



United Nations
University

WIDER

World Institute for Development Economics Research

Discussion Paper No. 2001/76

New Economy and ICT Development in China

Qingxuan Meng¹ and Mingzhi Li²

September 2001

Abstract

The rapid development and diffusion of the information and communications technology (ICT) is the major driving force of the New Economy. While there is ample evidence to suggest that the ICT industry has contributed a great deal to the overall economic growth of the developed countries, its role in the developing countries is far from clear. The pressure of unemployment that may result from ICT's displacement effect is a major concern faced by the developing countries in their adoption of ICT.

This study provides empirical evidence on China's ICT industry development and diffusion in recent years. Although there is still a huge gap between China and the developed countries in the development of the ICT industry, the astonishing pace of its progress shows promise for the country's New Economy. The ICT industry is becoming the most dynamic sector in China's economy. There is, however, a clear digital divide among the nation's three economic regions.

.../...

Keywords: economic growth, ICT, information and communications technology, IT information technology, new economy, economic inequality, digital divide

JEL classification: O1, O3, O57

Copyright © UNU/WIDER 2001

¹Guanghua School of Management (Peking University); ²School of Economics and Management (Tsinghua University)

This study has been prepared within the UNU/WIDER project on Production, Employment and Income Distribution in the Global Digital Economy, which is directed by Professor Matti Pohjola.

UNU/WIDER gratefully acknowledges the financial contribution to the project by the Ministry for Foreign Affairs of Finland.

To promote China's New Economy, the following issues have to be addressed: (i) its financial market has to be reformed to conform to international standards, and an over-the-counter market (namely, second board market) to be established; (ii) talent has to be attracted to China; (iii) the ICT industry has to be further deregulated, particularly the telecoms sector; and (iv) strategies to cope with the opportunities and challenges of China's accession to the WTO have to be formulated.

Acknowledgement

We thank Matti Pohjola for comments and suggestions. The second author also thanks his research assistants, Ming Gao, Yang Liu, Bin Wang, and Lin Yang, for data collection and analysis.

1 Introduction

Information and communications technology (ICT) is the major driving force of the New Economy. While there is ample evidence that information and communications industry has contributed a great deal to the overall economic growth of the developed countries (Kraemer and Dedrick 2001 and Jalava and Pohjola 2001), the role of the ICT industry in developing countries is far from clear. Since developing countries are short of capital investment and knowledge know-how, they lag far behind the industrialized nations in their ICT-industry development and diffusion. Industrialization is deemed the most urgent issue of economic development in these countries, and it is difficult to reach a consensus on the priorities needed to speed up the ICT industry in the overall strategy for economic development. Developing countries are hesitant to leapfrog into the process of industrialization to keep abreast with the developed countries in capturing the opportunities generated by the explosive advancement of the information and communications technology. Governments are reluctant to take bold measures for fostering the necessary environment for the development of the ICT industry because of many concerns. Among these, the pressure of unemployment that may result from ICT's 'displacement effect' is a major factor. As we discuss in Section 2, the large-scale adoption of ICT can reduce the demand for low-skilled labour.

As the most populous country and the largest economy shifting towards market economy, the development of China's New Economy will have a great impact on the world. In this study, we first provide empirical evidence on China's ICT industry development and ICT diffusion in recent years. We then investigate the opportunities and challenges faced in China's development of the New Economy, especially those of the ICT industry.

The paper is organized as follows. In the next section, we address two major issues. First, we explore the status of China's ICT industry development and ICT diffusion, and compare it with countries at similar stages of economic development. We refer to India in particular, as these two countries have key similarities—comparable stage of industrialization, a huge population base, and a relative low level of computer literacy. An analysis of the strengths and the weaknesses of the two countries will help shed light on the future of ICT industries in the developing world. Second, China is a vast nation in terms of population and territory. The disparity in economic development among its different regions is a major barrier to establishing a nationwide common market. Whether the adoption of ICT will broaden or narrow this disparity is an important and urgent issue to be explored. This issue has important policy implications as well. Based on empirical evidence, we try to find links between ICT disparity and disparity in the overall economic development. In the third section, we discuss the opportunities and challenges facing China in developing its New Economy with regard to financing the ICT industry, attracting talent, constructing high-tech parks, deregulating the ICT industry, and the challenges and opportunities introduced by its accession to the WTO. Finally we discuss the policy implications of developing China's New Economy in section four.

2 ICT industry development and ICT diffusion

2.1 ICT and economic development–dilemmas facing the developing countries

The late 1990s and the start of the year 2000 have witnessed a dramatic revolution in the information and communications technology. The convergence of the IT industry and the communications industry has been the driving force of the New Economy. Some scholars even believe that the invention of Internet and its widespread applications are the twilight of the third industrial revolution, comparable to the role played by the internal combustion engine and the railroad in the second industrial revolution. While there is ample evidence from the developed world to support this argument (Kraemer and Dedrick 2001 and Jalava and Pohjola 2001), the impact of the ICT revolution on developing countries remains unclear and controversial.

Developing countries face many problems in handling the relationship between ICT promotion and overall economic strategies. Increasingly they have to confront tough questions such as (i) Can a developing country find competitive advantage in building its ICT industry?, (ii) Will ICT adoption and diffusion increase the pressures of unemployment?, and (iii) Can ICT development and diffusion reduce disparity among regions?

In order to answer these questions, we need to look at the characteristics of the third industrial revolution, in particular the impacts of ICT technology on the economy. According to Moss (1996), the third industrial revolution has the following characteristics, producing profound impacts on a country's economy. First, today's labour-replacing technology, such as computers, are biased against low-skilled and poorly educated workers. In many cases, new technologies can replace tasks previously performed by low-skilled labour, and their demand is rapidly declining. The third industrial revolution has also introduced extraordinary innovations in communications technology, which have allowed business operations to decentralize and to globalize simultaneously. Finally, the late 1990s have witnessed the rise of global markets. During the second industrial revolution, businesses increasingly crossed local and regional boundaries in search of national markets, whereas they currently cross national boundaries on a regular basis in search of global markets.

If Moss' arguments are correct, fear of the displacement effect of ICT on employment is not groundless. Take China as an example. Before the country's economic reform in the late 1970s, about 80 per cent of its population lived in the countryside. By 1999, this had shrunk to 69 per cent. At the end of the year, there were 705.86 million rural workers. The official unemployment rate was 3.1 per cent. However, if the 'quasi unemployed' workers from state-owned enterprises (SOE) and seasonal unemployed farmers are added, the rate could be as high as 20 per cent. The high unemployment rate caused by the inefficiency of the state-owned enterprises and the migration of rural workers to cities have already caused problems in social stability. If the widespread adoption of ICT leaves more people unemployed, it is understandable that developing countries are reluctant to encourage its rapid development.

While a consensus to these questions is difficult to reach, we can see the clear trend of ICT liberalization in many developing countries (Wong 2001 and Cogburn and Adeya 2001). These countries also realise that globalized markets are impossible to resist. With

regard to the strategies for developing the ICT industry, the classical battle between the two approaches—'import substitution' and 'export led'—will continue even though Singapore, Taiwan and South Korea have been successful in adopting the export-led approach to develop their ICT industries. In large countries like China and India, the ICT industry will more likely become the internal engine for economic structural change.

To address these issues, the next two sectors investigate the current status of ICT industry development and diffusion in China. Then we then come back to these issues at the end of the paper.

2.2 ICT industry development and ICT diffusion in China

The contribution of ICT goods and services to economic growth can be measured according to production as well as from the usage side. Measured as a share of GDP, the ICT industry is becoming an increasingly important sector, but the benefits from ICT use are likely to outweigh those from production (Kraemer and Dedrick 2001). In this section, we provide empirical evidence of China's ICT industry from both aspects. In order to find common patterns of ICT development in the developing countries, we examine countries that are at comparable stages of economic development. We refer in particular to India as these two nations have key similarities such as a comparable stage of industrialization, a huge population base, and a relative low level of computer literacy.

It is difficult to make international data comparison, especially in the case of a country like China that is experiencing rapid economic change. To obtain a complete picture of the country's development and diffusion of information and communications technology in recent years, we have collected data from a variety of sources.

2.2.1 ICT production

As referenced by many researchers, including Wong (2001) and Steinmueller and Bastos (1995), the Elsevier Yearbook of World Electronics Data (EYWED) is a useful source of information on electronics production and export by country on a global basis. As commented by Wong (2001), using this common data pool rather than individual national sources eliminates the problem of differences in sectoral definitions and currency conversions. First, based on the EYWED, we compare China's recent ICT production with that of India. Overall, total electronics production in China increased from US\$7.6 billion in 1987 to US\$33.4 billion by 1996, a 4.4 fold increase in nine years, with an annual growth rate of 17.9 per cent. During the same period, world production increased 1.9 fold, with an annual growth rate of 7.6 per cent. China's share rose from about 1.4 per cent to 3.1 per cent, and its production of ICT has consistently been about 5 times that of India for each year.

Despite the above-mentioned advantages of EYWED, it also has obvious disadvantages. For example, it is hard to link with other economic indicators of a country because of its narrow selection of variables. Thus, we also collected data from several yearbooks published in Chinese: *Yearbook of China's Electronic Industry* (YCEI), *China Statistical Yearbook*, *China Yearbook of Fixed Investment* and the *China Input Output Tables*. It is worth noting that the definitions of ICT products may not exactly match

those given in the EYWED, but are adequate for comparisons across time as long as the definitions in the yearbooks for different years are consistent.

We use two indicators to review the growing importance of the ICT industry in China's economy: the contribution of electronics as a percentage of GDP and the share of labour force in this industry as a percentage of the nation's non-farm labour force. The electronics industry in this analysis includes the following economic sectors: electronics equipment manufacturers, communications equipment manufacturers and the computer industry (hardware, software and services). The ICT industry is not as broadly defined here as in the framework adopted by Wong (2001).¹

As shown in Table 1, the contribution of the electronics industry to GDP has increased from 0.69 per cent in 1993 to 1.66 per cent in 1997, an increase of 140 per cent. The industry's labour force as a share of the total non-farm labour pool has been stable over the past several years, employing each year about 1.1 per cent of the non-farm labour force (Table 2). Both indicators underestimate ICT's contribution to China's economy due to the narrow definition of the electronics industry in this analysis.

We can also examine the changing ICT industry structures by looking at the percentages of computer products (including hardware and software), communication equipment and electronic components, the main three electronic products. The changing composition of electronic production is given in Figure 1. The contribution of computer products to total electronics production has steadily increased from 1993 to 1999, while communications equipment stabilized around 30-35 per cent. In contrast, electronic components have over the years steadily declined in relative importance, dropping from more than 50 per cent of total electronic products in 1993 to less than 30 per cent in 1999. It is worth noting that software production has a negligible role with regard to China's ICT industry. Although a huge jump is apparent from 1998 to 1999, software production accounts for only 1 per cent of total ICT production.

Table 1
Contribution of the electronic industry to China's GDP
(nominal RMB yuan, billions)

	1993	1994	1995	1996	1997
Net output of the electronics industry	23.90	35.05	62.70	93.90	123.67
GDP	3463.44	4675.94	5847.81	6788.46	7446.26
Percentage	0.69	0.75	1.07	1.38	1.66

Source: *Yearbook of China's Electronics Industry* (various years).

¹ As is discussed in Section 3, China's telecoms industry is experiencing rapid deregulation, making data collection and comparison very difficult. Thus empirical evidence from the telecom industry is not included in the analysis.

Table 2
Employment in the electronic industry in China (in millions)

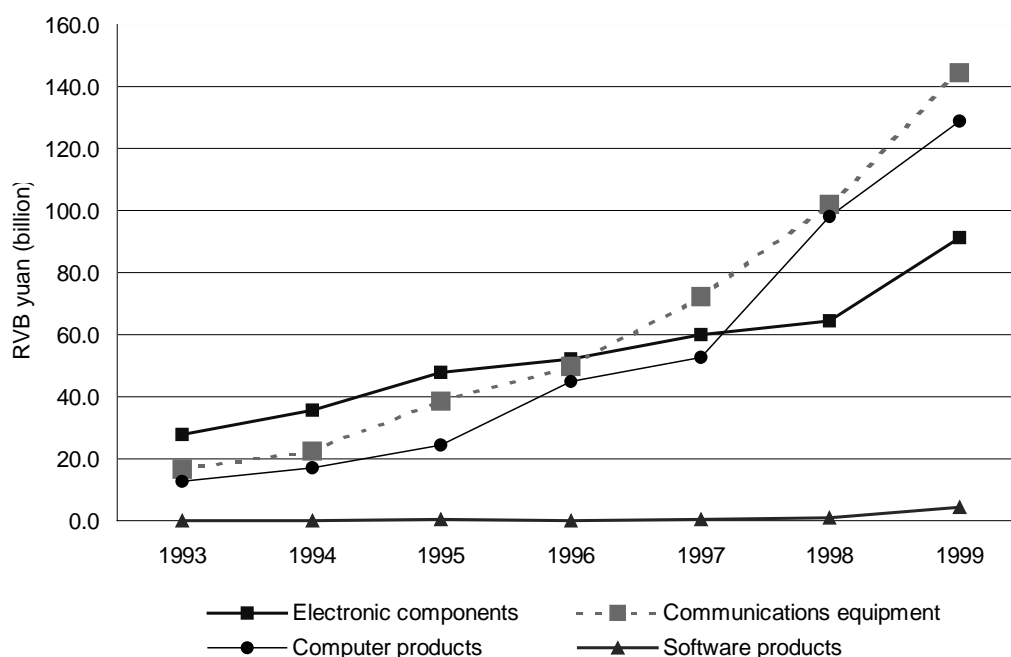
	1995	1996	1997	1998	1999
Labour force in the electronic industry	169.68	164.86	162.25	134.86	135.06
Total non-farm labour force	14908	14845	14668	12337	11773
Share (%)	1.14	1.11	1.11	1.09	1.15

Source: *China's Yearbook on Electronics Industry* (various years).

If we categorize electronic products according to their final usage into consumption type and investment type, both types were almost equal in 1999, whereas in 1993 the consumption type was almost twice the investment type. This trend perhaps reflects the fact that consumer electronics within households are becoming saturated and a larger proportion of products is destined as intermediate or final goods for commercial use.

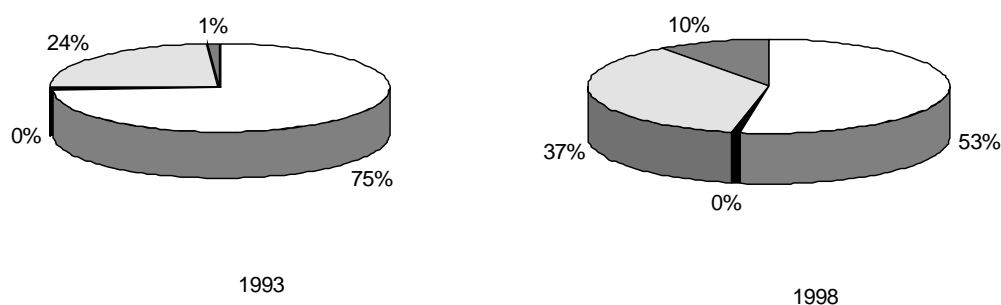
Figure 2 compares electronic production according to ownership. It is interesting to see that production from state-owned and collectively owned enterprises dropped from 75 per cent in 1993 to 53 per cent in 1998. On the other hand, the production share of joint ventures with foreign companies rose from 24 per cent to 37 per cent. In 1993, electronic products from companies independently owned by foreign capital accounted for only 1 per cent, but increased to 10 per cent in 1997. We believe that after China's entry into the WTO, joint ventures and independent foreign firms will account for a larger share of production. Developed countries or regions can be expected to relocate the more labour- and land-intensive phases of their electronics production to countries like China (Wong 2001). Our data indirectly support this theory.

Figure 1
Composition of electronic production in China



Source: *Yearbook of China's Electronics Industry* (2000).

Figure 2
Electronic production according to company ownership



- State-owned and collective enterprises
- Private enterprises
- Joint venture enterprises (incl. Hong Kong, Macao, Taiwan and foreign funds)
- Enterprises funded by entrepreneurs from Hong Kong, Macao, Taiwan and abroad

Source: *Yearbook of China's Electronics Industry* (2000).

2.2.2 Adoption and diffusion of ICT

We investigate China's ICT adoption and diffusion from four different aspects:

(a) Size of domestic market for ICT

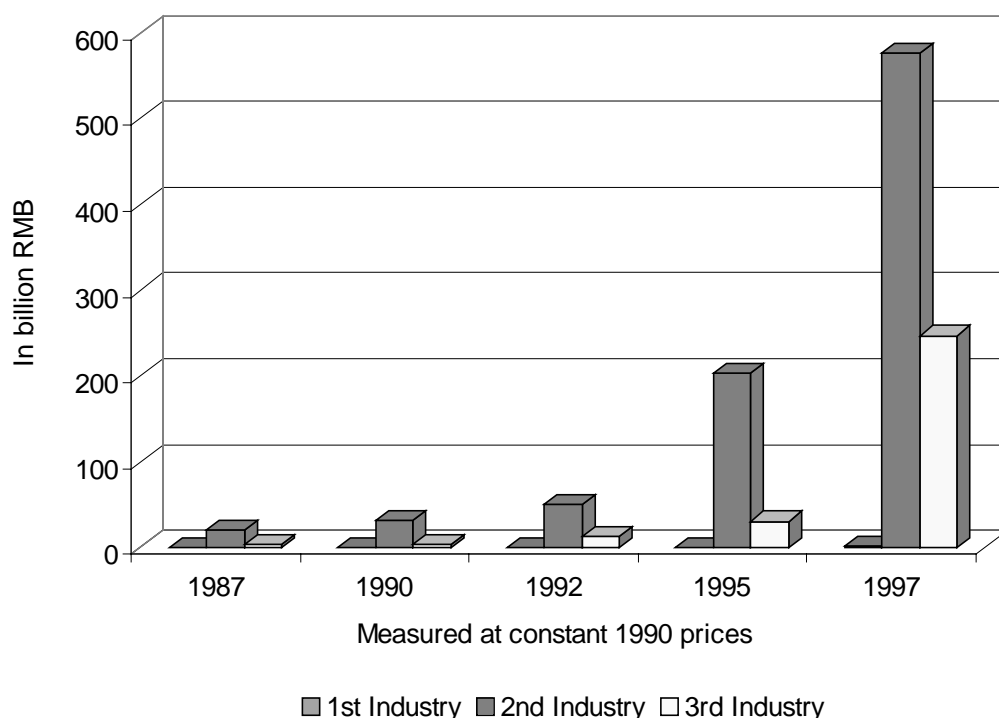
According to EYWED, in 1998 China's electronic goods market was valued at US\$34 billion, triple the value a decade earlier. The annual growth rate in this period was 11.8 per cent. In the two-country comparison, we can see that India's ICT market size in 1998 was not significantly larger than in 1988, and the annual growth rate during this period was only 2 per cent.

(b) ICT investment as a percentage of GDP and ICT usage across industries

To analyse ICT's role in the economy, we review China's recent ICT investments across industries. As shown in Figure 3, ICT usage is increasing at an amazing speed in the three main industrial groups. According to the China Statistical Yearbook, the first group includes farming, forestry, animal husbandry and fishery; the second covers manufacturing and the construction industry; while the third group encompasses all the remaining sectors of the economy. As shown in Figure 3, ICT input in the second and third industrial groups during 1992-95 increased by 2 and 7 fold, respectively, indicating much higher rates in these industries than GDP growth.²

² As shown in Figure 3, ICT usage in the 1st industry has also increased dramatically, but the amount is very small compared to the 2nd and 3rd industry groups.

Figure 3
ICT usage in the three industrial groups in China for selected years



Source: *Input-Output Tables of China* (various years).

Overall, using the aggregate measure of IT investment as a percentage of GDP, China's 0.96 per cent is significantly above that of India's 0.53 per cent (EYWED).

(c) Expenditures on hardware, and the consumption of software and IT services

The recent Information Society Index (ISI) project by International Data Corporation (2000) is the most comprehensive attempt so far at developing a composite informatization index of indicators for major nations. Based on a composite ISI index covering 55 countries, China was ranked in 51st position and India in 54th, which is much lower than of other industrialized Asian countries or regions (Singapore was in 11th place, Hong Kong 14th, Taiwan 18th and Korea 22nd place).

China and India are at very similar levels of ICT development, but their IT-market composition shows significant difference. The following data were compiled from OECD (2000). In IT expenditures, in 1998 the percentages of package software are 4.6 per cent for China versus 5.6 per cent for India, while the hardware percentage is significantly higher in China than in India, 88.1 per cent and 62.2 per cent, respectively. Interestingly, India's percentage of services, 32.1 per cent, is significantly higher than in most Asian countries. In contrast, China's percentage is only 7.3 per cent, considerably less than in other Asian neighbours. It is commonly believed that the more advanced a country is in its ICT-industry development and diffusion, the higher the share of spending on software and IT services. However, this reasoning does not explain the differences in other indicators for these two countries. We believe that China's low share of software and IT spending is due to its explosive adoption of computer hardware compared to software and IT services. It is reasonable to assume that as computer usage

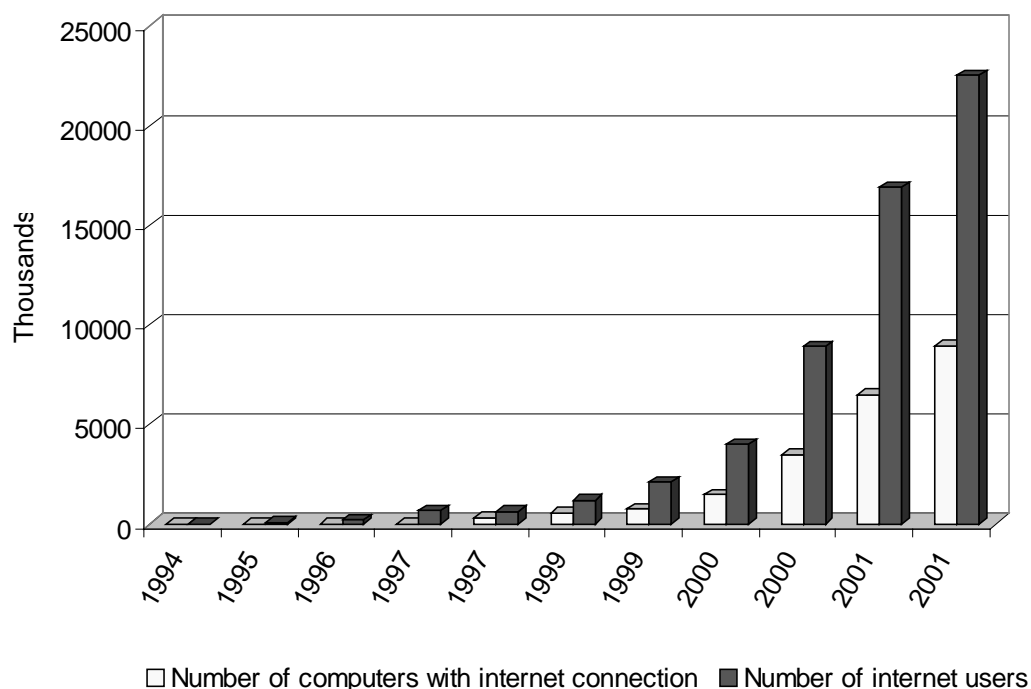
reaches a point of saturation within the next several years, the percentage of software and IT services will go up significantly. India's high percentage of software and IT services in its IT total expenditure versus other Asian countries (Singapore and Hong Kong included) remains a mystery.

(d) New Internet, e-commerce and wireless technologies

More specific measures of ICT diffusion and adoption, especially those pertaining to the 'new ICT' of Internet, e-commerce and wireless technology, further emphasize the difference between China and India. According to the World Bank (2000), China's 7.01 PCs per 1,000 homes in 1998 is about twice that of India. Main telephone line penetration is three times higher in China and its wireless usage is 3 per cent, or 15 times compared to India.

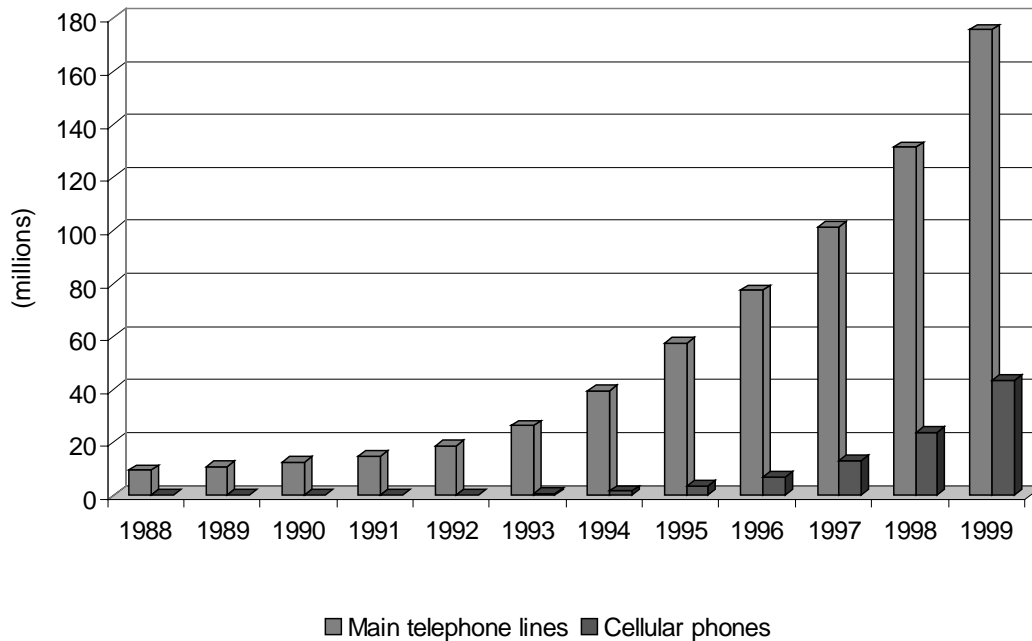
China's Internet usage has exploded in recent years. One of the most authoritative resources on Internet development, the China Internet Network Information Centre (CNNIC) reports on the latest developments every six months. In January 2001, China's Internet international bandwidth reached 2799 M, double the July 2000 level. Over the same period, Internet users increased 33 per cent to 22.5 million, and the number of computers with Internet access totalled 8.92 million, a 37.2 per cent upsurge (see Figure 4). According to CNNIC, the total number of main telephone lines in 1999 exceeded 175.6 million and mobile phones 43.3 million, an increase of 34 per cent and 81 per cent, respectively, over 1998 (see Figure 5). Despite the obvious lag in the development of the Internet and e-commerce compared to industrialized countries, these figures give an optimistic picture for the future of China's New Economy.

Figure 4
Number of computers with Internet connection, and number of Internet users in China



Source: CNNIC Report (2001).

Figure 5
Number of main telephone lines and cellular phones in China



Source: CNNIC Report (2001).

2.2.3 Disparity in the ICT industry development and diffusion across the regions of China

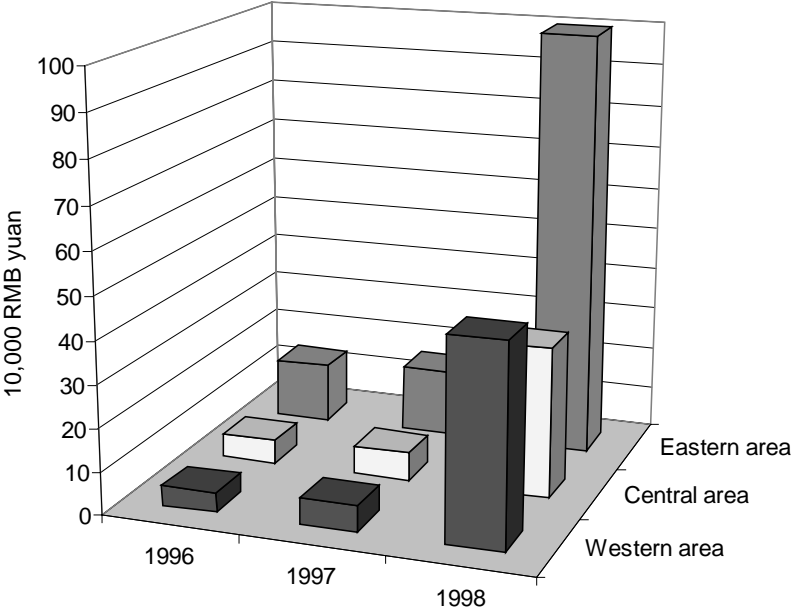
There has always been great regional variation in China's economic development. The standard of living is relatively high in the southern provinces and coastal areas. In fact, people in these areas have benefited the most from China's rapid growth. The country's 31 provinces, autonomous regions and cities under direct guidance of the central government are geographically categorized into three zones: the eastern, the central and the western zones. In terms of economic development, the eastern region is the most advanced, followed by the central region and finally by the backward western region. The eastern region includes 12 provinces and cities that are administered directly by the central government (Beijing, Shanghai, Tianjin, Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangxi, Guangdong and Hainan). The nine provinces of the central zone include Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Huan. The western region encompasses the ten provinces and autonomous regions of Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia and Xinjiang.

China is a vast country and the degree of informatization is very uneven across the regions. To analyse the prospects of the ICT industry in China, we need to examine further the adoption and diffusion of ICT among the various regions.

In 1997, the ratio of GDP per capita among the three zones was 1 for western, 1.29 for central, and 2.32 for eastern regions, but changed slightly in 1999 to 1, 1.28, and 2.39, respectively. The degree of disparity remained unchanged.

The per capita investment in ICT in the three regions also reflects this unevenness. In 1997, the ratio was 1 for the western zone, 1.1 for the central, and 2.64 for the eastern zone, changing by 1998 to 1, 0.754, and 2.13, respectively. In the ICT-based New Economy, the level of ICT investment will become the engine for long-term economic growth. The relative higher capability of the eastern part of China may further accentuate the gap to the other two zones.

Figure 6
ICT investment per capita across the economic regions of China



Source: *Yearbook of China's Fixed Investment* (various years).

If we look at the new ICT-indicators—Internet, e-commerce and wireless technologies—the disparity among the three regions is obvious. Penetration rate for telephone in 1999 is 15.41 per 100 in the eastern region, 7.58 in the central and 5.53 in the western. In 1999, Internet users as a percentage of total population in the same three zones were 0.56 per cent, 0.14 per cent and 0.18 per cent, respectively.

3 The road to developing the New Economy in China: opportunities and challenges

China is in the throes of two transitional processes—it is moving from a command economy to a market-based one, and from a rural, agricultural society to an urban, industrial one. In fact, many challenges facing the development of China's New Economy are not new issues—employment security, growing inequality, stubborn poverty, mounting environmental pressures, and periods of macroeconomic instability stemming from incomplete reforms, etc. But the information and communications revolution is indeed introducing new opportunities and challenges to these transitional

processes. Some of the major challenges, in view of the characteristics of the New Economy and the third industrial revolution addressed in Section 2, are more imminent to building the ICT-based New Economy.

Foremost, to promote the ICT industry, China needs to foster capital markets to finance the advancement of the high-tech sector. Growing evidence suggests that the country's financial system has become an increasingly inefficient intermediary of funds, and financing the ICT industry may become a bottleneck to developing the New Economy.

Braindrain is another problem. Small companies, chronically short of capital, are unable to maintain the stream of talented technical people graduating from leading universities, who opt instead to take more lucrative positions with well-established multinationals in China such as IBM, Microsoft and Motorola.

Liberalization of the ICT industry is a worldwide phenomenon of the New Economy. The government needs to take bold steps to deregulate the ICT industry, particularly the telecoms sector. Increased competition will encourage new ideas and technology know-how—a necessity for the healthy development of the ICT industry.

3.1 Financing the ICT industry

The financial system is the brain of the economy. Well-functioning financial markets enable risks to be transferred and diversified, so that firms can undertake projects which entail greater risk, but often also higher returns. This is true especially in the high-tech industry, and the development of a modern financial system is an important precondition for financing the ICT industry.

Over the past 50 years, investment activities in China have undergone three stages. The first stage was from 1949 to 1978, characterized as investment by the government under the centrally planned economic system. Central and local governments funded all industrial projects from fiscal revenue. The second stage lasted from 1978 to 1997. During this phase, bank loans were the main source for industrial investment. Banks, the financial intermediaries of the first two decades of reform were relatively inefficient particularly in the 1990s. Excessive real resources were poured into property development, into excess production capacity and into massive inventory build-ups, creating a major property bubble by the mid-1990s, and leading to unusually low levels of capacity utilization. After the Asian financial crisis in 1997, banks gradually faded from the investment sector. The third stage began in the late 1990s, and can be characterized as investment by market, reflecting the government's desire to develop a venture capital market. Venture capital is the major channel of funding for the ICT industry believed to produce high returns, but at high risks. The second-board market, enabling the withdrawal of venture capital, is of great importance for the entire Chinese venture capital industry. It offers an opportunity for small and medium-sized high-tech companies to raise funding outside of the country's debt-mired banking system.

3.1.1 Venture capital in China

Commercialization of scientific ideas in China has been lagging behind the United States and Europe for some time. In light of the success of venture capital activities in the United States, China has recognized the need to encourage the emergence of

innovative enterprises in order to compete in the global New Economy. In March 2000, the People's Congress promulgated a proposal for reform in the area of private equity and the establishment of mechanisms conducive to venture capital. Since then, interest in venture capital has increased exponentially. Governmental, industrial, corporate, and academic analysts are almost unanimous in their belief that China should quickly develop its venture capital institutions and industry.

In recent years venture capital financing activities have been evolving on a limited scale.³ This has revealed the existence of numerous problems related to certain restrictions or lack of supportive legislation under the existing legal framework. Unless corrected, these can impede venture capital financing and start-up processes in general. These problems also highlight areas where legislation and regulation need to be reformed. It is therefore instructive for both policymakers and for domestic as well as foreign venture capital community to examine the existing legal environment closely, to determine how these deficiencies have affected venture capital financing activities in China with regard to both domestic and foreign players, and what legislative and regulatory changes are needed to improve the existing system.

A huge amount of capital could become available to boost the growth of the venture capital industry, were it possible to steer even a small fraction of China's tremendous private savings towards start-up financing. Active private involvement is the answer. But one obstacle is the lack of a legal framework that would legalize the formation of investment funds from the private sector. So far most, if not all, domestic venture capital funds in China have been created and funded by government initiative. Such funds typically operate without the built-in incentive schemes found in the West in limited partnership vehicles. This limited partnership law and other legislation for the formation of investment fund vehicles are yet to be enacted in China, and huge financial resources from the private sector remain inaccessible for the budding venture capital industry.

The National People's Congress is in the process of drafting a bill on venture capital funds that would enable domestic firms to operate and raise funding from the private sector. Recent reports indicate that efforts are being made at the State Council to amend the Corporate Law. Year-end is the goal for completion. These amendments would include (i) deleting or reducing the minimum capital requirement under Article 23; (ii) cancelling or minimizing the limitation on valuation of intangible property as a percentage of capital contribution under Article 24; (iii) explicitly allowing companies to create different types or classes of shares; (iv) clarifying the extent to which foreign entities may hold equity interest in a limited liability company; and (v) allowing holders of legal personal shares to dispose such shares in the open market.

Both the indigenous venture capital industry and foreign venture capital are likely to grow significantly in the years ahead. China's policymakers seem to be very aware of the many shortcomings in the present investment framework. Remedial changes can be introduced only gradually because of bureaucratic inertia and time lag, but business imperatives for venture capital in China will ensure a healthy growth of the industry in the mid- to long-term.

³ Mostly by a small but growing number of foreign venture capital firms pioneering the effort, and a number of home-grown, government-sponsored venture capital companies.

3.1.2 Over-the-counter (the second board) stock market

Characterized as China's NASDAQ, the second-board market will support the exit of venture capital by allowing small and medium-sized hi-tech or high-growth companies to secure capital from the general public. The second board, with fewer restrictive qualifications for being listed on the market, should provide golden opportunities for the development of high-tech firms. Thus, it is significant for the development of the New Economy. Taiwan's over-the-counter (OTC) market is a good example. Most of the companies listed in its OTC market are high-tech firms specializing in electronics, telecommunications, PCs, etc. Over 90 per cent of the new high-tech companies were established by young expatriates returning from the United States or Europe. Taiwan's OTC market made a major contribution to the country's successful transition from traditional labour-intensive industries to high-tech businesses.

Corporate Law in China has prompted the State Council to draw up regulations for the second-board market. These have already been drafted and are currently under discussion in the State Council. To open the door for low-threshold listings, however, the Corporate Law needs to be amended with regard to asset scale, operation and profit record as well as the structure of shareholders. But as the law was not on the agenda of the most recent session of the Standing Committee of the National People's Congress in late October, amendments will not be forthcoming soon.

Firms registering with the main-board market, under mainland Corporate Law, must have been in operation for at least three years, have recorded profits for three consecutive years, and have a minimum share capital of RMB50 million. Regulations governing the second-board market would be considerably more flexible. Tangible net assets valued at RMB8 million (about HK\$7.52 million) would be sufficient to secure a listing, and companies, given that their income exceeded RMB3 million in the year prior to listing, need show a business income of only RMB5 million for the previous two years. No profit history is required. The limit on the value of intellectual property assets as a percentage of total equity may be raised from 20 per cent to 70 per cent. Stock options, the major incentive for high-tech start-ups, will be allowed for firms to go IPO at the second-board market. Also included in the draft rules for the second-board are provisions setting minimum standards for a share listing, and a one-year prohibition on the sale of shares by company founders and senior executives.

Aimed at promoting the start-up of high-tech and other companies with good growth potential, the second board is likely to involve riskier investments than the main board, implying that more standard practices and stricter supervision are needed. Reportedly over a thousand start-ups have expressed an interest in being listed with the proposed second board. Also, to give priority to certain start-ups, not all enterprises will be permitted access to the second board.

3.2 Talents

The United States, as a leader in the New Economy, has a long history of a strong market economy with a healthy business atmosphere. It also has a mature management culture and creative environment that emphasizes innovation. Many American executives of high-tech companies have a strong background in technology—known in China as 'digital heroes'. However, the situation is quite different in China. Generally speaking, because of their traditional education, local technical experts lack the ability

to design new concepts, new technologies, new models and new ideas, which prevents them from propelling companies and the industry forward.

Both traditional industries and high-tech companies in China need professional executives and managers with globalized vision, rich knowledge and managerial experience. The country also needs a wide range of experts in the IT industry and financial world. Conventional Chinese companies must change their autocratic and ineffective management culture to participate fully in the New Economy.

China has an abundance of technically competent personnel. Over the past two decades some 260,000 students have been sponsored by the government to study in 113 different countries. The disciplines have ranged from space to biotechnology, and from agriculture to various fields of manufacturing technology. So far, about 90,000 have returned to China. Most of those who have remained abroad are currently in the US, and quite a few occupy leading positions in academia and businesses.

The number of returning scholars has increased at an average annual rate of 13 per cent in the 1990s, providing promise for the future of China's rapid economic and social development. Expatriates, although scattered around the globe, have been supportive and enthusiastic about opening up the country. These scholars have had an important role in promoting China's exchange with the rest of the world in science, technology, education, culture, economy and trade. Some of these scholars have developed new subjects or edited new textbooks for university use. Others have made important inventions in key state science and high-tech projects, or have introduced advanced knowledge in finance and securities, and trade and business management to state-owned firms.

The government is taking measures to encourage expatriates to return. The National People's Congress (NPC) Overseas Chinese Committee plans to submit this year the final amendment to the Law on the Protection of the Rights and Interests of Returned Overseas Chinese and Family Members of Overseas Chinese. China will have qualified returnees in sufficient numbers to enable the country to achieve technological maturity on its own terms. Similarly, it was the initial wave of students returning to Taiwan in the 1980s who developed and guided the electronic manufacturing, new technology and the educational system.

3.3 High-tech parks

As shown by the Silicon Valley experience, high-tech parks are the driving force in the development of the New Economy originating from the US. The secret of success, where Silicon Valley differs from any other high-tech park in the world, is its culture that advocates risk-taking and encourages innovation. Theoretical and practical technological research in Silicon Valley is conducted at the Stanford University and the Stanford University Research Park. Talented engineers, the pioneers of today, are especially responsive to risky ventures that have potential for great rewards, and the heroes of Silicon Valley are the successful entrepreneurs who took aggressive risks, both professionally and technically.

Zhongguancun in northwest Beijing, known as China's Silicon Valley, is home to dozens of the country's top universities⁴ and nearly 5,000 private high-tech businesses and numerous academic and research institutes. It is the major hope of the city and of the entire country in the development of high-tech industries.

According to Liu Zhihua, Vice-Mayor of Beijing, the specific development programme of the area was initiated and approved in April 2000 after complex feasibility studies and international bidding. The plans for a world-class high-tech enclave in the Zhongguancun area have the approval of President Jiang Zemin and are considered by the state media as a milestone in China's development.

Zhongguancun's importance as a new growth engine for the economy is being compared to the Special Economic Zone in Shenzhen, southern China, in the 1980s and to Shanghai's Pudong Development Area in the 1990s. While these two schemes are the landmarks of Deng Xiaoping, reform architect of China, and have been decisive in the country's transition to the market, the Zhongguancun project will fulfil Jiang's policy of 'rejuvenating the country through science and education'. Leaders forecast that Zhongguancun will spur growth in the Bohai Gulf in northern China in a manner similar to the Shenzhen project promoting the development of the Pearl River Delta or the Pudong scheme engineering the boom of the Yangtze Delta. They also envisage the Zhongguancun area duplicating the success of California's Silicon Valley to make China a leader in information technology.

The Shangdi Information Industry Base, considered a priority in Zhongguancun, was founded in 1991 as a comprehensive high-tech industrial park focusing on electronic information services. Shangdi, with 264 high-tech enterprises including Legend, Founder, and Huawei, has produced an average yearly income of more than US\$2.4 billion over the past nine years which translates into an output value of US\$36.1 million per hectare. With no space for newcomers, it is in great need of expansion. A new north area, to be marketed during the second half of 2001, will accommodate about 150 additional companies engaged in intellectual industries. An exchange centre to handle property rights of high-tech inventions was opened this year in Beijing. The Zhongguancun high-tech exchange centre will be important in promoting the commercialization of scientific and technological results and in attracting more investment to the city's high-tech industry.

One obstacle, however, may hinder the future development of China's high-tech parks—the issue of ownership. According to the state press, some 2,000 enterprises, or half of the Zhongguancun ventures coming into existence during the last decade, are fighting the 'ownership rights syndrome'. The opaque company structures make it difficult to ascertain ownership rights and consequently to attract investment.

3.4 Deregulation of the ICT industry

Liberalization of the ICT industry is a worldwide phenomenon in the New Economy. Deregulation in particular of the telecom sector, the backbone of the ICT industry, is an

⁴ Including, among others, Beijing University, Tsinghua University, and People's University.

exciting and controversial issue in almost every country. Its deregulation process will have a great impact on developing the New Economy in the world.

During the planned economy era, China's Ministry of Information Industry (MII) and its predecessor, the Ministry of Posts and Telecommunications, were both the government regulator and the business operator. With the aim of creating a competitive telecom services market, restructuring began in 1999 with the breakup of China Telecom into four separate operational entities, the China Telecom, China Mobile, China Satellite and China Unicom. In addition, the China Netcom Corporation is installing a national IP fixed-services network and also planning a third CDMA network. The Ministry of Railways (MoR) is upgrading its fibre backbone for commercial service and rolling out VoIP services.

Deregulation is creating competition among China Telecom's operational entities. The Provincial Telecom Administration's (PTAs) fixed-line business is being progressively taken over by China Mobile Communications Corporation's cellular service. Local PTAs are exploring the prospect of using fixed wireless networks to deliver wireline services, while cellular operators have a compelling commercial motivation for building their own wireline backbone infrastructure and developing their own data service portfolios.

Relatively high telephone and Internet access charges are a major barrier to electronic commerce in developing countries. According to a report by the Boston Consulting Group (2000), access costs among Asia's developing countries are generally similar to the US. But, given the lower income levels, these are a significant barrier. Internet access costs in most cases account for more than 15 per cent of a household's monthly income (as much as 48 per cent in China and 35 per cent in India). Added competition in the telecoms industry will lower these charges. According to a study by Dr Tian Jie of the China's Academy of Science (2001), the average Internet access charge in 1996 was 20 RMB yuan (US\$2.40) per hour, but had decreased to 3 RMB yuan (US\$0.36) per hour by 1999, a drop of 85 per cent as a result of intense competition. In comparison, phone rates stayed the same at 3.6 RMB yuan (US\$0.40) per hour because of China Telecom's monopoly position at the last mile.

3.5 China's entry into the World Trade Organization

Entry to the WTO will bring more opportunities and challenges to China's development of the New Economy:

- WTO agreements will allow foreign companies to invest directly in ICT, through the normal merger and acquisition approach to expand to China's markets. This offers the opportunity to solve the capital shortage problem of firms in China.
- Face-to-face competition with foreign companies will encourage Chinese companies to leap forward in their adoption of technology and management skills. The feasibility of this approach was testified by the Chinese home appliance industry competing successfully with Japanese firms.
- Foreign companies operating in China will generate more local high-tech firms. To succeed, these foreign companies will need local suppliers and

partners. This will generate opportunities for Chinese entrepreneurs. It is expected that many local high-tech companies will be set up in this way. These companies will going to be more flexible and competitive, as they will be operating under international standards since their inception. Some of these may become China's high-tech giants.

4 Conclusions: Policy implications for developing the New Economy in developing countries

Based on our analysis, China clearly has a long way to go to develop its ICT-based New Economy. The country's ICT industry development and diffusion trail far behind those of the developed countries. However, the speed of progress is astonishing. In the era of the New Economy, there is no doubt that the ICT industry is becoming the most dynamic sector of the economy, surpassing traditional industrial-age industries. After entry into the WTO, China's huge market will become the most spectacular field of competition in the world. The global diffusion of the information and communications technology provides developing countries the opportunity to reduce the economic gap between the developing and the developed countries. With the integration of the world market, it is obvious that developed nations will outsource more and more of their labour-intensive products and service production to the developing countries. This may lessen the developing countries' concern over the displacement effect of ICT adoption. To participate in these markets, however, developing-country enterprises will need to develop the ICT links to integrate themselves into the supply links being created for these activities.

For vast developing countries like China and India to develop their ICT industries, policymakers need to consider the following issues:

- It is time to rethink the classical battle between 'import substitute' and 'export-led' strategies of economic development. There is huge domestic market potential for the development and diffusion of the ICT industry. Although the success of export-led strategies in ICTs has been spectacular for a number of nations, these have also had a very strong export orientation in other areas. With their large domestic markets, it may be possible for China and India to develop local markets in sufficient scale to support domestic ICT industries.
- The developing countries can also find comparative advantage in the global ICT markets, as exemplified by India's experience in promoting its software industry, which currently ranks as number two in the world, second only to the United States. India's success has been built on: (i) Comparative and absolute advantage in production costs; and (ii) Export-driven demand from developed countries for outsourcing. India, however, faces potential constraints in its software industry, which include a shortage of skilled engineers and the inadequacy of its infrastructure.
- Developing countries can use the information and communications technology to their advantage to restructure their industry structures. The unprecedented information communications and technology transmission is providing a unique shortcut for the developing countries to learn from the industrialized world and to build a completely new market mechanism.

References

- Boston Consulting Group (2000). 'E-Tail of the Tiger: Retail E-commerce in Asia-Pacific'. NetBizAsia Strategy Report, March.
- China Statistical Yearbook* (various years). Beijing: The China Statistical Press.
- Cogburn, D. L., and C. N. Adeya (2001). 'Prospects for the Digital Economy in South Africa: Technology, Policy, People, and Strategies'. WIDER Discussion Paper 77. Helsinki: UNU/WIDER.
- International Data Corporation (2000). *2000 IDC/World Times Information Society Index*. Available at <http://www.worldpaper.com/ISI/country.html>.
- Jalava, J., and M. Pohjola (2001), 'Economic Growth in the New Economy: Evidence from Advanced Economies'. WIDER Discussion Paper WDP 2001/05. Helsinki: UNU/WIDER.
- Jie, T. (2001). 'Considering the Development of Internet in China'. Lecture given on April 4. Beijing: School of Economics and Management, Tsinghua University.
- Kraemer, K. L., and J. Dedrick (2001). 'Information Technology and Productivity: Results and Policy Implications of Cross-Country Studies' in M. Pohjola (ed.), *Information Technology, Productivity, and Economic Growth*. Oxford: Oxford University Press.
- Moss, D. A. (1996). 'Confronting the Third Industrial Revolution'. Harvard Business School Case # 9-796-161.
- OECD (2000). *Information Technology Outlook 1999*. Paris: OECD.
- Steinmuller, E., and M. Bastos (1995). 'Information and Communication Technologies: Growth, Competitiveness, and Policy for Developing Nations'. UNU/INTECH Discussion Papers #9511.
- Wong, P. K. (2001). 'ICT industry Development and Diffusion in South East Asia'. WIDER Discussion Paper WDP 2001/08. Helsinki: UNU/WIDER.
- World Bank (2000). *World Development Indicators 2000*. Washington DC: World Bank.
- Yearbook of China's Electronics Industry* (various years). Beijing: The China Electronics Industry Press.
- Yearbook of China's Fixed Investment* (various years). Beijing: The China Planning Press.
- Yearbook of World Electronics Data* (various years). London: Elsevier.

UNU World Institute for Development Economics Research (UNU/WIDER) was established by the United Nations University as its first research and training centre and started work in Helsinki, Finland in 1985. The purpose of the Institute is to undertake applied research and policy analysis on structural changes affecting the developing and transitional economies, to provide a forum for the advocacy of policies leading to robust, equitable and environmentally sustainable growth, and to promote capacity strengthening and training in the field of economic and social policy making. Its work is carried out by staff researchers and visiting scholars in Helsinki and through networks of collaborating scholars and institutions around the world.

UNU World Institute for Development Economics Research (UNU/WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

Camera-ready typescript prepared by Liisa Roponen at UNU/WIDER
Printed at UNU/WIDER, Helsinki

The views expressed in this publication are those of the author(s). Publication does not imply endorsement by the Institute or the United Nations University, nor by the programme/project sponsors, of any of the views expressed.

ISSN 1609-5774
ISBN 952-455-276-0 (printed publication)
ISBN 952-455-277-9 (internet publication)