for the B2B model to gain acceptance. Second, electronic payments entail a high degree of risk. Overall, little negotiation takes place through online bidding. Thus, the time does not appear ripe for promoting e-commerce as a widespread business model.

## 7. The case of Shanghai Guochi Import & Export

Shanghai Guochi Imp. & Exp. Co. Ltd. is a small importer and exporter of glass with 40 employees and 5 million *yuan* in registered capital. It had US\$ 8.8 million in exports in 2003 and was expected to reach US\$ 10 million in 2004.

Guochi acts as an export broker for SMEs. As an import and export company, rather than a producer, it receives orders from abroad and channels them to glass manufacturers in Shanghai or Jiangsu. It also sells manufactured products on the international market. Guochi has played a pivotal role in promoting local SMEs.

### a) Use of IT for exporting

Guochi has contacted its present customers mainly at trade fairs such as the China Export Commodities Fair, the East China Export Commodities Fair and others in Frankfurt, Dubai and Madrid, where Guochi can meet clients in person. This allows the company to win the confidence large glass importers and other potential clients. In addition, its presence at such events allows Guochi to provide information to foreign SMEs who may later contact the company. After these initial contacts, Guochi will send samples to prospective clients, inviting them to communicate with the company and make orders.

All of Guochi's staff have computers. Correspondence with foreign clients is evenly divided between e-mail and faxes. The company requires orders to be confirmed by fax, so as to have hardcopy receipts, while e-mail is used for other types of communication. This is another indicator that foreign-trade SMEs such as Guochi continue to rely on traditional business methods for transactions, whereas they use e-mail to expedite work and facilitate communication with clients. Guochi has implemented digitization for internal management, including financial management and CRM.

### b) Network and e-commerce platform

Guochi's website, located at [www.sgc-glass.com](http://www.sgc-glass.com), mainly serves to publicize the company and its products. The website is updated only about once a month.

Guochi's website is maintained by Global Sourcing, which targets purchasers in Guochi's leading markets, Europe and the United States. Guochi chose Global Sourcing over Alibaba, a Chinese e-commerce platform, despite Global Sourcing's higher fees. Only 5% to 10% of Guochi's total export sales are conducted online.

### c) Main problems with IT encountered by SMEs involved in foreign trade

The customers of large foreign-trader firms are often major players both in their own country and abroad. And large trading firms use a higher level of digitization in management, which enables them to launch ERP and SCM system for communication with their clients. SMEs like Guochi that are involved in foreign trade face several problems in applying IT.

First, due to their limited resources, SMEs are unable to set up their own e-commerce platform. This means that they often use third-party platforms to expand their business. These platforms are very expensive; for instance, whereas Alibaba charges a yearly registration fee of 60,000 *yuan*, Global Sourcing charges 150,000 *yuan*. Hence, high costs preclude many SMEs from doing business online.

Second, Guochi's domestic suppliers are SMEs with between 200 and 300 employees who generally are unable to use IT for management tasks. Therefore, Guochi visits its domestic

suppliers to meet them or become better acquainted with them. This adds to the difficulties preventing Gouchi from establishing its own SCM system. This is an example of why SMEs involved in foreign trade need to raise their IT capacity before implementing SCM.

Third, SMEs involved in foreign trade have a small number of employees, which makes it difficult for them to adjust to IT-based management.

### **C. Obstacles preventing SMEs from participating in international value chains**

Rapid economic growth in China since 1992 has created market opportunities for SMEs, whether as joint ventures, private companies or joint-stock enterprises. These companies' sales and exports have quickly grown. With the expanding market and the opportunities to make profits, SMEs are more inclined to invest in IT equipment to improve their management. This is seen in the higher penetration rate of IT equipment among SMEs. However, SMEs need to do more in terms of using IT to expand their market and promote exports. The main obstacles faced by SMEs are listed below.

- Integrating hardware investment with software development. With the exception of the Taiwanese-owned companies, SMEs have purchased a large number of computers and other IT products; implemented OA, financial management, human resource management; digitized their operations; and partially implemented IMSs, including SCM and ERP. However, these firms still need to make the transition from storing information on a single computer to using software for shared information management over the Internet. In order to participate in industry value chains, SMEs must construct complete IMSs compatible with transnationals' sophisticated IT systems. Therefore, they need to improve the way they use software so as to make the most of their hardware.
- In a business model predicated principally on the use of IT for conducting transactions, having more highly skilled employees is the starting point for a company to increase its presence in value chains. The human resources of most SMEs are not highly skilled, especially in some traditional industries such as textiles, in which most workers have no more than a middle school education and only managers have college degrees. To further improve the way they use IT, SMEs, including those specialized in software development, are trying to improve the skills of their human resources, because their competitiveness depends on their ability to do so. SMEs with more highly skilled employees are more competitive and are able to participate in a broader range of business models. SMEs are at a disadvantage vis-à-vis large companies, which can pay higher wages and are viewed more favourably by society.
- Increased IT use brings enterprises closer to each other, as the Internet allows them to communicate more quickly. SMEs have set up websites to raise their profile and publicize their products. Yet Internet transactions still represent a small portion of total sales, and many SMEs do not engage in e-commerce at all. The main impediment to more use of e-commerce is the lack of a legal framework to instil confidence in purchasers.

Some Taiwanese-based enterprises use e-commerce to finalize purchases or sales with companies abroad. However, within China, e-commerce is not widely used, because companies without a long business partnership will not do business over the

Internet, since they prefer face-to-face communication and long-term business relationships. Therefore, the traditional transaction model is the basis for e-commerce, and distrust is a barrier to the spread of e-commerce transactions.

- No financial support structure for e-commerce is yet in place. One reason for this is that banks are unable to provide highly efficient Internet services. For example, banks need around 10 days to confirm electronic payments and they charge high fees—for example, 5% on credit-card transactions. Another reason is that firms regard online payments as risky. Thus, the lack of efficiency and security in the online payment system hinders the spread of Internet transactions.
- As SMEs do not have the financial means to set up their own websites, most of them turn to third-party e-commerce platforms or portals, which charge an annual fee. When the volume of e-commerce transactions is small, the annual fee can be onerous for an SME. Only when an SME is in a position to make large transactions through a portal or website will it become more involved in e-commerce. These considerations reduce online business and make SMEs reluctant to pay annual fees to portals. The decline in the number of SMEs registered at portal websites has further reduced online business. Therefore, greater Internet use by SMEs will lead to higher online sales, and vice versa.

## **IV. Government policies vis-à-vis SMEs, IT and international trade**

Above all two policies have strongly contributed to improving China's international competitiveness. First: the transition to digitization, which has been the cornerstone of industrial technology-promotion policies. Second: trade liberalization, which has been one pillar of a set of more open policies designed to attract foreign capital and expand international trade. However, among policies that have had a greater or lesser influence on firms' behaviour, the special policy to promote SME development has been sorely inadequate.

### **A. IT policies in China's development strategy**

#### **1. IT development policies**

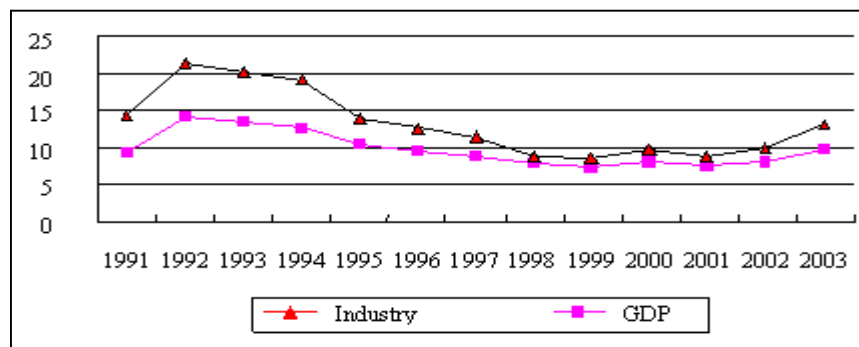
Industry is the driving force behind China's economic growth. From 1992 to 2003, industrial growth averaged 13.2% per year, more than three percentage points above the 9.8% increase in GDP. China's strategy stresses intensive IT use during the current stage of industrialization.

In a word, the central government's IT development policy seeks to promote a market-oriented application of IT products, the use of networks for resource sharing, technological innovation and greater competition.

The government's IT strategy, outlined in the Tenth National Economic Development Plan, set the following IT-industry goals for 2005: that ICT products and services would account for more than 7% of GDP; that the nationwide network's size and capacity would satisfy the nation's need for information-based development; and that the informatics industry would grow and the quality of its products would improve to such a degree that the value added in manufacturing would rise to 3.3% of GDP.

Through these policies, the Chinese government ratified its commitment to promote the use of IT in society and its widespread application in traditional industries as well as the rapid development of the electronics and information industries. Hence, the government has sought to encourage IT development by spurring demand for IT-related products and services.

**FIGURE 16**  
**GROWTH OF GDP AND INDUSTRIAL OUTPUT**  
*(In percentages)*



**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, State Statistical Press, 2004.

## 2. Structural adjustments and the rise of the ICT industry

Worldwide, IT has been among the industries experiencing the highest growth rates in the past two decades. IT is commonly viewed as the new mechanism for other sectors to cut costs and increase profits. Not only has IT driven the development of other high-tech industries, it has also led to adjustments across industries, raised industrial engineering skills and improved the quality of life throughout society.

Since 1995, the IT industry has been propelled to a new stage of development in China, all while being transformed into the engine of economic growth. In constant 1990 prices, production of electronics and telecommunications equipment was 259.90 billion *yuan* in 1995, accounting for 5.22% of manufacturing output. By 2002, the figure had risen to 1.208 trillion *yuan*, or 11.48% of manufacturing output. Moreover, office equipment and computer sales rose from 48.40 billion *yuan* to 443.80 billion *yuan* in the same period, a more than ninefold increase. In 2002, IT accounted for 16.8% of output in manufacturing, surpassing textiles and machinery, the traditional mainstays of Chinese manufacturing.<sup>3</sup>

Table 39 details the fundamental changes in the structure of China’s manufacturing industry from 1980 to 2002.

**TABLE 39**  
**SHARE OF OUTPUT OF FOUR MANUFACTURING INDUSTRIES IN CHINA, 1980-2002**  
*(In percentages)*

| Industry            | 1980  | 1985 | 1998 | 2002  |
|---------------------|-------|------|------|-------|
| Textiles            | 16.97 | 9.51 | 7.33 | 6.48  |
| Transportation      | 4.18  | 6.23 | 7.06 | 8.50  |
| Electric appliances | 3.70  | 5.38 | 6.08 | 6.25  |
| Electronics         | 1.85  | 5.22 | 8.20 | 11.48 |

**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, State Statistical Press, various issues.

<sup>3</sup> The textile and machinery industries accounted for 9.51% and 8.51% of manufacturing output in 1995, declining to 6.48% and 7.19% in 2002.



In 2002, the electronics and telecommunications industries contributed 252.09 billion *yuan* in added value, equivalent to 2.41% of GDP (1.048 trillion *yuan*), whereas the figure for computers and office equipment was 60.40 billion *yuan* (0.58% of GDP). As the total value added by ICT industries was equivalent to 2.99% of GDP, it was quickly approaching the government's goal of 3.3% of GDP by 2005.

A breakdown of electronics and telecommunications output shows that telecommunications and home audio-visual equipment were the largest segments of this industry in 2002, accounting for 33.68% and 30.12% of total output. As shown in table 40, between 1995 and 2002, the performance of China's IT industry was as follows: Sales of telecommunications equipment rose from 6.73 billion *yuan* in 1995 to 40.68 billion *yuan* in 2002, and this segment's share of all sales in the electronics and telecommunications industry increased from 25.9% to 33.7%. Also, production of components increased very quickly—from 94.10 billion *yuan* to 400.60 billion *yuan* in seven years. Importantly, integrated-circuit output more than quadrupled, from 9.8 billion *yuan* to 44.50 billion *yuan*. Sales of integrated circuits reached 207.40 billion *yuan* in 2003, equivalent to 17.5% of the global market, making China the world's third-largest consumer of these components, after the United States and Japan.<sup>4</sup>

**TABLE 40**  
**BREAKDOWN OF OUTPUT IN CHINA'S ICT INDUSTRY (1995-2002)**  
(In billions of *yuan*)

|   | 1995         | 1999         | 2000         | 2001           | 2002           |
|---|--------------|--------------|--------------|----------------|----------------|
| <b>Electronics and telecommunications</b> |              |              |              |                |                |
| 1. Telecommunications equipment           | 67.3         | 194.7        | 288.4        | 411.1          | 406.8          |
| 2. Electronic devices                     | 40.6         | 96.7         | 134.9        | 139.9          | 181.9          |
| - Integrated circuits                     | 9.8          | 19.3         | 35.5         | 36.8           | 44.5           |
| 3. Electronic components                  | 53.5         | 119.1        | 47.2         | 169.7          | 218.7          |
| 4. Home audio-visual equipment            | 73.8         | 229.3        | 244.0        | 272.7          | 363.8          |
| 5. Other                                  | 24.7         | 22.2         | 33.7         | 35.2           | 36.8           |
| <b>Subtotal</b>                           | <b>259.9</b> | <b>662.0</b> | <b>848.2</b> | <b>1 028.6</b> | <b>1 208.0</b> |
| <b>Computer and office equipments</b>     |              |              |              |                |                |
| 1. Computers                              | 26.4         | 84.0         | 125.0        | 150.1          | 239.2          |
| 2. Computer peripherals                   | 18.7         | 64.4         | 96.8         | 124.7          | 174.7          |
| 3. Office equipment                       | 3.4          | 16.4         | 19.0         | 23.8           | 29.9           |
| <b>Subtotal</b>                           | <b>48.4</b>  | <b>164.6</b> | <b>240.8</b> | <b>298.6</b>   | <b>443.8</b>   |

**Source:** National Bureau of Statistics of China (NBS), "2003 China statistical yearbook on high technology industry", Beijing, China Statistics Press, 2003.

**Note:** ICT industry output expressed in 1990 constant prices.

The output of home audio-visual equipment rose to 363.80 billion *yuan* from 73.80 billion *yuan*, a nearly fivefold increase.

Computers were the ICT industry's strongest performer in terms of growth, as output increased ninefold, from 26.40 billion *yuan* to 239.20 billion *yuan*.

Clearly, the output capacity of ICT industry has risen substantially.

<sup>4</sup> In 2003, the value of China's integrated-circuit industry market was 35.14 billion *yuan*, of which 24.84 billion *yuan* corresponded to exports. Hence, domestic sales, worth 10.30 billion *yuan*, accounted for 29.3% of all sales (Wenhui Daily, 19 July 2004).

### 3. Accelerating the pace of construction of Internet infrastructure

With the constant advance in Internet technology, infrastructure also needs to improve to meet quickly growing demand for Internet access. Today, growth in e-commerce, e-government and distance learning is barely able to keep up with demand for those services. The increasing number of ways the Internet is being used requires new, reliable infrastructure. Accordingly, China has greatly increased its investment in Internet infrastructure and laid a solid foundation to allow the Internet-based market to expand. For example, from 1992 to 2002, the capacity of the long-distance telephone exchange increased from 521,885 to 7,730,133 circuits, and long-distance optical cable lines increased from 14,388 km to 487,684 km. Bandwidth for international connections increased from 25 megahertz (MHz) in 1997 to 53,941 MHz by June of 2004.

Raising the proportion of users with broadband access is an important goal for the telecommunications sector. Regarding the backbone network, Internet protocol synchronous digital hierarchy (IP SDH) is increasingly gaining acceptance, and dense wavelength division multiplexing (known in China as “IP DWDM optical”) technology is also beginning to be used in some networks. The Internet backbone network has now reached all provincial capitals, and the bandwidth among the key Internet nodes is generally above 155 MHz, and as high as 622 MHz or even 40 GHz on some key routes.

In terms of type of access, broadband access has become the centrepiece of Internet infrastructure. Providing wired access is seen as the key to expanding broadband access, such as through digital subscriber lines (DSL) and fibre to the building (FTTB) for LANs (known as “FTTB + LAN” in China), etc. The construction of this type of Internet infrastructure, based on large-scale investments, has greatly expanded Internet access.

In 2002, the number of dial-up connections reached 2.9 million. The size of the network available for basic data increased to 1.34 million (2M) circuits. There were more than 7 million xDSL connections and some 13 million fibre to the neighbourhood (FTTN) + LAN and hybrid fibre coaxial cable modem (known as “HFC + CM” in China) connections. Data for 2004 indicate that ISDN and cable Internet access is spreading more rapidly than any other type of access.

**TABLE 41**  
**CHANGES IN HOW THE INTERNET IS ACCESSED IN CHINA**  
(x 10,000 users)

|                             | <b>Dec-2001</b> | <b>Jan-2003</b> | <b>Jun-2004</b> |
|-----------------------------|-----------------|-----------------|-----------------|
| Special line                | 2 023           | 2 660           | 2 870           |
| Dial-up                     | 4 048           | 4 916           | 5 155           |
| ISDN                        | 432             | 552             | 600             |
| Broadband                   | 660             | 1740            | 3110            |
| <b>Total Internet users</b> | <b>5 910</b>    | <b>7 950</b>    | <b>8 700</b>    |

**Source:** China Internet Network Information Centre (CNNIC), “Statistical report of China Internet development”, various issues.

**Note:** Since many Internet users are charged for more than one type of connection, the number of users indicated here is greater than the actual number. A special line Internet user refers to those who are on an Ethernet LAN. Broadband refers to xDSL (ADSL, HDSL RADSL, etc.) and cable modem connections, etc.

As the number of PCs in homes increases and broadband access in new communities becomes increasingly common, the number Internet access points is growing rapidly. This makes it much easier for people to access the Internet anywhere and at any time.

Table 41 shows the ways in which Chinese users access the Internet. By June 2004, the number of Internet users in China had increased to 87 million, of whom 28.7 million used “special line” connections; 51.55 million, dial-up connections; 6 million, ISDN connections; and 31.10 million, broadband connections.<sup>5</sup> Although the most common form of access continues to be through dial-up services, the number of special-line and ISDN users has increased steadily. Cable broadband is by far the fastest growing type of access.

#### **4. Reform and competition policy in the telecommunications sector**

China’s telecommunications industry has entered a new stage of development with the entry of new competitors and the break-up of the monopoly that existed from the days of the planned economy until 1998.

In 1998, the government created the Ministry of Information Industry (MII), marked a clear separation between politics and business and began restructuring the telecommunications industry. In February 1999, the State Council approved a plan to reorganize China Telecom, creating China Mobile, China Telecom and China Satellite Corporation as separate entities. In April 1999, China Netcom was established, and December 2000 saw founding of China Railcom Corp. At the national level, the telecommunications sector has a mix of monopoly, duopoly and limited-competition regimes. To enhance efficiency and improve the quality of telecommunications services, the government should continue to allow new entrants to compete with the well-established State-owned firms.

In December 2001, the State Council issued the Telecommunications Reform Plan. The plan split China Telecom into two separate entities, one in the north and the other in the south. The company formed in the north was merged with China Netcom and Jitong Corp. and became the Chinese Network Communication Group, which provides service in provinces and cities in North and Northeast China, Henan and Shandong. It holds 30% of all capital assets in the national long-distance telecommunications network. The company formed in the south kept the name China Telecom, allowing it to benefit from the goodwill and invisible assets of the former company. China Telecom’s territory spans provinces and cities in South, East and Northwest China and holds 70% of the capital assets of the national long-distance telecommunication network.

Beginning on 16 May 2002, the telecommunications monopoly was officially changed to a duopoly regime with the incorporation of China Telecom and the Chinese Network Communication Group (China Network). In 2003, the two telecommunications firms set off a wave of competition by establishing a large number of subsidiaries throughout China.

### **B. Policies to support SMEs**

The Chinese government’s SME policy is designed to encourage SMEs to create more jobs at the local level, as expressed in the government’s slogan, “small enterprises – high employment”. At the beginning of the decade, China enacted the Small and Medium-Sized Enterprise Promotion Law, which it hoped would serve as a legal framework to favour SME development. The law’s actual effect is unclear, however.

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<sup>5</sup> Since many Internet users are charged for more than one type of connection, the number of users indicated here is greater than the actual number.

At present, although most of the government's preferential policies are not specifically focused on SMEs, SMEs may benefit from them more than other types of companies.

## **1. Export promotion**

### **a) Export-duty refunds**

Refunds of some value-added taxes paid on exports are one of the Chinese government's primary export-promotion policies. Refunds range from 9% to 17% for most manufactured goods. Until July 2004, all duty refunds were posted against the central government's revenues. Subsequently, the government implemented new policies regarding export-duty refunds. Refunds on some products dropped from an average of 15% in 2003 to 11% in 2004. In addition, duty refunds on some simple goods whose production causes considerable environmental pollution were repealed. Third, the central government shouldered the burden for 75% of the amounts refunded, with local governments picking up the rest. And fourth, duty refunds are paid directly to manufacturers. This purpose of this policy is to encourage exports by SMEs.

### **b) Simplification of export and import procedures for in-bond manufacturing**

Since October 2001, the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) has been using computer networks to track in-bond enterprises' imports and exports. In "in-bond" (sometimes called "trade processing") manufacturing, firms import a certain percentage of their raw materials, spare parts and other components. The goods they process or assemble are re-exported.

MOFTEC has done away with the requirement that contracts signed by these enterprises in the in-bond industry be reviewed. Instead, only the qualifications, line of business and capacity of in-bond manufacturers need to be reviewed and approved. Allowing import and export procedures carried out by the in-bond industry to be monitored electronically will simplify the process, thereby encouraging further growth in this sector.

### **c) Streamlining of customs procedures**

The introduction of electronic customs procedures simplifies the processing of customs documents and applications for SMEs, by connecting government agencies to enterprises over an EDI system. The system used in China, known as "China E-Port", plays an important role in simplifying export procedures overall.

## **2. Trade facilitation**

### **a) Liberalization of foreign trade**

To promote foreign trade, the Chinese government relaxed restrictions on the kinds of enterprises eligible to take part in foreign trade operations. In particular, it lowered the threshold for SMEs to do so.

The Ministry of Commerce issued a decree modifying the requirements for import and export operations and for obtaining permits. All Chinese-owned enterprises registered in China are to abide by the unified policy governing import and export operations. In addition, all domestic enterprises are now eligible to engage in foreign trade operations. In September 2003, the amount of registered capital that Chinese-owned enterprises are required to have in order to engage in such operations was reduced from 5 million *yuan* to 1 million *yuan* (from 3 million

*yuan* to 500,000 *yuan* in the midwest). The requirement of having been in business for at least one year was also eliminated. The required amount of registered capital for manufacturing enterprises involved in directly importing and exporting was reduced from 3 million *yuan* (2 million *yuan* in the midwest) to 500,000 *yuan*. At the same time, the agency responsible for reviewing and approving foreign-trade qualifications was authorized by the special government agency, instead of applying to a certification-issuing institution, and responsibility for review and approving registrations was transferred to local governments.

This policy has eliminated the stranglehold on foreign trade long enjoyed by a few firms, allowing SMEs to freely enter the international market.

## b) Preferential tax policy

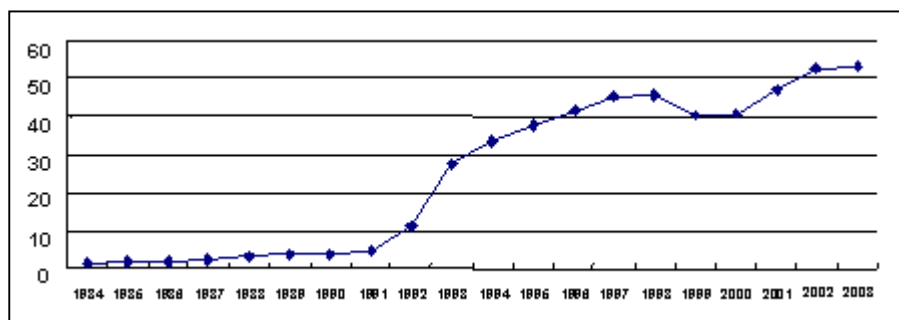
The 1994 tax reform set the income tax rate for enterprises at 33%. In addition, with a view to alleviating small businesses' tax burden, the government has since 1994 issued a preferential policy specifically to favour SMEs. An 18% tax rate now applies to enterprises with annual profits of less than 30,000 *yuan*, while a 27% rate applies to enterprises with annual profits of between 30,000 *yuan* and 100,000 *yuan*. In addition, township and village enterprises (TVEs) are eligible to pay as little as 10%, and the taxes paid by these enterprises are used to subsidize social expenditures.

## 3. FDI promotion

In this era of the knowledge-based economy, economic development is increasingly tied to the development of information technology, and enterprises are focusing on knowledge-intensive and technology-intensive products. For developing countries, FDI is an important source of capital, technology and foreign trade.

China's open-door FDI policy is one of the driving forces behind its economic growth. From 1979 to 1991, only US\$ 23.34 billion of FDI flowed into China. Since 1992, however, FDI has flooded the country, as total FDI between 1979 and 2003 amounted to nearly US\$ 500 billion.

**FIGURE 17**  
**FDI IN CHINA (1984-2003)**  
(In billions of U.S. dollars)



**Source:** National Bureau of Statistics of China (NBS), "2004 China statistical yearbook", Beijing, China Statistics Press, 2004.

The bulk of FDI —about 70% in most years— has gone into China's manufacturing industry. Since 1992, more and more FDI has flowed into the IT and IT-related industries, thereby increasing IT production capacity.

Table 42 shows the extent to which the development of China's ICT industry is dependent on joint ventures with foreign investors. In 2002, such joint ventures accounted for 64% of output, 65% of value added and 66% of profits in the electronics and telecommunications industry. In the computer and office-equipment industry, the corresponding figures were 87%, 80% and 85%. This underscores the role of FDI flows into China in promoting the development of the ICT industry and becoming a key player in that industry.

**TABLE 42**  
**OUTPUT, VALUE ADDED AND PROFITS OF JOINT VENTURES**  
**IN CHINA'S ICT INDUSTRY**  
(In billions of yuan)

| Industry                                  | 1997   | 1998   | 1999   | 2000   | 2001   | 2002   | 2002 (%) <sup>a</sup> |
|---|--------|--------|--------|--------|--------|--------|-----------------------|
| <b>Electronics and telecommunications</b> |        |        |        |        |        |        |                       |
| 1. Output                                 | 232.77 | 309.13 | 427.40 | 552.32 | 697.50 | 772.98 | 64                    |
| 2. Value added                            | 43.63  | 52.15  | 75.56  | 93.28  | 107.01 | 126.84 | 65                    |
| 3. Profits                                | 10.81  | 11.27  | 19.28  | 29.24  | 27.22  | 23.77  | 66                    |
| <b>Computers</b>                          |        |        |        |        |        |        |                       |
| 1. Output                                 | 62.30  | 81.70  | 112.75 | 186.49 | 245.44 | 385.14 | 87                    |
| 2. Value added                            | 12.45  | 14.95  | 17.63  | 28.11  | 35.29  | 48.38  | 80                    |
| 3. Profits                                | 4.60   | 2.27   | 3.78   | 6.25   | 6.17   | 9.97   | 85                    |

**Source:** National Bureau of Statistics of China (NBS), "2003 China statistical yearbook on high technology", Beijing, China Statistics Press, 2003.

**Note:** Output is expressed in constant 1990 prices.

<sup>a</sup> As percentage of industry total

By the end of 2002, there were 2,577 joint ventures with foreign investors in the IT industry, representing 48.27% of China 5,339 IT firms. More importantly, these firms accounted for 74.17% of sales and 90.33% of IT exports. The rapid growth of IT exports suggests that the quality of IT products made in China is quickly approaching world standards.

**TABLE 43**  
**REGIONAL DISTRIBUTION OF FDI IN CHINA**  
(In percentages)

| Region       | 1998       | 1999       | 2000       | 2001       | 2002       |
|--------------|------------|------------|------------|------------|------------|
| Guangdong    | 26.4       | 28.9       | 27.7       | 25.5       | 21.5       |
| Jiangsu      | 14.6       | 15.1       | 15.8       | 14.8       | 19.3       |
| Shanghai     | 8.0        | 7.0        | 7.8        | 9.2        | 8.1        |
| Zhejiang     | 2.9        | 3.1        | 4.0        | 4.7        | 5.8        |
| Shandong     | 4.8        | 5.6        | 7.3        | 7.5        | 9.0        |
| Fujian       | 9.2        | 10.0       | 8.4        | 8.4        | 7.3        |
| Beijing      | 4.7        | 4.9        | 4.1        | 3.8        | 3.3        |
| Tianjin      | 4.6        | 4.4        | 2.9        | 4.6        | 3.0        |
| Liaoning     | 4.8        | 2.6        | 5.0        | 5.4        | 6.5        |
| Others       | 20.0       | 18.4       | 17.0       | 16.4       | 16.2       |
| <b>Total</b> | <b>100</b> | <b>100</b> | <b>100</b> | <b>100</b> | <b>100</b> |

**Source:** National Bureau of Statistics of China (NBS), "China statistical yearbook", Beijing, China Statistics Press, various issues.

FDI in China is unevenly distributed, as the coastal region has received more than 80% of the total. Table 43 gives a regional breakdown of FDI from 1998 to 2002. Yangtze Delta (Shanghai, Jiangsu, Zhejiang) accounted for about 33% of total FDI, while the Pearl River Delta (Guangdong) and the Round Bohai Bay region (Beijing, Tianjin, Shandong, Liaoning) each received 22%. The continued flow of FDI has undoubtedly expanded capital accumulation in these regions.

SMEs in Yangtze Delta receive the largest amount of foreign investment. For example, in Changzhou in 2002, there were 180 enterprises with overseas Chinese investments from Hong Kong (China), Macao and Taiwan (Province of China), and they had an average of 87 employees. By contrast, the 172 foreign-owned enterprises had an average of 132 employees. Changzhou received US\$ 620 million in FDI in 2001 and US\$ 561 million in 2002. The small joint ventures located there mainly export labour-intensive products.

#### 4. Growth of small high-tech firms

Another important central-government strategy is the use of preferential policies to encourage the start-up of high-tech firms in industrial-development or export-oriented zones. New high-tech enterprises in various industrial-development zones are exempt from income tax for their first two years of operation. In addition, there is a temporary tax exemption on technology transfers, consultations and related services for enterprises and institutions with annual net earnings of less than 300,000 *yuan*. These measures have led to the rapid expansion of small enterprises in the technological sector.

As shown in table 44, new high-tech enterprises in development zones are generally small, with an average of between 110 and 126 employees. From 1998 to 2002, the output of these enterprises tripled, from 433.36 billion *yuan* to 1.294 trillion *yuan*, and exports nearly quadrupled, from US\$ 8.53 billion to US\$ 32.92 billion. The number of SMEs in these industrial zones increased from 16,907 to 28,338. The large number of new high-tech small enterprises has led to an upgrading of the industrial structure and the creation of new jobs.

**TABLE 44**  
**MAIN INDICATORS OF HIGH-TECH FIRMS IN INDUSTRIAL DEVELOPMENT ZONES**

| Indicator                         | 1998        | 1999        | 2000        | 2001        | 2002        |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|
| Number of firms                   | 16 097      | 17 498      | 20 796      | 24 293      | 28 338      |
| Employees per firm                | 108         | 126         | 113         | 114         | 123         |
| <b>Total workforce (millions)</b> | <b>1.74</b> | <b>2.21</b> | <b>2.35</b> | <b>2.76</b> | <b>3.49</b> |
| Output (billions of <i>yuan</i> ) | 433         | 594         | 794         | 1 193       | 1 294       |
| Exports (US\$ billions)           | 8.53        | 11.91       | 18.58       | 22.66       | 32.92       |

**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, China Statistics Press, various issues.

### C. Special measures to bridge the digital divide among companies

The term “digital divide” refers to the disparity of opportunities for different individuals, families, enterprises and regions using ITs and conducting business on the Internet. Overall Internet use by

SMEs is not particularly high, as only 47% have Internet connections. The rapid growth of SMEs stems from concrete policy choices; policy support, whether from the central or from local governments is still needed. However, since many policies have not been designed specifically for SMEs, special attention needs to be paid to narrow the digital divide between small and large firms.

## 1. Growth in the supply of human resources

Economic growth theory has begun to regard the accumulation of human capital as the most important factor in promoting economic growth and improving welfare. For this reason, enterprises' technological capabilities are universally regarded as being largely determined by their employees' educational level.

China has a vast labour force, but few workers have a college education. Table 45 gives a breakdown of educational levels from 1996 to 2002. As seen in the table, most workers have less than a high school education, while 35% have attended primary school and 38%, middle school.

**TABLE 45**  
**SCHOOLING AMONG PERSONS OVER SIX YEARS OF AGE**  
(In percentages)

| Year | Primary | Middle | High | College or above | No schooling |
|------|---------|--------|------|------------------|--------------|
| 1996 | 35.3    | 37.5   | 11.3 | 2.8              | 13.0         |
| 1997 | 34.8    | 37.9   | 12.1 | 3.5              | 11.6         |
| 1998 | 34.2    | 38.9   | 11.9 | 3.5              | 11.5         |
| 1999 | 35.3    | 39.9   | 11.9 | 3.8              | 11.0         |
| 2002 | 35.0    | 37.7   | 12.5 | 4.7              | 10.2         |

**Source:** National Bureau of Statistics of China (NBS), "China statistical yearbook", Beijing, China Statistics Press, various issues.

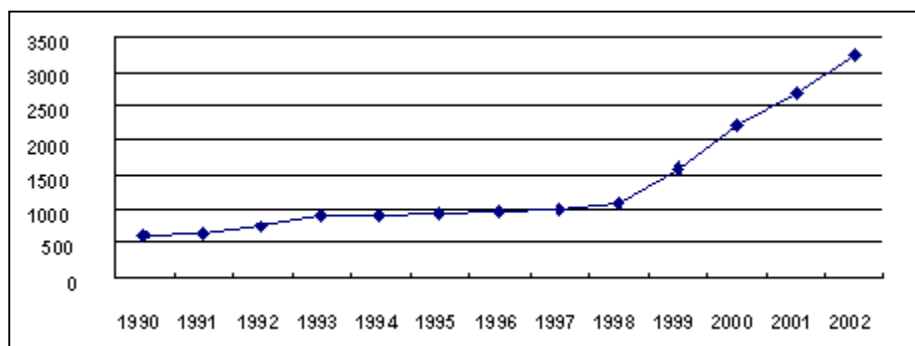
Still, as table 45 shows, there has been progress in this regard. From 1996 to 2002, there was a 3% decline in the number of persons with no schooling, while those with a high school education rose one percentage point. China has improved the quality of its workforce by raising the educational level. Increased educational opportunities are undoubtedly an important starting point for narrowing the digital divide among firms of different sizes. More policies such as those discussed below may be urgently needed in the coming decade to raise workers' ability to take advantage of IT.

First, the fact that schooling through the ninth grade has been compulsory since the early 1990s has led to higher enrolment. The number of high school students rose from 18.16 million in 1990 to 33.71 million in 2002. And since 1998, enrolment in institutions of higher learning has greatly increased—at an annual average rate of more than 30%. Graduate school enrolment also rose quickly, nearly tripling in six years. This extensive training of human capital helps explain the strong surge in the number of high-tech and software firms.

The next step in this policy should be to bring about another large increase in enrolments through the relaxation of accreditation regulations for educational institutions, and in particular to gradually raise the proportion of the population with a high school education and make university education generally available.



**FIGURE 18**  
**NEW ENROLMENTS IN INSTITUTIONS OF HIGHER LEARNING**  
*(In thousands of enrolments)*



**Source:** National Bureau of Statistics of China (NBS), “2003 China statistical yearbook”, Beijing, China Statistics Press, 2003.

Second, a policy to give primary and middle school students greater access to computer education has been implemented. Introductory courses in IT are part of the curricula of lower-level institutions, giving the coming generation of workers basic computer knowledge and skills.

## 2. Technical assistance

The most noteworthy aspect of the technology used by small enterprises in China is that these firms do not have advanced equipment. Many TVEs and private enterprises and, consequently, many small enterprises use obsolete equipment discarded by companies in the cities, and some enterprises in the midwest use computers no longer needed by enterprises in the east.

### a) Estimated level of technology used by different-sized firms

Table 46 shows the average fixed assets owned by firms in various categories (large, medium-sized, small) and in the private and State sectors, from 1999 to 2002.

**TABLE 46**  
**COMPARISON OF AVERAGE FIXED ASSETS FOR VARIOUS TYPES OF ENTERPRISES**  
*(In yuan)*

| Type of Industrial Firms            | 1999    | 2000    | 2001    | 2002    |
|-------------------------------------|---------|---------|---------|---------|
| Large                               | 127 748 | 139 078 | 163 828 | 175 596 |
| Medium-sized                        | 63 118  | 68 983  | 79 024  | 86 485  |
| Small                               | 49 969  | 54 603  | 53 499  | 55 776  |
| Privately-owned                     | 35 327  | 36 591  | 38 162  | 40 768  |
| State-owned                         | 97 850  | 109 361 | 120 375 | 142 505 |
| Enterprises with foreign investment | 151 397 | 152 408 | 157 744 | 152 617 |
| Industry average                    | 85 042  | 94 972  | 104 065 | 110 169 |

**Source:** National Bureau of Statistics of China (NBS), “China industry economy statistical yearbook”, Beijing, China Statistics Press, various issues.

**Note:** Government statistics classify industrial firms as mega, large A, large B, medium-sized A, medium-sized B, and small. Large enterprises are those in the “large A” classification, and medium-sized refers to those classified as “medium-sized B”.

From the standpoint of firm size, in 1999, small firms had only 49,969 *yuan* in fixed assets, whereas medium-sized enterprises had 63,118 *yuan* and large enterprises had 127,748 *yuan*. By 2002, small enterprises had an average of 55,776 *yuan* in fixed assets; medium-sized enterprises, 86,485 *yuan*; and large enterprises, 175,596 *yuan*. Hence, from 1999 to 2002, average fixed assets of small enterprise increased by only 11.62%, compared with a 37.46% increase for large enterprises.

In terms of type of ownership, privately owned enterprises had only 35,327 *yuan* in average fixed assets in 1999, or 36.1% of the figure for State-owned enterprises. By 2002, the figure for private enterprises had increased slightly, to 40,768 *yuan* —28.61% of the figure for State-owned enterprises. This shows that private enterprises continue to lag behind in technology investments.

Except in a few industries such as software, for SMEs to become more technologically competitive, they must invest more in capital goods. In particular, to use the Internet to do business, they also need to invest more in IT equipment. In any event, it is essential that SMEs receive assistance to allow them to upgrade the technology they use, including IT equipment.

## **b) The Spark Project**

Although small, growing enterprises are especially adept at adapting to market changes, their low level of technology prevents them from developing new products. This makes it difficult for them to improve their engineering skills. To help SMEs overcome this weakness and to revitalize the rural economy, in 1985 the State Science and Technology Commission implemented the Spark Project.

The Spark Project has provided technical support for TVEs in two ways: first, by putting each local project into contact with a research institution that offers support in the form of technology and technician training; and second, by striving to provide TVEs with technical capacities such as the ability to refurbish used equipment.

Spark has partially succeeded in raising the engineering skills of small enterprises. However, because of the project's limited resources, it has not reached a large number of TVEs.

## **c) Subsidized loans to promote SME technical innovation**

In recent years, the State Science and Technology Commission has offered funding to allow SMEs to conduct technological development projects. They can also apply for special funding or bank financing for innovation projects. The central government has provided 2 billion *yuan* in subsidized loans to support SME technical innovation projects.

This policy has been partially successful in raising SMEs' capacity to bring about technological innovation. However, since no government policy can reach all the SMEs in a given industry, it will be some time before SMEs generally have the capacity to develop technology.

## **3. Financial-support packages**

State commercial banks are the most important player in China's credit system, which lends to large and medium-sized enterprises, especially State-owned enterprises. SMEs have long had problems obtaining financing through the banking system.

Small enterprises, especially privately owned ones, have for the most part developed without borrowing from the traditional financial system. Financial reform has lagged far behind industrial reform. Indeed, State financial institutions are commonly biased against SMEs. Table 47 provides basic data on short-term lending in China. Three points need to be stressed:

Although short-term lending to township enterprises rose from 61.61 billion *yuan* to 68.12 billion *yuan* between 1999 and 2002, short-term lending as a percentage of all lending declined from 9.64% to 9.18%. Also, overall lending to private enterprises and individuals rose very quickly, from 5.79 billion *yuan* to 10.59 billion *yuan*, and short-term lending to private enterprises and individuals rose from 0.91% to 1.43%. Moreover, as a percentage of all lending, short-term lending for joint ventures decreased from 4.67% in 1999 to 3.63% in 2002. The remainder went to State enterprises.

**TABLE 47**  
**SHORT-TERM LENDING TO SMES**  
(In billions of *yuan*)

|                                       | 1998     | 1999     | 2000     | 2001     | 2002     |
|---------------------------------------|----------|----------|----------|----------|----------|
| Short term lending                    | 6 061.32 | 6 388.76 | 6 574.81 | 6 732.72 | 7 424.79 |
| Of which:                             |          |          |          |          |          |
| - Township enterprises                | 558.00   | 616.13   | 606.08   | 641.30   | 681.23   |
| - Private enterprises and individuals | 47.16    | 57.91    | 65.46    | 91.80    | 105.88   |
| - Joint ventures                      | 248.75   | 298.58   | 304.98   | 326.35   | 269.74   |

**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, China Statistics Press, various issues.

The government has found it difficult to ensure that the State banking system change the distribution of lending among the different sectors.

The government’s leading policies in this regard are described below:

#### **a) SME credit-guarantee system**

Various factors contribute to the low level of borrowing by SMEs; for instance, some SMEs are reluctant to borrow from banks. To raise the level of funding for SMEs, the central government established the Experimental SME Credit Guarantee System in 1999.

The credit guarantee system comprises service-providing institutions at the municipal, provincial and national levels as well as guarantee and re-guarantee institutions. As city-level agencies, guarantee institutions serve SMEs in the city where they are established. Likewise, re-guarantee institutions are provincial agencies and only serve their particular province.

By June 2003, 996 SME guarantee institutions had been set up throughout the country, raising a total of 28.70 billion *yuan* in guarantee funds, thereby allowing 118 billion *yuan* in loans to be provided to 50,000 SMEs.

#### **b) Credit departments for SMEs**

In 1998, to enhance the support given to SMEs, the Central Bank required that SME credit departments, be established by branches of the major commercial banks, that is, the Industrial and Commercial Bank of China, the Construction Bank, the Bank of China and the Agricultural Bank.

#### **c) SME stock exchanges**

In August 1999, the central government proposed establishing a “new high-tech enterprise exchange board” on the Shenzhen or Shanghai stock exchanges. In June 2004, the

government set up a board for listing small and medium-sized enterprises on the Shenzhen stock exchange. To make initial public offerings (IPOs) on these exchanges, SMEs must, among other things, have turned a profit the previous three years, have good prospects for continued growth, and have no more than 50 million *yuan* in registered capital.

As of 9 August 2004, 30 SMEs had gone public and were listed on the second board of Shenzhen Stock Exchange. The lowest volume of outstanding shares for any one company was 13.4 million, while the highest was 30 million. Thirty SMEs had raised a total of 710 million *yuan*. More and more SMEs were expected to raise funding through the stock exchange, as this was seen one way for them to overcome their problems in finding financing.

#### **4. SMEs development centres**

The lack of government services limits SMEs to producing goods requiring a low level of technology. To address this limitation, the Chinese government is establishing SME development bureaus or centres at economic commissions at all levels of government. These agencies try to solve problems by working with industrial associations, technological-support centres and a variety of other institutions. In addition, as government entities, they provide technological support, market information, vocational training as well as legal services for workers.

### **D. E-government for SMEs and trade promotion**

E-government offers very clear benefits, such as increased efficiency, better services, greater transparency in policies and more honesty in government. The introduction of e-government is an important component in the transition to an information-based economy. By coming online, the Chinese government hopes to spearhead the adoption of IT applications, reduce administrative costs and increase the efficiency of daily operation on the Internet.

#### **1. Structure of e-government**

Central, provincial and local government agencies are now online. The current framework and development strategy for e-government in China can be summarized as follows:

##### **a) Special network for central government affairs**

The central government has built intranet and Internet platforms as well as portals for government affairs. It has also made progress in building a resource system for administration and macroeconomic management, most notably, the “Golden Customs” and “Golden Taxation” projects, and a statistical information network.

Government websites have launched one-stop online service, enabling the public to easily access government announcements. The Internet platform will provide services for many sectors, such as enterprises and technology service systems.

##### **b) Local government network**

Progress has been made in ensuring government at all local levels come online. At the end of June 2004, the number of registered domain names ending in “gov.cn” had reached 13,963, and there were 12,332 government websites. More than 90% of the municipal governments had online-help pages for the public, and over 75% of the central government departments had done the preliminary engineering work needed for them to be networked.

Some coastal provinces and cities have built their own networks. However, most provinces and cities in other parts of the country have not yet joined the unified government-affairs network.

## 2. Some e-government applications

### a) How government websites are used

E-government is still in its initial stages of development in China. Like e-commerce, e-government is mainly used to issue public advisories and publicize government activities. According to the market survey, the main purpose of government websites is to provide information on the daily operations of different government offices; disseminate news, announcements, laws and regulations; and provide orientation on administrative issues. Less frequently, they allow users to download forms or apply for certifications or business licenses. Such activities account for only 0.2% of the services on government of websites (see table 48).

**TABLE 48**  
**MAIN USES OF GOVERNMENT WEBSITES**

| Use                                   | %    |
|---------------------------------------|------|
| Agency background information         | 87.0 |
| Advisories on laws and regulations    | 79.2 |
| Government news                       | 77.6 |
| Industry/regional information         | 76.0 |
| Guidelines on government requirements | 67.7 |
| Statistical data                      | 21.9 |
| Receipt of inquiries/complaints       | 5.7  |
| Receipt of forms                      | 0.2  |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

**Note:** Percentages are in relation to all government websites. The date of the survey is 30 April 2001.

### b) Slow adoption of e-procurement

In July 2002, the Chinese government issued its “Instructions for Constructing E-Government in China”, through which it announced plans for online purchasing and provided information on online procurement contracts and online calls for bids. Through the system subsequently introduced, enterprises may submit bids, fill orders, receive IT contracts, inquire on deliveries and pay bills. The expansion of e-procurement will help the G2B market gradually take hold.

Although e-procurement<sup>6</sup> is not yet widely used in China, the government’s e-procurement strategy should lead enterprises to adopt digitized processes more quickly, thereby promoting the expansion of B2B. For SMEs to be included in the government’s purchases system and make bids online, they must become more adept at using information technology. By leading the way and encouraging the development of e-commerce, the government’s e-procurement strategy should promote greater digitization by SMEs.

<sup>6</sup> E-procurement refers to online commercial activity between the government and enterprises.

### **c) Adequate e-customs procedures**

E-customs procedures have successfully been implemented following the March 2001 introduction of China's E-Port system, intended to facilitate import and export procedures for enterprises, particularly for SMEs. The scope of E-Port's applications has been continuously expanded. Four aspects of these applications are discussed below.

#### **i) Administration of quota licenses**

In 2001, MOFTEC finished networking the computers of 62 nationwide offices that issue licenses and verify electronic data. The purpose of this was to permit the verification of fabrics quotas with customs offices in the United States, the European Union, Canada and other countries.

#### **ii) System to clear foreign exchange payments for exporting and importing**

This system permits the online verification of customs declarations on imports and of applications for foreign exchange clearances on exports, the recording of the place of export by the customs office and the submittal of declarations to foreign currency departments for the settlement of foreign exchange. The system also transmits foreign exchange clearances after their verification on the Internet and ensures consistency in the electronic data contained in different departments of customs and the Foreign Exchange Office, which, in turn, allows such data to be verified. Since being implemented, the system has prevented duplicity in foreign-exchange operations.

#### **iii) Tariff-refund system**

This system uses the Internet to connect the computers of the General Customs Administration to those of the Foreign Exchange Control Administration. For instance, the system clears foreign exchange documents once they have been verified, and also provides proof of settlements on foreign-exchange payments at a specified future date.

#### **iv) Online payments of duties and fees**

Customs offices and banks now provide online services, and importers and exporters can pay all duties and fees electronically.

More than 100,000 import and export enterprises throughout the country have joined E-Port. For an enterprise to access E-Port and thus use the Internet to make customs declarations, clear foreign exchange payments and receive export-tax refunds, it must receive authorization from six government agencies: the departments of Industry and Commerce Management, of Taxation, of Quality Testing, MOFTEC, the Customs Bureau and the Foreign Exchange Control Bureau. These government agencies verify all of an enterprise's certificates, to ensure that the integrated circuit cards that enterprises are issued when joining E-Port are free of errors.

E-Port has led to notable economic and social benefits. The digitization of procedures such as filing customs declarations, clearing foreign-exchange payments, receiving export-tax refunds and making payments has made it less necessary for import and export enterprises to be in contact with government departments and import and export services providers.

### **d) Obstacles to the use of e-payments**

Electronic fund transfers, an important component of e-commerce, are mainly conducted with electronic credit cards, electronic cheques, digital money and through electronic bank transfers. Payments by electronic credit card are very common. Internet banking, an extension of traditional banking, is a more convenient and expedient way to make fund transfers.

Table 49 shows the growth of bankcards in circulation in China. There is now a very large number of bankcards —496.52 million cards were issued in 2002 alone. The value of transactions has also risen quickly, for example, from 8.428 trillion *yuan* in 2001 to 11.560 trillion *yuan* in 2002, a 37.16% increase. However, bankcard purchases are relatively infrequent, accounting for only 1.62% of all transactions in 2002. Use of bankcards for transfers between accounts has climbed to 21.60%, and e-transfers continue to be the predominant form of using bankcards.

**TABLE 49**  
**BANKCARD USE BY BUSINESSES**

|                          |                            | 2000     | 2001     | 2002      |
|--------------------------|----------------------------|----------|----------|-----------|
| 1. Cards issued          | (millions)                 | 277.44   | 382.83   | 496.52    |
| 2. Value of transactions | (billions of <i>yuan</i> ) | 4 530.00 | 8 427.95 | 11 560.18 |
| - Purchases              |                            | 105.80   | 128.00   | 187.48    |
| - Transfers              |                            | 1 113.24 | 2 330.97 | 2 496.91  |

**Source:** China Association of Finance, Almanac of China's Finance & Banking, Beijing, Almanac Publisher of China Finance, 2003, 2002 and 2001.

#### **i) Wider range of online banking services**

Before 2000, bank websites were mainly used to obtain information. Now however, online banking is being used principally to manage accounts, that is, for account-access, currency transfers, remittances, transfers between banks, securities purchases and payments (B2B, B2C). Some banks offer small mortgage loans online.

#### **ii) Higher volume of Internet transactions**

By the end of 2000, more than 410,000 commercial-bank customers were doing a total of 650 billion *yuan* in Internet banking transactions per year, and Internet banking was available in all urban areas. For example, 29,000 business customers of the Industrial and Commercial Bank of China (ICBC) were doing online banking by the end of 2002, and the value of the online transactions by these customers had risen to 5.400 trillion *yuan*. The main transactions were transfers between accounts.

#### **iii) Bringing e-payments to the entire country**

By 2004, China had completed its e-payment and settlement system, modelled on the electronic data-collection system used by commercial banks and the clearing houses used in urban areas.

However, China's e-finance system is still in its infancy, and China does not yet have "virtual banks" to provide Internet-based banking services.

Though most commercial banks have such basic Internet-banking functions as online payments, account access and transfers, payments are not normally made online. Most commercial banks' online payment systems are somewhat limited, and online payments have not become the primary form of payment for Internet purchases, which are normally paid C.O.D.

### **3. Promotion of IT through e-government**

The January 2003 enactment of China's Government Purchasing Law is expected to lead to rapidly increasing demand for IT products and services due to the growth of government online procurement.

Most e-government expenditures are related to building systems, databases and networks and security. The CCID predicts that in 2004 spending on desktop systems for civil servants would total 125 billion *yuan* — 100 billion *yuan* for hardware and 25 billion *yuan* for software— and that 50 billion *yuan* would be invested in the construction of such national projects as e-government LANs and the installation of a backbone network to connect government departments at all levels throughout the country. Hence, the promotion of e-government should serve as a catalyst for the development of the IT industry.

## **E. Incremental institutional improvements**

### **1. Standardization of EDI codes and use of XML**

An EDI system is composed of standardized data, EDI software and hardware and a communications network. The use of a data standard allows different types of file formats to be exchanged between organizations. EDI systems greatly facilitate document and file transfers while reducing cost and error rates. They also significantly improve efficiency and do much to promote international trade.

The two leading international EDI standards are ISO9735 and ANSI X.12. China mainly uses ISO9735, although some special standards are used in certain sectors. To take advantage of EDI's security features, a system using EDI must verify identity and ensure that contents are kept confidential and that data will remain intact. It must also allow a file transmission to be refused. Two methods are commonly used. The first is a virtual private network (VPN). With a VPN, depending on the special-purpose encryption and the specific algorithms agreed on by the two parties, all layers of the IP data package are encrypted. This allows an encryption tunnel to be set up for secure network management on both sides of the network. The second method is used when the parties that do not know each other, when transactions volumes are small or when small amounts of data are transmitted. Identity authentication allows parties to determine who the other party in the transaction is.. The encryption certification systems used for certificates issued by Certification Authorities (CAs) are the key to security in data transmission.

E-commerce technology is also in constant flux. Using EDI is comparatively expensive and complex. Setting up an EDI communication system requires a large investment, as does setting up a value-added network (VAN). This means that EDI is more suitable for large or financially sound companies than for small and medium-sized enterprises that do less online business. With the spread of the Internet, small and medium-sized enterprises in China now use Internet-based open extensible mark-up language (XML) to exchange electronic data.

### **2. Spread of public key infrastructures**

Public key infrastructure (PKI) is a security system that is modelled on the public key theory and that uses the technology derived from it. As such, it offers information security services for a wide range of network users and for networked computers.

A PKI system offers online identity authentication based on the uniform safety certification standard, the objective of which is to instil confidence in Internet users. As the infrastructure for the coming information society, PKI involves issues such as comprehensive strategies for developing e-government, e-commerce and digitization at the national level. It brings together relevant technologies, applications, organizations, standards, laws and regulations. A secure PKI system comprises five major components: a CA, a digital certificate repository, a system for copying and recovering secret keys, a certificate cancellation system and a series of application programming interfaces (APIs).



## **a) National PKI structure**

China's national PKI system is mainly composed of the following organizations:

### **i) At the national level**

The National PKI Coordination and Management Committee (NPCMC) is responsible for issuing, implementing and enforcing PKI-related policies and approving CAs and subordinate certificate authorities (SCAs), certificate policies (CPs) and certification practice statements (CPSs).

### **ii) National Root CA**

According to NPCMC guidelines, the main purpose of the root CA in the national e-government certification system is to oversee the institutions that carry out its daily operation for the root CA of e-government, to approve the establishment of CAs, CPs and CPSs to handle official business by ministries and commissions and by provincial governments and to sign and issue the CA certificates of all ministries and commissions or regions.

### **iii) Industry and regional Cas**

Industry and regional CAs are responsible for managing CAs and registration authorities (RAs) used for internal authentication at their subordinate sectors such as textile industry and banking.

At the national level, the NPCMC's policies and norms allow CAs to be set up in different industries and regions and hence to offer the corresponding information security services.

## **b) PKI application and development**

Since the establishment of the first CA in China in 1998 (the China Telecom Certificate Authority, or CTCA), many other CAs have been established and come into use and have thus played a role in e-commerce and e-government. CAs in China can be regional or local, or they can govern a specific industry or commercial activity.

By the end of June 2004, about 80 CA centres had been established throughout the country, and these CA centres had issued more than 5 million electronic certificates. Electronic certificates were widely used in such sectors as finance, tax accounting, customs brokering and industry.

China's Electronic Signature Law, passed by the National People's Congress on 28 August 2004, entered into force in May 2005.

## **c) Problems with PKI development**

PKIs and CAs are only beginning to be introduced in China. The main problems preventing them from becoming more widely adopted are that the CAs are small, few licences have been issued and the utilization rate is low. Also, CAs set up by local governments have their own procedures, which means that some CAs are mutually incompatible, which creates "CA islands".

In the long run, the continued improvement of PKIs does not depend primarily on technical applications but on the introduction, through the enactment of national laws, of a uniform operating environment for the CA market. The central government should promote PKI interconnectivity, including by encouraging cooperation between Chinese and international CAs and the increased use of PKIs in e-commerce.

### 3. Protection of computer software

Copyright law protects literary, artistic and scientific creations. With the advent of computer software, databases and multimedia technology, new products have been included in the purview of copyright regulations. A more comprehensive legal framework for copyright protection now exists in the world. Hence, computer software is covered by copyright protection, which gives software copyright holders the certainty that required actions will be taken in a timely fashion. In China, a Copyright Law, Computer Software Protection Regulations and a Computer Software Registration Method were introduced in 1990 to protect computer software and provide legal guarantees for the intellectual property rights of small and medium-sized software enterprises.

### 4. Customer mistrust

Even in brick-and-mortar markets, consumers often unwittingly buy the imitations. This makes it all the more difficult for the public to trust online markets. The lack of consumer trust has long thwarted the development of e-commerce in China. The recent bankruptcy of the 8848 portals has also caused many Chinese Internet users to be wary of B2C transactions. This lack of trust throughout society prevents electronic payment systems and mail-order businesses from gaining wider acceptance. The reliance on C.O.D. as the preferred method of payment also makes it more difficult for B2C enterprises to do business.

Nonetheless, two surveys of online trade, one conducted in December 2001 and the other in June 2004 (table 50), show that confidence in online transactions has grown. The percentage of respondents who considered online information unreliable fell from 48.7% to 7.3%, and that of those who were reluctant to make online payments declined from 60.6% to 6.8%. Still, the percentage that were wary of online security remained unchanged, at 28%, while that of those which were apprehensive of the quality of products sold online and of after-sale services rose to from 32.4% to 43.8%. This indicates that Chinese consumers continue to shy away from online transactions.

**TABLE 50**  
**PERCEPTIONS OF INTERNET USERS REGARDING ONLINE SHOPPING**  
(In percentages)

|  | Dec-2001 | Jun-2004 |
|--|----------|----------|
| Security does not live up to claims                      | 28.7     | 28.9     |
| Quality and after-sale services do not live up to claims | 32.4     | 43.8     |
| Goods are not delivered on time                          | 19.3     | 6.5      |
| Payment is complicated                                   | 60.6     | 6.8      |
| Information is unreliable                                | 48.7     | 7.3      |
| Buying online does not save money                        | 14.8     | 6.0      |
| Other  | 10.4     | 0.7      |

**Source:** State Information Centre/China Association of Information (SCI/CAI), “2002 China information yearbook”, Beijing, China Information Yearbook Press, 2002.

B2B, by contrast, is based on trust between enterprises. Thus, it is an extension of traditional aspects of business such as managing orders, logistics systems and transportation with network automation. In addition, B2B is convenient and fast. Before engaging in B2B transactions, parties often already know each other, including through in-person exchanges where they are able to see the advantages of each other’s organizational methods. Although industrial and commercial departments have strengthened their efforts to register and authenticate online

enterprises, effective management methods to deal with business credibility for online transactions are still lacking. Honesty is a basic prerequisite for the spread of online transactions e-commerce.

In conclusion, in China buyers and sellers do not yet trust each other enough. Moreover, electronic payment methods still need to be improved. These two issues are obstacles to the continued development of e-commerce.

## F. Policy recommendations

The Chinese government's new industrialization policy —consisting of “using digitization to usher in industrialization, while promoting digitization in tandem with industrialization” —has been a key factor in the spread of IT and the development of the IT industry.

As the transition to an information economy moves incessantly forward, government should adopt effective, proactive policies to narrow the information gap among enterprises of different sizes and promote the role of small and medium-sized enterprises in external trade. Policies such as those outlined below could prove beneficial:

- To further expand Internet infrastructure, government at various levels should expand Internet access, particularly broadband access, and upgrade infrastructure for such new fields as e-commerce and e-government.
- The residual effects of the presence of monopolistic and oligopolistic players in the telecommunications sector need to be addressed as soon as possible. The benefits in high prices to be found from giving State enterprises a leading role in the telecommunication market are unparalleled. An opening up of the telecommunications sector and the entry of new competitors is required to bring down exorbitant telecommunications rates and accelerate the spread of the Internet. A telecommunications market characterized by an optimal level of competition could reduce the cost of online transactions for SMEs and subsequently promote higher e-commerce penetration rates.
- The Small and Medium-sized Enterprise Promotion Law, enacted in 2002, merely provided a legal framework to permit SME development. Specific government policies and measures are urgently needed to help SMEs grow and rapidly become important players in foreign trade. Most needed of all are policies to encourage technological transformation and innovation and to promote exports. National SME-promotion institutions should be established and a general development plan should be formulated and implemented to support and protect SME interests and thereby foster competition.
- Raising the skills of human resources is the key to substantially narrowing the digital divide. Encouraging more young people to attend high school and university is the only way to create more demand for ICT products and to stimulate further expansion in the ICT industry. Raising the educational level should also ensure that there will be larger number of highly skilled workers, thereby allowing SMEs to rely less on low-productivity, low-skilled labour. Hence, central government policies should strive to reform the educational system.
- The introduction of e-government leads to higher efficiency in public administration and services and can also serve as a strong incentive for enterprises to use ICTs. Although most enterprises can obtain information on government policies and

regulations online, they conduct little business on the Internet. The accelerated introduction of government e-procurement should strongly influence business behaviour. All enterprises, and especially SMEs, can raise sales and profits by taking part in e-procurement. Promoting e-government should also encourage the development of B2B and set an example for the effective, comprehensive operation of e-commerce.

- The main reason for government to promote the development of e-commerce is to give institutional backing for and create an environment conducive to consumer trust in online commercial transactions. It is difficult to bring about a credit-based economy by asking people to abide by moral precepts or by admonitions made in the media. Common sense dictates that a credit-based economy must rest upon a legal foundation. All commercial activities including online transactions should be governed by a legal framework. The Electronic Signature Law announced in August 2004 applies only to Internet transactions and is therefore insufficient. Further regulations are needed to establish a legal structure to provide security for all purchasers and sellers of products and services. In sum, for SMEs the most difficult aspect of doing business over the Internet is not their lack of ICT equipment or their ability to buy computers, servers and routers, but the lack of legal guarantees regarding Internet transactions. China needs nationwide laws and regulations to ensure that e-commerce transactions are safe.

## V. The primary stage of regional networks

In China, the establishment and enhancement of regional networks to promote exports by small and medium-sized enterprises should ensure cooperation among these networks at two levels: first, among regional networks within the country, and second, between regional networks in China and those in its major regional trading partners. In the long run, cooperation with international networks should be expanded. Such expansion is predicated on increased interregional economic activity.

Intranets within and among regions are an important channel to allow SMEs to use IT to promote international trade and share information. Increased exports by East Asia will reduce the distances between it and other regions and create new avenues for promoting trade development.

### A. Regional websites: overview

The development and utilization of information resources is an important part of a country's transition to an information society. In a context of rapidly developing information infrastructure, the extent to which information resources are developed and utilized will directly determine the type of information society that emerges as well as the return on investments in IT infrastructure.

Undoubtedly, the business sector is the most important market for IT products and services. The domain names of 75% of all websites in China contain “.com” or “.com.cn”.

The degree of IT development varies from region to region in China. The regional distribution of websites or of registered domain names with “.cn” shows how large the digital divide is —a gap that has not narrowed much in recent years.

#### 1. Regional distribution of registered domain names containing “.cn”

The results of seven research projects by the China Internet Network Information Centre (CNNIC) are summarized in table 51. Registered domain names containing “.cn” are concentrated in three broad regions: North China, East China and South China, accounting for 89.4% of all such domain names in 1999 and 79.1% as of 30 June 2004.

These three regions are located along the coast and have a relatively high level of economic development. Enterprises there have a stronger capacity to use IT. Of the three, East China shows the strongest economic development and accordingly leads the country in the number of domain name containing “.cn”. Its share rose from 25.3% in 1999 to 30.7% in June 2004.

**TABLE 51**  
**REGIONAL DISTRIBUTION OF REGISTERED DOMAIN NAMES CONTAINING “.cn”**  
(In percentages)

| Region                        | Jul-1997      | Jan-2000      | Jan-2001       | Jan-2002       | Jan-2003       | Jan-2004       | Jul-2004       |
|-------------------------------|---------------|---------------|----------------|----------------|----------------|----------------|----------------|
| North                         | 41.3          | 41.3          | 41.4           | 38.6           | 37.9           | 29.4           | 28.6           |
| East                          | 25.3          | 26.6          | 25.4           | 27.4           | 24.6           | 29.6           | 30.7           |
| South                         | 22.8          | 21.2          | 20.1           | 20.6           | 20.3           | 19.4           | 19.8           |
| Northeast                     | 4.2           | 4.0           | 4.7            | 4.6            | 4.3            | 5.0            | 5.2            |
| Southwest                     | 4.1           | 4.2           | 4.6            | 4.4            | 3.7            | 4.9            | 4.9            |
| Northwest                     | 2.2           | 2.5           | 2.8            | 3.1            | 3.4            | 2.7            | 2.8            |
| <b>Number of domain names</b> | <b>29 045</b> | <b>48 695</b> | <b>122 099</b> | <b>127 319</b> | <b>179 544</b> | <b>340 040</b> | <b>382 216</b> |

**Source:** China Internet Network Information Centre (CNNIC), “Statistical report of China Internet development” [online] July 2004 <<http://www.cnnic.org.cn>>.

The number of domain names containing “.cn” in the northeast, southwest and northwest is relatively low and did not rise much from 1999 to 2004. This reflects the fact that the lacklustre economic development of these three regions has limited their ability to adopt new technologies.

## 2. Website distribution among regions

The number of websites in China increased rapidly between January 2001 and June 2004—from 265,405 to 626,600—underscoring the growth of China’s Internet industry.

The regional distribution of websites (table 52) closely mirrors that of domain names containing “.cn”. The north, east and south accounted for 89.1% of all such websites in the country in January 2001 and for 84% in July 2004. The percentage of websites in the northeast, southwest and northwest has increased slightly and in proportion to the decrease in the first three regions.

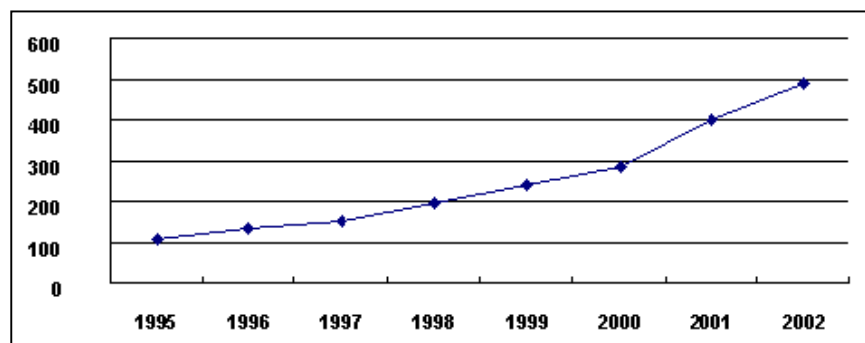
**TABLE 52**  
**REGIONAL WEBSITE DISTRIBUTION**  
(In percentages)

| Region                    | Jan-2001       | Jan-2002       | Jan-2003       | Jan-2004       | Jul-2004       |
|---------------------------|----------------|----------------|----------------|----------------|----------------|
| North                     | 28.3           | 25.1           | 24.7           | 25.8           | 26.0           |
| East                      | 39.2           | 38.1           | 36.9           | 37.1           | 35.8           |
| South                     | 21.6           | 23.0           | 25.6           | 24.5           | 22.2           |
| Northeast                 | 4.1            | 6.1            | 5.1            | 5.1            | 4.6            |
| Southwest                 | 4.5            | 4.8            | 5.4            | 5.1            | 4.8            |
| Northwest                 | 2.4            | 2.9            | 2.0            | 2.4            | 6.6            |
| <b>Number of websites</b> | <b>265 405</b> | <b>277 100</b> | <b>371 600</b> | <b>595 550</b> | <b>626 600</b> |

**Source:** China Internet Network Information Centre (CNNIC), “Statistical report of China Internet development” [online] July 2004 <<http://www.cnnic.org.cn>>.

ICT support infrastructure has improved dramatically in recent years. For example, long-distance optical cables increased to 487,684 km in 2002, 3.5 times the length in 1995, 106,882 km (figure 19).

**FIGURE 19**  
**LENGTH OF LONG DISTANCE OPTICAL CABLES**  
(In thousands of kilometers)



**Source:** National Bureau of Statistics of China (NBS), “2003 China statistical yearbook”, Beijing, State Statistical Press, 2003.

The regional distribution of networks continues to be uneven in China. The northeast, northwest and south need to quickly promote investment in information and communications infrastructure. However, it is even more urgent that these regions encourage enterprises to continue to raise their level of office automation and that they expand Internet access because the communication infrastructure in the midwest is not being fully utilized.

Thanks to the central government’s investment in communications infrastructure in all major regions, the gap between the midwest and the coastal region in such infrastructure is not as large as is the gap in the capability to utilize information resources. The Yangtze Delta had 1.1 million long-distance telephone circuits in 2002 (14.01% of the national total); the Pearl River Delta, 927,927 million (11.99%); and Round Bohai Bay, 1.3 million (17.30%). The remaining regions had 56.7% of the total.

As for long-distance fibre-optic cable lines, Yangtze Delta had 30,683 km (6.29%); Pearl River Delta, 29,455 km (6.04%); and Round Bohai Bay, 49,949 km (10.24%). The remaining regions had 77.43% of the national total.

Since there is no “gap” among regions in terms of communication infrastructure, other factors must explain enterprises’ demand for information services, in particular, the income gap resulting from different levels of economic development.

### **3. Correlation between economic development and network cooperation**

The “digital divide” among regions is a reflection of their disparate levels of economic development. Regional rankings for percentage of domain names and per capita GDP in 1999 and 2002 are listed in table 53.

**TABLE 53**  
**RANKINGS FOR PERCENTAGE OF DOMAIN NAMES AND**  
**PER CAPITA GDP, 1999-2002**

| Region    | 1999 |                   |                | 2002 |                   |                |
|-----------|------|-------------------|----------------|------|-------------------|----------------|
|           | Rank | % of domain names | Per capita GDP | Rank | % of domain names | Per capita GDP |
| Beijing   | 1    | 21.76             | 2              | 1    | 19.00             | 2              |
| Guangdong | 2    | 13.84             | 5              | 2    | 14.02             | 5              |
| Shanghai  | 3    | 9.85              | 1              | 4    | 8.83              | 1              |
| Zhejiang  | 4    | 6.39              | 4              | 3    | 9.75              | 4              |
| Jiangsu   | 5    | 5.78              | 7              | 5    | 7.58              | 6              |
| Fujian    | 6    | 4.73              | 6              | 7    | 5.19              | 7              |
| Liaoning  | 7    | 4.71              | 8              | 8    | 2.98              | 8              |
| Shandong  | 8    | 3.36              | 9              | 6    | 5.81              | 9              |
| Tianjin   | 14   | 1.64              | 3              | 16   | 1.46              | 3              |

**Source:** State Information Centre/China Association of Information (SCI/CAI), “2002 China information yearbook”, Beijing, China Information Yearbook Press, 2002.

All but one of the nine regions and metropolitan areas with the highest per capita GDP also have the highest percentages of domain names. The exception, Tianjin, had a population of 10.07 million in 2002 and a relatively buoyant economy, with a GDP of 205.12 billion *yuan*. Beijing had a population of 14.23 million and a GDP of 321.27 billion *yuan*, compared with Shanghai’s 16.25 million residents and 540.88 billion *yuan* in GDP. Shanghai was less populous than Zhejiang and Jiangsu, which had 46.47 million and 73.81 million residents.

As shown in table 53, regional rankings by percentage of domain names and per capita GDP changed little between 1998 and 2002. This has an important policy implication: regional policies to promote digitization should focus on economic development, since the comparatively high digitization level of the aforementioned regions has accelerated their economic development. Development in these regions, in turn, has prevented the most backward ones from bridging the digital divide. In the short run, the north, east and south are the regions where network cooperation can most effectively promote external trade by SMEs.

**TABLE 54**  
**REGIONAL BREAKDOWN OF EXPORT VOLUME**  
*(In percentages)*

| Region       | 1998       | 1999       | 2000       | 2001       | 2002       |
|--------------|------------|------------|------------|------------|------------|
| Guangdong    | 41.2       | 39.9       | 36.9       | 35.9       | 36.4       |
| Jiangsu      | 8.5        | 9.4        | 10.3       | 10.9       | 11.8       |
| Shanghai     | 8.7        | 9.6        | 10.2       | 10.4       | 9.8        |
| Zhejiang     | 5.9        | 6.6        | 7.8        | 8.6        | 9.0        |
| Shandong     | 5.6        | 5.9        | 6.2        | 6.8        | 6.5        |
| Fujian       | 5.4        | 5.3        | 5.2        | 5.2        | 5.3        |
| Beijing      | 5.7        | 5.1        | 4.8        | 4.4        | 3.9        |
| Liaoning     | 4.4        | 4.2        | 4.4        | 4.1        | 3.8        |
| Others       | 14.6       | 14.0       | 14.2       | 13.7       | 13.5       |
| <b>Total</b> | <b>100</b> | <b>100</b> | <b>100</b> | <b>100</b> | <b>100</b> |

**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, State Statistical Press, various issues.



Table 54 shows that the export volume of eight provinces located in Guangdong, Jiangsu, Shanghai, Zhejiang and Fujian and other regions accounted for 86.5% of total exports in 2002, slightly above the figure of 85.4% recorded in 1998. This indicates that China's export capacity continues to be highly skewed in favour of its coastal regions.

From 1998 to 2002, exports from Yangtze Delta have increased dramatically, from 23.1% to 30.6% of all exports from China, making it the fastest-growing region in terms of exports. By contrast, exports from the Pearl River Delta have decreased from 41.2% to 36.4%, whereas the north has remained unchanged, at about 18% of the national total. This underscores the opportunity to expand international trade by establishing SME cooperation networks in the three most backward regions.

## **B. Role of regional websites for SMEs**

One of China's economic strategies is to promote SME development. Government at all levels has made great efforts to support SMEs by setting up information-oriented websites. There are a large number of such sites, e.g., most municipal governments have websites to assist SMEs.

### **1. Regional breakdown of SME websites**

In line with China's political division, there are three general levels of websites for SMEs: provincial, municipal and county.

#### **a) Provincial-based regional networks**

Almost all the provinces in the eastern and middle regions and a large number of those in the west have their own SME websites. Most of these sites have been set up by local economic and trade commissions or by SME service centres, which report to provincial governments. The purpose of such sites is to promote the development and increase the competitiveness of local SMEs.

Some examples are the SME website in Jiangsu (<http://www.jste.gov.cn>), the SME services website in Fujian (<http://www.fjsme.cn>), the SME services website in Guangdong (<http://www.gdsme.com.cn>) and the SME website in Liaoning (<http://www.lnsme.gov.cn>).

#### **b) City-based regional networks**

This the most widespread type of website. Usually created by the economic and trade commissions or SME services centres that work for municipal governments, they target SMEs in the cities and aim to simplify policy- and business-related decisions for them. They are located in coastal cities that have a relatively advanced level of development, allowing SMEs to improve their performance by making better use of IT. In the coastal regions of the southeast as well as Round Bohai Bay, more SME websites have been established by municipal-government agencies.

#### **c) County-based regional networks**

With a relatively narrow scope of coverage, this type of intranet reinforces relationships among SMEs at the local level. Most are located in the regions of Jiangsu, Zhejiang and Shanghai, where the local private sector, mainly composed of SMEs, is experiencing high growth. In particular, the large number of SMEs that have spread throughout both the urban and the rural areas of Zhejiang contribute the bulk of local fiscal revenues. This explains why websites serving SMEs have been established with the support of local governments.

## **2. Features and functions of SME websites**

At present, SMEs are mostly served by non-profit websites founded by government agencies with a view to promoting continued SME growth. Most charge no registration fee and in fact receive subsidies from local government, although some SME websites have begun charging for membership.

These websites are mostly used to support and promote SME development by posting information relevant to them, especially advisories of central- and local-government policies and measures.

These websites also operate as centres to match the supply of goods or services with demand, through the establishment of network platforms. SMEs can search for market information as well as post information on their own sales and on procurement, business cooperation and transfers of obsolete machinery. Any SME that is a member of a resource centre can launch products or offer capital goods on these websites, as well as look for resources. Hence, many SMEs that lack brand recognition can receive assistance with opening new sales channels as well as with obtaining and processing market information.

Most websites allow SMEs to upload images and announce new products. Through “enterprise shows”, these websites give exposure to little-known SMEs, providing information on their history, business scope, products and clients, etc., or posting links to their own websites. Platforms such as these serve as SME information networks. This accelerates the adoption of new technologies by SMEs, while allowing them to publicize their main products to potential clients.

However, the number of visits to these websites is low. Generally, SME websites created by government agencies at all levels constitute a platform for SMEs to access information and cooperate with other businesses. As they continue to evolve, these websites are focusing less on providing information and more on becoming business networks.

## **C. Possibility for interregional linkages**

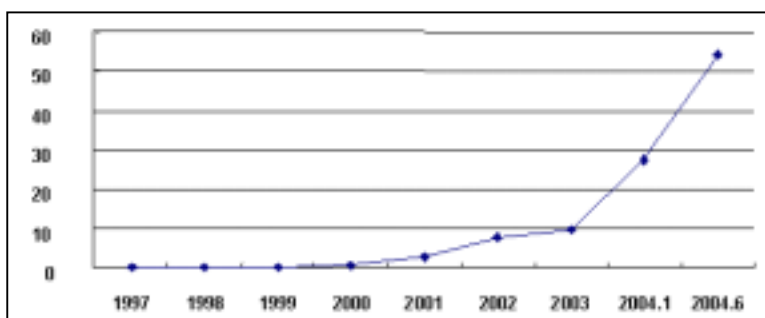
The Internet has proven to be a useful tool for regional economic cooperation. On one hand, the Internet can reinforce existing channels of economic cooperation among regions and accelerate regional economic integration. On the other, regional cooperation and Internet linkages depend on the extent of economic activity among regions. For this reason, the regional structure of international trade directly affects the expansion of interregional networks. International trade volume can be expected to be the main determinant of the choice of regional network linkages as well as of governments’ decisions on whether to support cooperation among regional trade networks.

### **1. Definition of international outbound traffic capacity**

International outbound traffic capacity, PC penetration rate and number of Internet users are important indicators of the development of a country’s networking capacity and of its network penetration rate. As a measure of network speed, international bandwidth capacity equals the quantity of data that can be transmitted at any given time to other countries. It is an important component of Internet infrastructure.

China’s Internet infrastructure has improved greatly since 1997 thanks to the rapid expansion of its international bandwidth capacity, from only 25.41 million bits per second (Mbit/s) in October 1997 to 9380 Mbit/s by the end of 2002, and then by a factor of 4.75, to 53,941 Mbit/s, by June 2004 (figure 20).

**FIGURE 20**  
**DEVELOPMENT OF CHINA'S INTERNATIONAL**  
**OUTBOUND TRAFFIC CAPACITY**  
*(In thousands of Mbit/s)*



**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003 and “Statistical report of China Internet development” [online] July 2004 <<http://www.cnnic.org.cn>>.

Regarding network linkages to other regions, China’s international bandwidth capacity is skewed. For example, in 2002, the largest segment of bandwidth capacity was to the United States, with 5,444 Mbit/s (58%). There were 1,016 Mbit/s (10.8%) of bandwidth to Japan, 1,000 Mbit/s (10.7%) to Republic of Korea, 1,220 Mbit/s (13%) to Hong Kong (China), 384 Mbit/s to Taiwan (Province of China), 90 Mbit/s to Singapore, 14 Mbit/s to Macao, 8 Mbit/s to Australia and 2 Mbit/s to the United Kingdom.

**TABLE 55**  
**CHINA'S BANDWIDTH TO OTHER REGIONS**  
*(Mbit/s)*

| Provider  | United States | Japan        | Rep. of Korea | Hong Kong    | Taiwan     | Macao     | Singapore | Other          |
|---|---------------|--------------|---------------|--------------|------------|-----------|-----------|----------------|
| International Economy and Trade Net of China (IETNET) | 2             |              |               |              |            |           |           |                |
| Education and Research Computer Net of China (CERNET) | 245           | 10           |               | 2            |            |           |           | 2 <sup>a</sup> |
| Netcom Public Net of China (CNCNET)                   | 1 442         | 90           | 180           | 622          | 90         |           | 45        |                |
| Public Computer Net of China (CHINANET)               | 3 145         | 710          | 620           | 356          | 204        | 12        | 45        | 8 <sup>b</sup> |
| Unicom Net of China (UNINET)                          | 355           | 206          | 200           | 240          | 90         | 2         |           |                |
| Mobile Net of China (CMNET)                           | 200           |              |               |              |            |           |           |                |
| Science and Technology Net of China (CSTNET)          | 55            |              |               |              |            |           |           |                |
| <b>Total</b>  | <b>5 444</b>  | <b>1 016</b> | <b>100</b>    | <b>1 220</b> | <b>384</b> | <b>14</b> | <b>90</b> | <b>10</b>      |

**Source:** China Internet Network Information Centre (CNNIC), “2002 China Internet development report”, Beijing, Posts & Telecom Press, 2003.

**Note:** As of 31 December 2002.

<sup>a</sup> United Kingdom.

<sup>b</sup> Australia.

Hence, China exchanges more data with the United States and East Asia than with Europe, Latin America and Africa. The difference in bandwidth capacity for different regions is due to data flows and demand. As the location of major “gateways” for traffic with other regions, the United States continues to have the largest amount of bandwidth.

With the continued spread and development of the Internet in China, the country’s international bandwidth capacity will also continue to expand to keep pace with the development of the Internet in other countries and to meet market demand.

It should be clear by now that there is not a direct correspondence between the breakdown of regional Internet bandwidth and the structure of international trade. This disparity mainly occurs with the European Union countries, which are China’s main trading partners, even though China’s bandwidth with the European Union is smaller than its bandwidth with the United States.

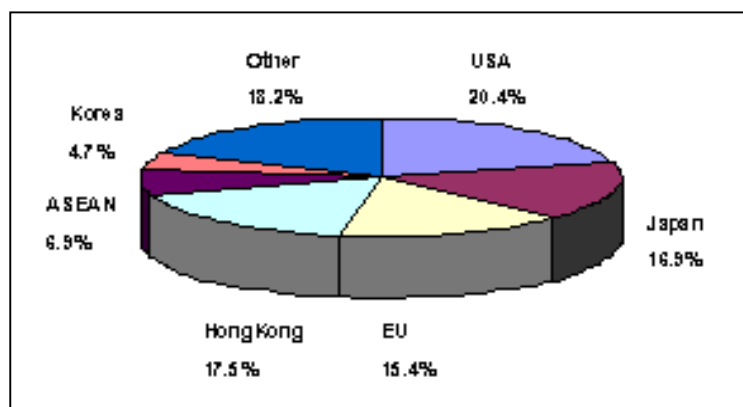
## 2. Regional breakdown of imports and exports

In the past 25 years, China has carried out a very successful trade-liberalization policy. The average tariff was lowered from 55.6% in 1982 to 44.1% in 1991. On industrial products it was lowered to 11% in 2003. A new tariff regulation calls for further reductions, to 10.4% by 2004 and 9.3% by 2005. Upon joining the Information Technology Association (ITA), China promised to eliminate all tariffs and other duties on IT products by 2005.

Beyond the general benefit of exposure to a competitive world market, trade liberalization holds out the potential for promoting greater economic buoyancy. China’s external trade increased from US\$ 20.64 billion in 1978 to US\$ 135.7 billion in 1991 and then jumped to US\$ 620.79 billion in 2002, making it the world’s sixth largest trading nation that year. In 2003, it was the fourth largest, after the United States, Germany and Japan. Indeed, China’s foreign trade increased 15% annually for eleven years, from US\$ 165.5 billion in 1992 to more than US\$ 800 billion in 2003, and was expected to climb to more than US\$ 1 trillion by the end of 2004.

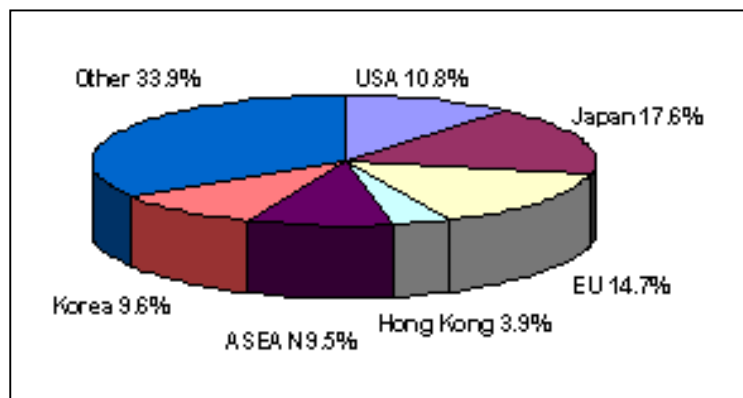
However, China’s foreign trade is heavily concentrated in three regions: East Asia, the United States and the European Union. The regional breakdown of China’s imports and exports in 2001 is shown in figures 21 and 22.

**FIGURE 21**  
**EXPORT DESTINATIONS IN 2001**  
*(In percentages)*



**Source:** Editorial Commission of Foreign Economic Relations & Trade Yearbook, “2002 yearbook of China’s foreign economic relations and trade”, Beijing, Foreign Economic Relations & Trade Press, 2002.

**FIGURE 22**  
**SOURCES OF IMPORTS, 2001**  
*(In percentages)*



**Source:** Editorial Commission of Foreign Economic Relations & Trade Yearbook, “2002 yearbook of China’s foreign economic relations and trade”, Beijing, Foreign Economic Relations & Trade Press, 2002.

The United States accounts for about 20% of China’s exports and about 10% of its imports. East Asia, including Japan, Republic of Korea, the ASEAN countries and Hong Kong (China), accounts for about 45% of its exports and about 49% of its imports. Most of China’s international bandwidth capacity is used to connect the country to these two regions. The expansion of imports and exports has meant greater use of the Internet to transfer data and financial resources.

China will undoubtedly continue to strengthen its ties with the rest of East Asia. Although the European Union accounts for about 15% of China’s foreign trade, China’s bandwidth capacity with the European Union is comparatively small. Since transfers of information and financial resources between China and the European Union presently go through the United States, it is important for China to strengthen its regional network cooperation with the European Union.

### **3. Towards genuine cooperation among networks in East Asia**

The trend in the world economy is clearly towards increasingly strong ties in production and trade. As a rapidly developing, emerging country, China has quickly made a place for itself in the globalised economy. In just 25 years (1978-2003), China became one of the world’s major trading nations.

The rest of East Asia is one of China’s most important trading partners. With the exception of Japan, most East Asian countries are also industrializing economies and therefore have a level of industrial and trade development similar to China’s. In addition, East Asia’s rapid economic development and relatively high level of dependence on exports have led to continuously rising trade volumes as well as to the emergence of a dynamic division of labour within the region. In most years, East Asia accounts for more than half of China’s external trade, since geographic proximity is the most important factor in regional cooperation. Once a country has opened up its economy, it must utilize its factors of production more effectively to compete on international markets.

As an economy becomes more developed, it will have more possibilities for intraregional trade, because of two factors: the greater diversity in and quality of its factors of production and

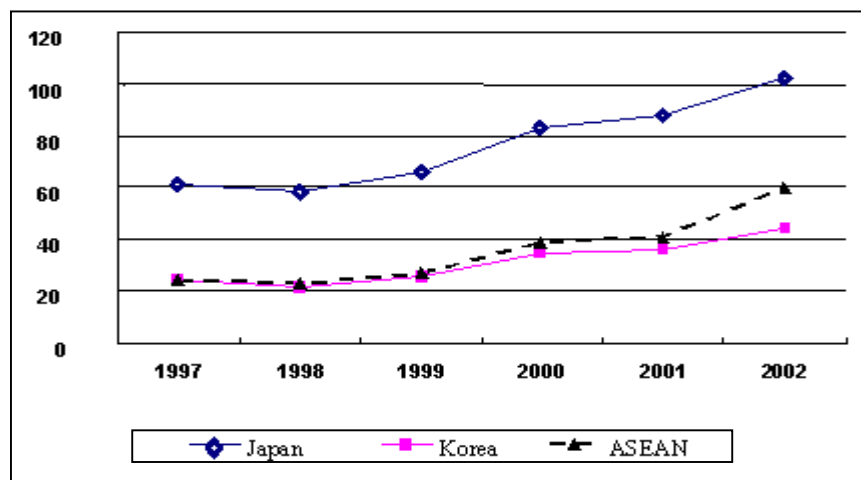
its greater specialization. For East Asia, intraregional trade is an effective way to enhance industrial competitiveness and to expand markets. In the last decade, trade between China and the rest of East Asia expanded dramatically, underscoring the increasingly close intraregional economic ties.

East Asia comprises China, Japan, Republic of Korea and the Southeast Asian countries. (South Asian countries such as India and Pakistan are not considered in this study). More than 33% of China's foreign trade in 2002 was with Japan, the Southeast Asian countries and Republic of Korea, making those countries China's major trading partners.

China's trade with the rest of East Asia is characterized by recurrent and rising deficits. In 2002, for example, China exported US\$ 86.52 billion to the rest of East Asia while importing US\$ 119.04 billion, giving it a trade deficit of US\$ 32.52 billion, compared with a mere US\$ 3.32 billion in 1997. Trade between China and Japan rose from US\$ 60.81 billion in 1997 to US\$ 101.90 billion in 2002, making Japan China's most important trading partner in East Asia. During the same period, trade between China and six Southeast Asian countries increased from US\$ 24.33 billion to US\$ 59.54 billion and trade between China and Republic of Korea increased from US\$ 24.05 billion to US\$ 44.10 billion (figure 23). Stronger trade within East Asia is the result of economic policy cooperation to promote trade in the region. In addition, intraregional trade has also become important in the last decade. The trade liberalization policies of the East Asian countries as well as government economic and trade cooperation within East Asia should continue to create opportunities for stronger intraregional trade.

**FIGURE 23**  
**TRADE WITH OTHER EAST ASIAN COUNTRIES**

*(In thousands of millions of U.S. dollars)*



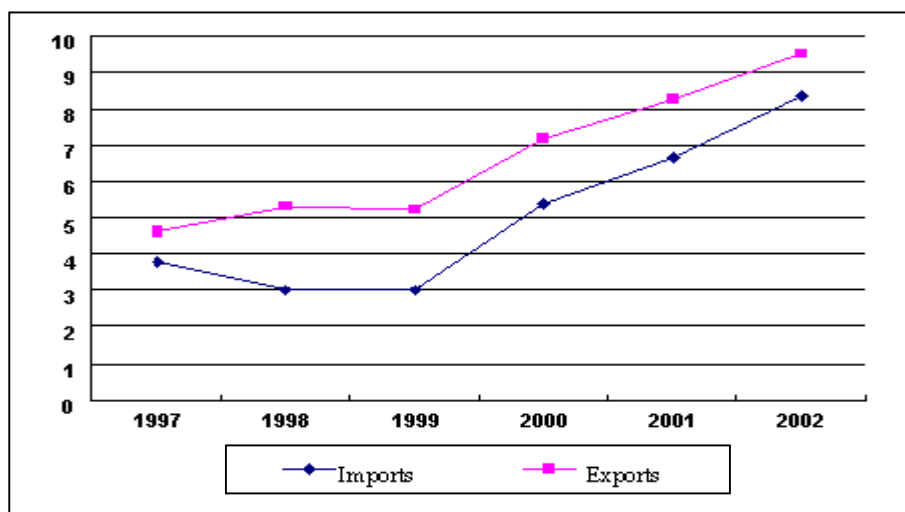
**Source:** Editorial Commission of Foreign Economic Relations & Trade Yearbook, "Yearbook of China's foreign economic relations and trade", Beijing, Foreign Economic Relations & Trade Press, various issues.

Increased intraregional trade in East Asia should also entail the further specialization of factors of production to meet international requirements, laying the foundation for future tariff reductions. This, in turn, should lead to even stronger cooperation in East Asia.

## 4. Possibilities for stronger ties between China and Latin America

China's trade with Latin America has been rising each year, more than doubling between 1997 and 2002, from US\$ 8.37 billion to US\$ 17.82 billion (see figure 24). Still, China's trade with Latin America is a small percentage of its total trade: 2.57% in 1997 and 2.87% in 2002. Moreover, it is important to examine which Latin American countries have the highest level of trade with China and, in particular, what the trends are in trade with those countries.

**FIGURE 24**  
**TRADE BETWEEN CHINA AND LATIN AMERICA**  
(In millions of US dollars)



**Source:** Editorial Commission of Foreign Economic Relations & Trade Yearbook, "Yearbook of China's foreign economic relations and trade", Beijing, Foreign Economic Relations & Trade Press, various issues.

China's largest trading partners in Latin America from 1997 to 2002 were Argentina, Brazil, Chile, Mexico and Peru. In 1997, these five countries accounted for 91% of China's imports from Latin America and 56% of its exports to the region; by 2002, the figures had increased to 92% and 61%.

Of these five countries, Mexico and Brazil stand out as China's two leading trading partners in Latin America. Brazil, which has a longstanding trade relationship with China, accounted for 30.26% of China's trade with Latin America in 1997 and 25.07% in 2002. By contrast, China's trade with Mexico has taken off only in recent years, rising from US\$ 598 million (7.14% of China's total trade with Latin America that year) to US\$ 3.979 billion (22.32%) in 2002.

Moreover, the fact that Brazilian enterprises have commissioned firms in Hangzhou to develop software over the Internet points to the need for the two regions to strengthen the Internet-based linkages between them.

**TABLE 56**  
**TRADE GROWTH BETWEEN CHINA AND SELECTED LATIN AMERICAN COUNTRIES**  
*(In millions of US dollars)*

| Country      | 1997         |              | 2002         |              |
|--------------|--------------|--------------|--------------|--------------|
|              | Imports      | Exports      | Imports      | Exports      |
| Argentina    | 722          | 465          | 1 240        | 185          |
| Brazil       | 1 489        | 1 044        | 3 003        | 1 466        |
| Chile        | 415          | 562          | 1 567        | 998          |
| Mexico       | 184          | 414          | 1 115        | 2 864        |
| Peru         | 621          | 98           | 732          | 247          |
| <b>Total</b> | <b>3 431</b> | <b>2 583</b> | <b>7 657</b> | <b>5 760</b> |

**Source:** National Bureau of Statistics of China (NBS), “China statistical yearbook”, Beijing, State Statistical Press, various issues.

Bandwidth between China and Latin America should be increased due to the surging trade between them. Brazil and Mexico, in particular, should lead the way in this effort.

## D. Summary of regional networks

Efforts to strengthen cooperation between domestic and international networks and boost SMEs’ role in trade have been sorely inadequate. Cooperation among regional networks depends on the level of economic development and trade ties. The spread of IT and the advent of the Internet have led to an expansion of intra- and interregional trade.

An analysis of the scope of regional networks in China and a region-by-region breakdown of international trade lead to the following conclusions on how to promote cooperation among regional networks.

First, the development of China’s different regions is uneven. SMEs in the coastal regions have a somewhat stronger capacity to use IT and they will play an important role in cooperation among regional networks.

Second, data on international bandwidth capacity point to more possibilities for China to increase its cooperation with East Asian networks, because of geographic proximity and the rapid increase in trade with that region. Regional economic and trade cooperation fomented by East Asian governments should create more trade opportunities in the near future. In the medium term, there is clearly a need to establish a network for authentic cooperation as soon as possible in order to promote and facilitate international trade.

Third, cooperation between Chinese and Latin American networks aimed at promoting stronger trade ties should advance gradually. There is no doubt that cooperation between Chinese and Latin American networks will increase as trade between them begins to rise steadily and as transaction costs for enterprises continue to fall in response to the increased use of the Internet.



## **VI. Conclusions and recommendation**

The advent of IT creates an environment conducive to more efficient resource use and therefore higher profits. A particular company's ability to leverage IT so as to participate in the global division of labour and increase its exports depends on its own development strategy and the support provided by its government.

The growth of the IT industry is predicated on higher aggregate demand in the economy. In China, enterprises that are intensive IT users as well as SMEs, because of their extremely large number, play an important role in economic development. The analysis given in the preceding pages shows that as an increasing number of SMEs enhance their ability to use IT, the demand for IT products also rises, spurring the further development of the IT industry. The experiences of some Chinese SMEs in using IT to take better advantage of digitization in management and to stimulate exports, as well as some of the problems faced by SMEs in doing so, are summarized below.

### **A. Maintaining a balance between hardware purchases and software development**

Business accounts for 66.2% of all computer-related sales in China. Although demand is growing much faster among SMEs than among large companies, SMEs tend to emphasize hardware investment and neglect software development, limiting the range of IT products to which they have access.

If SMEs use IT products only for general business procedures and for information management without networking their computers, they fail to take full advantage of the possibilities offered by digitization.

Statistics consistent with the authors' empirical observation indicate that in 2002 sales of hardware, software and services represented 67.2%, 14.6% and 18.2% of total computer-related sales. Once an SME has acquired a certain number of IT products, it should make the transition from storing information on isolated computers to system integration using networking software. ERP and SCM, which integrate logistics, information-flow management and cash-flow management, are two important applications, that can help enterprises better manage their

information. ERP and SCM also help them manage their entire sales process, from order taking through product assembly, thereby improving their ability to satisfy their customers' needs.

A proactive effort to improve SMEs' implementation of ERP and SCM is needed. Some regions such as Zhejiang and Jiangsu Provinces give tax breaks to SMEs that launch ERP systems, in order to offset the cost of transition to digitized management. The considerable amount of information SMEs need to keep track of and their low capacity to integrate that information are two obstacles preventing them from using digitization to raise their efficiency and improve their management skills and competitiveness. The Chinese government should give greater support to help SMEs develop IMSs and take full advantage of the information-management possibilities offered by the computers that they own.

## **B. Additional government efforts to encourage the transition to an information society**

The Chinese government is responsible for promoting the transition to digitization. Its role in, encouraging that transition through e-government, improving infrastructure and fostering market competition cannot be filled by the private sector.

In recent years, the government has greatly increased its investment in infrastructure. From 1998 to 2002, 1.054 trillion *yuan* was invested in IT capital goods; the fibre-optic network increased from 1 million km to 2.25 million km; and the number of telephone lines rose from 7 per 100 persons to 16.8. By June 2004, the number of phones had risen to 32 per 100 persons. In this short period, the country's Internet infrastructure has been greatly enhanced. However, China still lags behind industrialized countries in IT penetration among enterprises, households and the public sector. For example, in 2000, Singapore had 48.4 telephone lines per 100 persons and Japan had 65.3. With increased demand for telecommunications services, IT infrastructure should continue to expand and prices for those services should fall, allowing a larger number of SMEs to actively use the Internet to gather information and conduct business at affordable prices.

To promote lower prices and more efficiency in telecommunications services, more intense competition is needed. China today stimulates competition in telecommunications through a duopoly system. For example, China Telecom and China Netcom account for 62.1% and 36.8% of fixed-telephone lines, while China Mobile and China Unicom have 70% and 30% of the mobile telephony market. Although this arrangement represents a substantial change from the days of the State monopoly, efficiency and prices are still a far cry from what they would be in a fully competitive market. Encouraging a faster opening in telecommunications and the entry of non-SOEs are two ways of promoting more efficiency and better services. Such a transformation from "limited competition" to open competition would dramatically spur demand by SMEs and individuals for telecommunications services and accelerate the spread of digitization.

In addition, rather than using websites solely to disseminate information, government should make it easier for SMEs to do business through them. The spread of e-government can directly encourage the expansion of the domestic IT industry. Moreover, by conducting operations online, government can accelerate the spread of digitization among SMEs and boost their demand for IT-related products and services.

Obviously, the aim of regulations should be to ensure full market competition, and any policies not consistent with this goal should be modified.

## **C. Effect of SME-export-promotion policies**

China's exports were expected to surpass US\$ 500 billion by 2004, four times the 1994 level, US\$ 121.01 billion. Clearly, this rapid export growth is closely tied to investment policy and trade liberalization. In particular, the large number of export bases created by the huge influx of FDI into China has played an important role in the export boom.

It would be impossible to list all policies to promote SME exports or to detail the effects of those policies. However, some policies that have proven useful in promoting SME exports are listed below.

### **1. Clusters in special zones**

The aim of regional development policies is for firms in certain industries to be concentrated in export-processing, industrial-development, bonded, high-tech and software-development and similar zones. These zones have the entire infrastructure, including advanced telecommunications equipment, required by foreign investors to set up manufacturing bases. Several zones have evolved into industrial clusters. This allows the firms that belong to supply chains to be located closer to each other, reduces operating costs and enhances product export competitiveness. All but a few industrial zones consist of SMEs that produce mainly for one or several large companies, and most zones have a large number of SMEs. Subsidiaries of large foreign companies bring SMEs from their supply chains to set up factories in the zones. High-tech zones are characteristically composed of local SMEs that form new industrial clusters. Industrial-development zones have proven to be a successful export-promotion strategy.

As SMEs raise their exports and begin to expand, government should make an all-out effort to encourage industrial zones to evolve into larger industrial clusters and export-processing zones to form economic zones or even new cities with closer linkages to local economies.

### **2. Preferential export policy**

The central government has begun to relax its policies regarding foreign-trade permits and tax refunds on exports. Previously, only foreign-trade companies could engage in external trade, giving them a near-monopolistic position. Manufacturers were excluded from importing and exporting. However, to raise manufacturing exports, new regulations allow manufacturers to obtain permits, and many SMEs have done so. Since 2004, individuals have been allowed to engage in foreign trade, underscoring the more open foreign-trade policy. Another export-promotion policy allows enterprises to receive refunds on the value-added taxes they have paid on exports. The amount of the refunds varies according to the product. This policy has encouraged many SMEs, which by definition are not monopolists, to focus more on exporting in order to increase their profits.

### **3. E-customs**

Online customs processing facilitates procedures for SMEs. Export procedures are increasingly being handled online. Such procedures include those related to the Ministry of Commerce, tax-collection offices, banks and other government agencies and institutions responsible for overseeing foreign trade and professional services. Settlements and tax payments are also being handled online. This should improve the efficiency and transparency of government-related procedures.

## **D. Elimination of institutional barriers in e-commerce**

Most SMEs have websites, but since only a few use them for transactions, the volume of online trade by SMEs is quite low. Most e-commerce practice has just completed the business transactions based on face-to-face deals. Such pattern cannot be classified into the real Internet business.

The main reason for the slow growth of B2B e-commerce in China is institutional — specifically, the lack of confidence and the inadequate payment system.

The growth of e-commerce — a new business model based on the Internet — is restricted by the availability of IT and networking equipment and by potential users' lack of confidence. China does not yet have a law to make e-commerce transactions secure. Their distrust of online transactions and the existence of online fraud make enterprises reluctant to engage in e-commerce. Online bidding has merely become a mechanism for enterprises to keep abreast of prices. Consumer confidence is not enhanced through admonitions for people to behave ethically but from the establishment of a reliable legal structure. The passage and dissemination of a law governing e-commerce transactions is a necessary condition for the expansion of online business.

Although many commercial banks have established their own CA centres or use centres managed by other parties, there is no centralized CA centre for the entire country. In addition, online payments through State-owned commercial banks are inefficient and expensive, which also restricts the expansion of e-commerce. Enterprises will not feel secure doing business on the Internet until an effective online payment system and clearinghouse have been established. To address this issue, domestic banks could be encouraged to adopt the online payment and settlement policies in effect at foreign banks.

In addition, cash-strapped SMEs are unable to establish their own e-commerce platforms. Portals should not be viewed as the only option for SMEs to engage in B2B; government should set up e-commerce platforms specifically for SMEs. Only after SMEs begin to experience sales growth by using the Internet will more SMEs be attracted to e-commerce and will websites become a normal channel for them to do business.

## **E. Raising the skills of SME human resources**

China's experience shows that SMEs' lesser capacity to use IT to meet global specifications — for example, in traditional industries such as textiles and appliances — stems from the lower skills of their human resources. But SMEs in the software-manufacturing and high-tech industries have more highly skilled human resources, enabling them to take full advantage of cutting-edge IT and raise the quality of their products and services. Such SMEs are intensive users of IT products and even employ them as production tools and not merely for management tasks.

Consequently, raising the educational level of the workers employed by SMEs is essential for bridging the gap between foreign and Chinese companies and between large and small companies. By 2002, China had 9.03 million undergraduate students, including 3.94 million science majors. There were also 500,000 graduate students and 3.94 million students enrolled in technical secondary schools, 1.38 million of which were studying engineering and IT. As the skills of China's human resources improve, SMEs should be able to recruit workers with a higher educational level and enhance their IT use.

The rapid adoption of IT stems from the fact that the new generation is learning to use new technologies easily and quickly. The aim of policies should be to further raise the number of high school and college enrolments so that enterprises will have more highly skilled workers and thereby be in a position to adapt to the changes brought about by the IT revolution.

## **F. Possibilities for cooperation among regional networks**

Cooperation among networks in China, whether at the provincial or the national level, is still far from sufficient, as China has never established a framework for IT-based cooperation. The promotion of regional cooperation could accelerate the expansion of trade and bring the benefits of IT and the Internet to all regions.

The analysis given in the preceding pages shows that regional disparities in economic development directly affect the transition to digitization at the regional level. In terms of the possibilities for cooperation among Chinese regions, Pearl River Delta, Yangtze River Delta and Round Bohai Bay are the most dynamic economic regions and have the largest IT industries. Because the three regions have a strong capacity to use IT, it is more feasible to establish interregional networks for network-based information cooperation among them. For instance, in the Yangtze River Delta many networks have been created, such as one for sharing science and technology resources. Information-based cooperation between networks in China and those in other nations does not yet exist on this scale.

The authors believe that cooperation among national networks in China, Japan, Korea and other Asian countries should be enhanced. Although the level of economic development and of digitization of enterprises is much lower in China than in Japan and Korea, the gap between China's coastal regions and those countries is much smaller. For this reason, cooperation among regional networks should begin in China's coastal areas and then spread inland.

Because of the lack of security in Internet transactions in China, cooperation with other nations should preferably begin with the promotion of regional sharing of PKIs in e-commerce. Once e-commerce transactions are more secure, China can gradually promote the establishment and improvement of regional networks for information sharing.

To make the Internet a viable platform for trans-boundary business transactions, CAs in different countries must perform multiple confirmations. This should include international purchasing systems, electronic purchasing and auctions and EDI. Only creditability and consistence in the means of exchanging confirmations will given parties in different countries the assurance that they can use PKI for international transactions.



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