

China and the Knowledge Economy: Challenges and Opportunities

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Abstract

The rapid pace of economic growth in China has been unprecedented since the start of economic reforms in late 1970s. It has delivered higher incomes and made the largest single contribution to global poverty reduction. Measured by international poverty lines, from 1978-2004, the absolute poor population in rural areas has dropped from 250 million to 26.1 million. Such gains are very impressive and have been driven largely by a set of market-oriented institutional reforms, strong investment, and effective adoption and application of various knowledge and technologies, especially foreign ones through trade and foreign direct investment (FDI). While enjoying tremendous success, China also faces many challenges that have to be addressed in order to sustain its long-term development. These include weak institutions, low overall educational attainment, weak indigenous innovation capacity, poor linkages between research and development (R&D) and industries, etc. This paper is intended to provide an insightful analysis on some strengths, weaknesses, opportunities, and Challenges of China's knowledge economy in the areas of economic incentives and institutional regime, human capital, innovation system, and information infrastructure.

Key words: China, knowledge economy, competitiveness, innovation, institutions, governance, education, strengths, weaknesses, opportunity, challenges.

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China and the Knowledge Economy: Challenges and Opportunities

The rapid pace of economic growth in China has been unprecedented since the start of economic reforms in late 1970s. Its GDP has grown over 9.0% on average over the past two decades and today still maintains a strong momentum. The size of the economy has ranked No. 4 globally, only after the U.S., Japan, and Germany. It has delivered higher incomes and made the largest single contribution to global poverty reduction. Measured by international poverty lines, from 1978-2004, the absolute poor population in rural areas has dropped from 250 million to 26.1 million.³ Such gains are very impressive and have been driven largely by a set of market-oriented institutional reforms, strong investment, and effective adoption and application of various knowledge and technologies. While enjoying tremendous success, China also faces many challenges that have to be addressed in order to sustain its long-term development. This paper is intended to provide an insightful analysis on some strengths, weaknesses, opportunities, and threats/challenges (SWOT) of China's knowledge economy, using the knowledge economy framework developed by the World Bank Institute.⁴

A. Strengths

In addition to unmatched basic endowments, such as the largest population in the world (1.3 billion), and huge domestic market whose large potential is yet to be explored, there are many other strengths manifested in the four pillars of the knowledge economy.

A.1. Economic and Institutional Regime

China's success can be attributed to many factors, such as an adaptive approach of transition, strong vision and full commitment of leadership, mass support, pragmatism, great openness, high saving rate, and an emerging and dynamic private sector, etc.

A.1.1. An effective leadership with strong vision and pragmatism

³ OECD Economic Surveys: China, OECD, 2005.

⁴ The framework consists of four pillars: economic and institutional regime, education and skills, innovation system, and information infrastructure.

China's economic reform started in 1978 with the strong vision of developing a market economy with Chinese characteristics, architected by then leader Deng Xiaoping. Putting aside the communist ideology, the transformation started in the agricultural sector by introducing the household responsibility system – which actually privatized the use rights of lands previously controlled by communes. Built on the success of the agricultural sector, the Chinese again invented the township and village enterprises (TVEs) – enterprises owned and managed by local governments – to tap the rural surplus labor and rising farmer incomes. The amazing success of the TVEs has left the traditional economy theory a puzzle to solve.

In pursuing the transition towards a market economy, China has adopted a gradual approach with great pragmatism. As at the outset of a reform, it is not possible to foresee, let alone to resolve, all the potential problems that might emerge at later stages; change has been conducted as a process of adaptive learning. Through such an approach, China has successfully allowed regions and localities to experiment and then scale up the most successful experiences at the national level. The agricultural reform, the TVE initiative as well as the special economic zones later on were all tested as pilot(s) first and then scaled up when proved successful. With the same principle, the reforms were gradually expanded from the agricultural sector to industry and large parts of the service sector (see table 1 for a chronology of China's major reforms). This might be one of the major reasons which could explain the contrasting results of the Russian and Chinese reforms.

Table 1. China's Major Policy Reforms

Year	Policy Change
1978	“Open door” policy initiated, allowing foreign trade and investment to begin
1979	Decision to turn collective farms over to households; TVEs given stronger encouragement
1980	Special economic zones created
1984	Self-proprietorships encouraged, of less than 8 people
1986	Provisional bankruptcy law passed for SOEs
1987	Contract responsibility system introduced in SOEs
1988	Beginning or retrenchment of TVEs
1990	Stock exchange started in Shenzhen
1993	Decision to establish a “socialist market economic system”
1994	Company law first introduced
1995	Strategy of vitalizing the country through science & education initiated
1996	Full convertibility for current account transactions
1997	Plan to restructure many SOEs began
1999	Constitutional amendment passed recognizing private ownership
2001	China's accession to WTO
2002	Endorsement of the role of the private sector
2003	Decision to “perfect” the market economic system
2004	Constitution amended to guarantee private property rights

Source: Zeng's compilation and OECD China Economic Survey 2005.

A.1.2. Open-door policy

Since the open-door policy was introduced in the early 1980s, the Chinese economy gradually opened to foreign trade and investment. This process encompassed allowing enterprises to participate in foreign trade, replacing trade procurement targets by market based trade policy instruments such as tariffs, quotas and duty exemption schemes, gradually reducing trade barriers, and finally, increasingly using market mechanisms. Meanwhile, China set up various economic development zones and techno parks (from a few to a big mass) to attract FDIs and new and high technologies. China's entry into the WTO in late 2001 further facilitated its openness and transition towards a market-based economy. Today, China is well integrated into the global market (trade as a share of GDP

is 79%⁵), and the largest destination for FDI (this will be discussed further in the innovation section).

The great openness – allowing imports of capital flows, technologies, and management competencies, along with other major policy reforms – greatly enhanced China’s market competition and efficiency. A World Bank study estimated that nearly a quarter to a third of China’s post-1979 growth is from increases in organizational and production efficiency, incurred from the reforms. Other estimates of the sources of growth suggest that technological advances sped up in the 1990s with the opening of the economy and inflow of FDI, raising the demand for skilled labor. Technological growth has averaged above 2% per year, which is a strong performance by international standards.⁶

A.1.3. Strong FDI presence

FDI have played a critical role in China’s economic take-off. Initiated in 1979, China has taken a series of policy measures to encourage the inflow of FDI. This has been demonstrated by the gradual shifts from the establishment of the four Special Economic Zones (SEZs) to the nationwide implementation of open policies for FDI, from granting permission for joint ventures to allowing wholly foreign owned enterprises, from tight foreign exchange control to RMB convertibility on current account and from offering tax incentives to granting national treatment.⁷ In 2004, China attracted \$60.6 billion worth of FDI, up 13.3% from 2003, and total FDI stock has reached \$562.1 billion.⁸ The technologies, advanced management practices and training services that FDI brought to China have greatly contributed to the local economy. The role of FDI was even more important in the early years of developing technology parks, as foreign firms formed the nuclei of these important building blocks of Chinese high-tech industry. According to the Chinese Ministry of Commerce, about 690 research facilities or research centers had been set up by multinationals in China by 2004.

⁵ World Bank DDP database.

⁶ World Bank, *China – Promoting Growth with Equity* (CEM), EAP, September 2003.

⁷ Chen, Chunlai, “The Evolution and Main Features of China’s Foreign Direct Investment Policies”, Working Paper of the Chinese Economies Research Center, Adelaide University, 1997.

⁸ UNCTAD, World Investment Report, United Nations, 2005.

A.1.4. High saving and investment rates

Consistent with its culture of strong propensity for saving, China's domestic saving rate remains high (around 35-45% from 1978-2003). Such a high rate of saving was able to withstand remarkable institutional changes, and meet strong investment needs incurred from rapid economic expansion. A marked increase in household savings offset the ending of artificially high state-owned enterprise profits and consequently lowered savings in the combined accounts of the government and SOEs.⁹ In the future, with the decrease of total fertility and an increase of per capita income, the saving might continue to be strong.

A.1.5. An emerging private sector

China's private sector started to develop in mid-1980s, but it has emerged as a major driving force in the economy. Output by privately controlled companies now accounts for almost 60% of GDP (table 2), and dominates many industries, making them increasingly market-oriented. The growth of the private sector has been facilitated by an increasingly tolerant policy environment, and widespread structural reforms.

Table 2. Share of GDP by Firm Ownership (1998-2003)

	1998	1999	2000	2001	2002	2003
Private Sector	50.4	51.5	52.8	55.5	57.4	59.2
Public Sector	49.6	48.5	47.2	44.5	42.6	40.8
State-controlled	36.9	37.1	37.3	35.7	34.6	33.7
Collectively controlled	12.7	11.3	10.0	8.8	8.0	7.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: National Bureau of Statistics and OECD estimates.

A.2. Education and Skills

A well-educated population is the key enabler of the knowledge economy. China's massive relatively educated labor force is the backbone of its strong economic performance.

A.2.1. A relatively skillful human capital base

⁹ OECD Economic Surveys: China, OECD, 2005.

With a series of educational reforms starting from 1979, mainly focusing on improving access, governance, financing and curriculum, China has made great progresses in building a relatively well educated population. From 1978-2003, the adult literacy level increased from 64% to 89%¹⁰; from 1982-2000, the average number of years of education for the population aged 15 and above increased from 5.33 to 7.85, and for the total labor force, it increased from 5.81 to 7.99 (for the secondary industry where manufacturing is the bulk, it increased from 8.05 to 9.44).¹¹ In addition, from 1990-2004, China's primary enrollment ratio (net) increased from 93.9% to 98.9%, junior secondary (gross) increased from 66.7% to 94.1%, and tertiary (gross) rose from 3.4% to 19%¹².

A.2.2. Rapidly emerging private higher education

To address the huge demand for higher education, which the public system alone could not fulfill, the private provision for tertiary education has been growing very rapidly (table 3), especially in more remunerative disciplines such as business, commerce, and ICT. Since most of them are more market-driven, more flexible, and better suited to business needs, they will have great potential to grow and become the driving force for better quality higher education. Although they still face many institutional constraints and only account for 10% of total enrollment, given China's huge household savings (estimated at RMB 60 trillion) and long tradition of putting a high premium on good education, private education will play an increasingly important role.

Table 3. Growth of Tertiary Education in China (1997-2002)

	1997	1998	1999	2000	2001	2002
Growth of Private Tertiary Schools	0	13.3	94.1	30	97.7	54.1
Growth of Total Tertiary Schools	-1.2	0.2	4.8	-2.8	17.7	14
Growth of Private Tertiary Enrollments	33.2	38.5	80.8	70	105.4	126.2
Growth of Total Tertiary Enrollments	5.1	7.4	21.3	34.5	29.3	25.6

Source: Chen, Guoliang, Shanghai Academy of Educational Sciences. Presentation at the WB/KRIVET Workshop on "Revamping Lifelong Learning System", Seoul, June 2003.

¹⁰ World Bank SIMA database.

¹¹ Chinese Census 1982, 2000.

¹² China Education Statistic Yearbook 2000, 2004.

A.3. Innovation System

A.3.1. Rapid increase of R&D investment

As one of the important pillars of “revitalizing the country with science and education” strategy, China has put great emphasis on science and technology, and has defined strengthening the indigenous innovation capacity as one of the main objectives of its 11th five-year development plan.

Following such a strategy, China’s R&D spending has increased from 34.8 billion yuan a year in 1995 to about 160 billion yuan in 2004. According to a recent study by UNESCO, Asia today represents 30.5 percent of world R&D expenditures and much of the credit for this belongs to China, which is edging ahead of the newly industrialized economies in Asia in terms of R&D expenditures.¹³ From the mid-1990s to 2003, China’s R&D spending as a share of GDP increased from 0.6% to 1.31% (table 4), and further to 1.35% in 2004. This ratio is the highest in the developing world, higher than India and Brazil’s, but still lower than the world average (1.6%) and that of developed countries (2.2%). The share of government expenditures has remained about 4 % since 1998. China is ranking now the sixth in the world in terms of its total R&D expenditure. However, it should be noted that China’s expenditure statistics are not comparable to those for OECD countries because China does not attach values to tax incentives (expenditures) whereas other countries do.

Table 4: China’s R&D Expenditures and Shares to GDP

	1995	1996	1997	1998	1999	2000	2001	2002	2003
GERD (billion Yuan)	34.87	40.45	50.92	55.51	67.89	89.57	104.25	128.76	153.96
Growth %		9.5	24.9	10.9	20.3	16.9	15.0	23.8	17.1
As % of GDP	0.6	0.6	0.68	0.7	0.83	1.0	1.07	1.22	1.31
Govt. S&T appropriations (billion Yuan)				43.86	54.39	57.56	70.33	81.62	97.55
As % of government expenditure				4.1	4.1	3.6	3.7	3.7	4.0

Source: China S&T statistics annual report, 2003.

A.3.2. Critical mass of scientists and engineers in R&D

¹³ UNESCO: *Emerging global trend in scientific R&D* (Wstholm, Tchatchoua and Tindemans), 2003

China boasts one of the world's largest forces of scientists and engineers. Table 5 shows that in absolute term, China's number of researchers in R&D (almost 811,000) is second only to the U.S., and the S&T journal articles only after the U.S., Japan, and Germany. Its S&E enrollment ratio as a share of tertiary students is one of the highest in the world. Such a critical mass forms a solid human foundation for its S&T and innovation activities.

Table 5. A comparison of S&T talents (2003-04)

	China	India	USA	Japan	Germany	Russia
Science & Engineering Enrolment Ratio (% of tertiary students)	43	20	19	20	29	50
Researchers in R&D	810,525	117,528	1,943,000	646,547	267,000	487,477
Researchers in R&D / Mil. Pop.	633.0	119.7	4525.8	5084.9	3222.2	3414.6
Total Expenditure for R&D as % of GDP	1.23	0.85	2.67	3.11	2.64	1.24
Scientific and Technical Journal Articles	20,978	11,076	200,870	57,420	43,623	15,846
Scientific and Technical Journal Articles / Mil. Pop.	16.5	10.7	704.0	451.6	529.8	109.5

Source: WBI KAM database.

A.3.3. Strong business participation in R&D

Enterprises are now becoming big players in both financing and conducting R&D activities in China (tables 6 and 7). In 2003, the business sector accounted for 62.4% of total R&D funding. However, it should be noted that public enterprises undertake most of the R&D in the business sector - roughly 50% of all R&D in China. This means that the amount being done by non-public enterprises is just about 10% of the total R&D effort, and it appears that a large share of this is being done by multinational companies (MNCs), not by domestic Chinese firms. The total R&D input in 2004 by state-owned enterprises, supervised by the Central State Assets Supervision and Administration Commission (SASAC), came to 76.8 billion yuan, accounting for 1.5% of firms' annual

sales revenues.¹⁴ As for the overall business sector, its share in total R&D spending is much higher than India (table 7). Although this is mostly concentrated in big firms and spin-offs from former public institutes, in general, it is an important trend which shows the business sector's enhanced capacities and increased demand for technologies as well as stronger linkage between R&D and the market. Meanwhile, China needs more efforts to encourage the R&D activities of the domestic non-public firms.

Table 6: Distribution of funding on R&D (1996 – 2003)

Year	1996	1997	1998	1999	2000	2001	2002	2003
R&D institutions	42.8	40.6	42.6	38.5	28.8	27.7	27.3	25.9
Enterprises	43.3	46.1	44.8	49.6	60.0	60.4	61.2	62.4
Universities	11.8	11.3	10.4	9.3	8.6	9.8	10.1	10.5
Others	2.1	2.0	2.2	2.6	2.6	2.1	1.4	1.2

Source: MOST, 2004.

Table 7. R&D spending breakdown (%)

	Business	GRI	University
China (2001)	60.4	27.7	9.8
India (1998-99, roughly)	22	75.5	2.5

Source: World Bank internal database and country statistics.

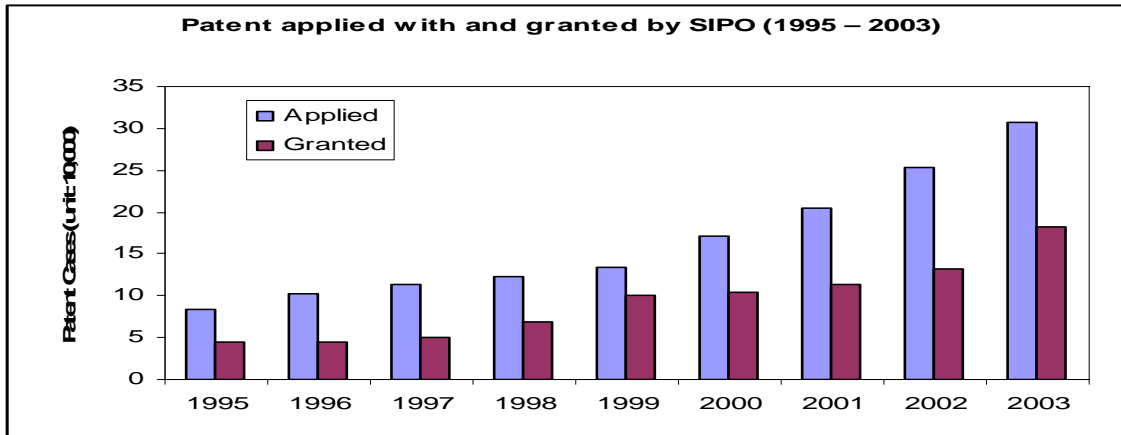
A.3.4 Rapid increase of S&T output

China's patenting has increased dramatically over the last decade in terms of both patent applications and patents granted. The number of applications filed (for all three types of patents) increased from 41,773 in 1995 to 130,133 in 2004; and patents granted totaled 49,360 in 2004 (Figure 1 and Table 8). China's international patents applications also increased very rapidly. According to WIPO recent report *Annual PCT Statistical indicators report (annual statistics 1978 -2004)*, China fared very well. In 2004 it filed 1,705 invention applications, an increase of 32% compared with the previous year and ranked 14th in international application percentage (1.4%). Among developing countries

¹⁴ The Central State Assets Supervision and Administration Commission (SASAC), "Firms' Input in R&D Activities", Aug, 2005,

China ranks second in terms of international applications filed. Invention applications filed in the United States by Chinese residents were up from 695 in 2001 to 2,043 in 2005, and patents granted by the USPTO (US Patent and Trademarks Office) were also up from 239 to 583 (Table 9).

Figure 1: Patents applied with and granted by SIPO (accumulative, 1995 – 2003)



Source: State Intellectual Property Office of China (SIPO), 2004

Table 8: Patents Applied for and Granted by SIPO (1996 – 2004)

Reporting year	Applications for patents filed by			Grants of patents to		
	Residents	Non-residents	Total	Residents	Non-residents	Total
1995	10 066	31 707	41 773	1 530	1 863	3 393
1996	11 698	41 016	52 714	1 383	1 593	2 976
1997	12 786	48 596	61 382	1 532	1 962	3 494
1998	14 004	68 285	82 289	1 653	3 082	4 735
1999	15 742	73 300	89 042	3 097	4 540	7 637
2000	25 592	96 714	122 306	6 475	6 881	13 356
2001	30 324	118 970	149 294	5 395	10 901	16 296
2002	40 346	140 910	181 256	5 868	15 605	21 473

2003	56769	48549	105318	11404	25750	37154
2004	65786	64347	130133	18241	31119	49360

Source: SIPO and WIPO, 2003, 2004 and 2005

Table 9: Patent applications filed by and granted to Chinese residents in the United States Patent and Trademark Office (FY 2001 - FY 2005)

	2001	2002	2003	2004	2005
Patent applications filed	695	966	1230	1132	2043
Patents granted	239	347	442	551	583

Source : USPTO, 2005

Meanwhile, China has improved from 15th in the world in terms of scientific publications listed in SCI, EI and ISTP in 1990 to the fifth in 2003. Table 10 shows China's publications catalogued in refereed international journals since 1998.

Table 10: Publications catalogued in refereed scientific journals (SCI, EI and ISTP)

Year	1998	1999	2000	2001	2002	2003
# of S&T papers catalogued	35,003	46,188	49,678	64,526	77,395	93,352

Source: China national S&T output indicators; <http://www.sts.org.cn>

A.3.5. Well-established state key labs and techno parks

Though they are not prevalent, China has built some national key laboratories in the fields of physics, chemistry, biotech, pharmaceuticals, optics, space, etc., and some are world-class, such as those located in the Chinese Academy of Sciences, Beijing University, Tsinghua University, and Shanghai Jiaotong University, and so on. In addition, China has several leading technology parks which serve as important technology and innovation hubs for the country, such as the Zhongguancun high-tech

park (Beijing, with 500 R&D centers), Shanghai Pudong technology park, Shenzhen Technology Park, and Suzhou Techno Park, etc.

A.4. Information Infrastructure

A.4.1. Rapid improvement of ICT access

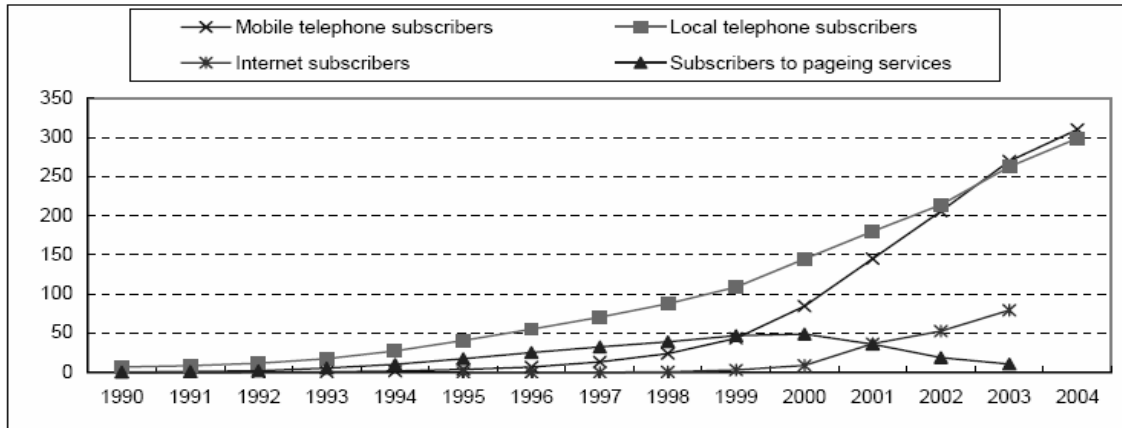
China's ICT expenditure as % of GDP is 5.3% in 2004. Although its overall ICT penetration is still low compared with more advanced countries, it has been growing rapidly (table 11). From 2000-04, mobile subscribers per 1,000 people increased almost 4-fold, internet users per 1,000 people increased by 4 times, and personal computers per 1,000 people increased 2.5 times. By 2004, China's mobile phone and PC penetrations were higher than the average of either the lower middle income group or the EAP region. The internet penetration is slightly lower than the EAP region average but higher than the lower middle income group. The growth of the absolute numbers is even more impressive. By 2005, China became the largest mobile phone market in the world and its total number of internet users had surpassed 100 million (figure 2).

Table 11. China's ICT Penetration

	China		Lower middle income group	East Asia & Pacific region
	2000	2004	2004	2004
Telephone mainlines (per 1,000 people)	115	241	192	194
Mobile subscribers (per 1,000 people)	68	258	255	248
Population covered by mobile telephony (%)	..	73	76	73
Internet users (per 1,000 people)	18	73	70	75
Personal computers (per 1,000 people)	16	40	38	37

Source: World Bank: ICT at a glance – China, 2005.

Figure 2. Rapid Growth of China's ICT Applications (millions)

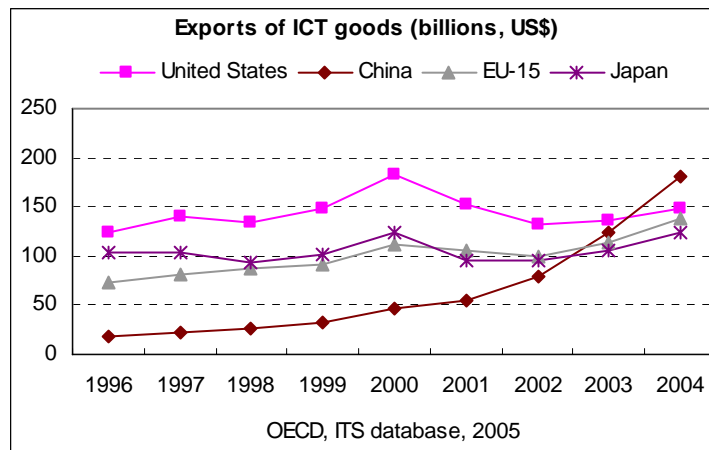


Source: China Statistical Yearbook 1996-2004.

A.4.2. Strong capability in ICT hardware manufacturing and exports

Fueled by its strong manufacturing capacity, China's ICT exports have been very strong (figure 3). As of 2004, China became the biggest exporter of ICT goods (\$180 billion), surpassing Japan and the

Figure 3. China Exports of ICT Goods



European Union in 2003 and taking the lead over the U.S. in 2004 (\$149 billion).¹⁵

B. Weaknesses

¹⁵ OECD: "OECD Finds that China is the Biggest Exporter of Information Technology Goods in 2004", OECD, 2005.

Despite the strengths it possesses and significant achievements it has made over the last quarter of the century in the different pillars of knowledge economy, China still has many weaknesses to overcome, especially in the institutional and governance aspects, and its unfinished agenda remains large.

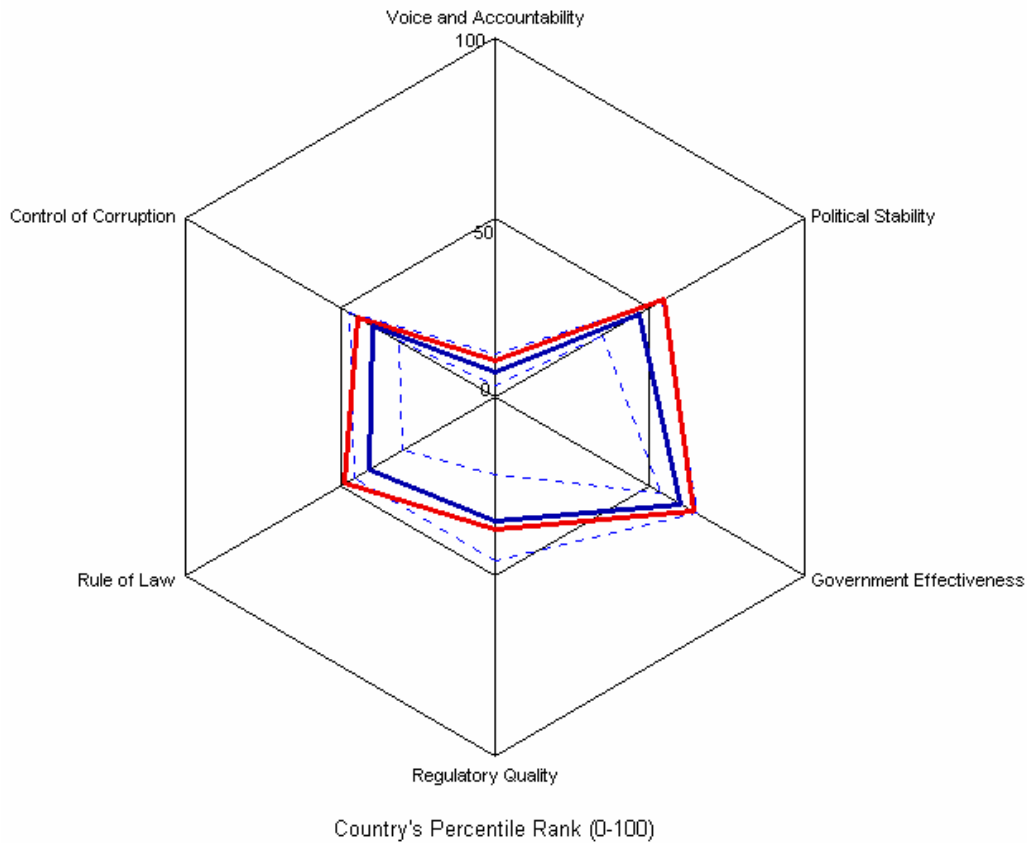
B.1. Incentive and Institutional Regime

B.1.1. Weak institutions, governance and IPR protection

In China, the legislative body has been a relatively weak player in the government function and largely controlled by the party. Beyond the contents of law, the more substantial problem is the enforcement of laws. A relatively complete set of laws and regulations covering economy and IPRs are in place, but enforcement is still inadequate. Weakness here may hold back the degree of innovation and product development of both foreign and local companies. Chinese entrepreneurs feel that expansion across provincial borders is made difficult by the lack of objectivity of local judiciaries when it comes to trying cases involving the infringement of trade secrets, IPRs, and contract enforcement more generally.

Meanwhile, the weak monitoring system and the prevalence of personal relations – “Guanxi” – in governance tend to create some bureaucratic inefficiency and rent-seeking activities. Based on the recent WBI governance indicators, in certain areas, China’s scores are actually retreating (figure 4).

Figure 4. China Governance (2000 vs. 2004)



Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

B.1.2. Weak financial system

A healthy financial system is the key to achieving higher productivity of investment and more balanced growth in China. Though China has conducted major reforms in the banking sector in recent years, some recent evidence shows that the financial sector is still not functioning efficiently. One major weakness is that the financial market does not provide enough investment channels for China's huge savings, and capital has been persistently funneled to loss-making state-owned enterprises, and the incremental capital output ratio is high (table 12). On the other hand, private firms with generally higher marginal productivity of capital have much difficulty getting access to external credits. This reflects a lack of sound credit culture such as market-based lending and risk-based pricing. Most state-owned lending institutions had limited incentives and ability to assess

and enforce rigorous credit standards while state backed borrowers were often able to avoid repaying their debts. Limited financial outlets other than banks have contributed to burdensome debt loads of businesses and make the payments system more vulnerable to credit risk than it would be in a more diversified system.¹⁶

Table 12. Incremental Capital Output Ratio (ICOR) calculations for selected countries

Country	Investment (% of GDP)	GDP growth (average 2001-04)	Incremental Capital Output Ratio
China (2003-05)	43.1%	9.3%	4.6
China (1993-95)	36.1%	12.2%	3.0
Vietnam (2003-05)	34.6%	7.8%	4.4
India (2003-05)	23.7%	7.9%	3.0

Source: World Bank.

B.1.3. Inefficient labor market

The labor market in China has been largely improved with greater mobility, particularly from rural to urban areas and from public to private sectors. But there is still evidence that the restrictions on labor mobility drive a wedge between urban and rural labor markets. By 2005, the number of rural migrants has reached about 150 million, but they still face discrimination linked to the Hukou system, which deprives many of various entitlements, such as housing, access to education, healthcare, and social security. There are also big differences in wage rates, working environment, access to employment services, etc. There is also a serious problem of unemployment, mostly incurred from enterprise restructuring (40 million in 2004).¹⁷ In addition, the career guidance and information services remain poor.

B.1.4. Underperforming state business sector

In the past decade, the state sector has withdrawn significantly from many parts of the economy. The number of state-controlled companies in China fell from over 300,000 in

¹⁶ OECD Economic Surveys: China, OECD, 2005.

¹⁷ China Development Research Foundation and UNDP, "China Human Development Report 2005", UNDP, 2005.

1995 to less than 150,000 in 2005. Increasing competition and ongoing enterprise restructuring efforts have led to a better capital structure and performance. About one-fifth of state industrial companies now have rates of return above 10%. Nonetheless, state enterprises in the industrial sector compare poorly with private companies in terms of productivity, and there remains a large tail of enterprises that continue to waste investment and drain financial resources from the economy. For example, over 35% of state-owned enterprises are not earning a positive rate of return and one in six have negative equity.¹⁸

B.2. Education and Skills

B.2.1. Low overall educational attainment

China has made impressive strides in improving the educational attainment of its population over the last two decades. By 2003, among population aged 6 and above, 51.4% had attained secondary education and 5.5% attained tertiary education.¹⁹ From 1990-2004, the gross enrollment rate for junior secondary level increased from 67-94%; senior secondary from 22-47%; and tertiary increased from 3.4-19% (table 13).

Table 13. Educational Enrollments and Literacy Rate

	1980	1990	2000	2004
Primary (net, %)	93.0	96.3	99.1	98.9
Junior Secondary (Gross, %)	..	66.7	88.6	94.1
Senior Secondary (Gross, %)	..	21.9	38.2	46.5
Tertiary (Gross, %)	..	3.4	12.5	19.0
Adult Literacy Rate (population aged 15 or above, %)	68.1 *	..	84.9 **	89.0 ***

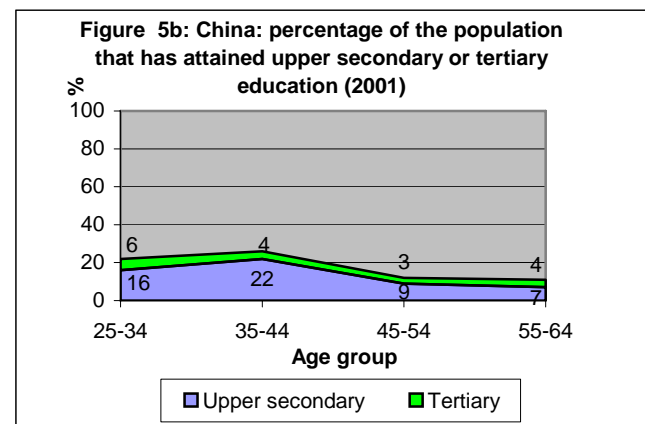
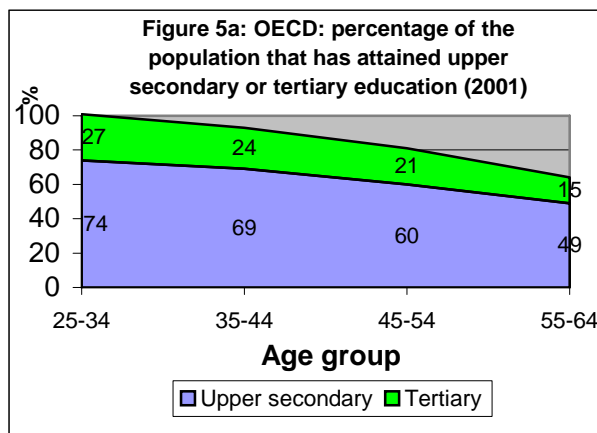
Note: * 1982 figure; ** 1999 figure. *** 2003 figure.

Source: China Education Statistic Yearbook 2000, 2004; and MOE: *China Education & Human Resource Report – Stride from a Country of Tremendous Population to a Country of Profound Human Resources*, Higher Education Press, Beijing, 2003.

¹⁸ OECD Economic Surveys: China, OECD, 2005.

¹⁹ MOE: *China Educational Statistical Yearbook 2005*, People's Education Press, 2005.

However, the overall educational attainment of the population is still low compared to OECD countries. In 2001, the average years of education of the total labor force was 7.99, and only 4.7% of them had education at the college level or above. In OECD countries the corresponding figures were 11.67 and 24%. A comparison of the shares of population that has attained upper secondary or above shows sharp contrast between the OECD average and China (Figure 5a and Figure 5b). In the agriculture and manufacturing sectors, only 0.4% and 6.7%, respectively, of the labor forces got college or above education in 2004.²⁰



- Note: 1. The upper secondary level includes the population that has attained at least upper secondary education.
2. The tertiary level includes three categories of qualifications: tertiary-type A; tertiary-type B and advanced research programs at the doctorate level. Tertiary-type A programs are largely theoretically-based and designed to provide qualifications for entry to advanced research programs and professions with high skill requirements. Tertiary-type B programs are classified at the same level of competencies as tertiary-type A programs but are more occupationally-oriented and lead to direct labor market access.

Source: OECD, *Education at a Glance 2003*.

B.2.2. Low quality of tertiary education with inadequate relevance to market needs

In recent years, China's higher education had experienced rapid expansion with the enrollment ratio increased from 3.4% in 1990 to 19% in 2004, however, it seems focusing more on quantity rather than quality. In many fields, the courses are still too

²⁰ National Bureau of Statistics (NBS) and Ministry of Labor and Social Security (MOLSS) of China, *China Labor Statistical Yearbook*, China Statistics Press, Beijing, 2005.

academic and the skills provided somewhat mismatch with market needs. As a result, from 2002-05, about 30% of its tertiary graduates could not find a job. According to the McKinsey Global Institute, Chinese students focus more on theory and get little practical experience in projects or teamwork, and in the end, fewer than 10% of the college graduates can directly work for a foreign company.²¹

B.2.3. Lack of effective assessment, accreditation, and qualification systems

In China, education quality control is mainly through supervision (on-site visits to primary and secondary schools by education authorities of various levels) and assessments (for tertiary schools, done by MOE). This process rarely involves parents, society, or industries (for upper secondary and tertiary), thus, hard to obtain objective results. So far accreditation is only being piloted at schools that accommodate the children of foreign expatriates residing in China.²² In addition, the lack of an integrated vocational qualification system makes skills assessment, credit transfer, and recognition of informal learning quite difficult.

B.3. Innovation System

B.3.1. Weak indigenous innovation capacity

China still mainly remains as an imitator or adaptor of foreign technologies, with innovation mostly occurring in process rather than in product. This might explain that China's exports of medium and high tech products have been increasing rapidly, but not many of them are actually invented in China. One of the reasons could be the little relevance of China's R&D to industrial needs. For example, in the U.S., out of 100 S&T Ph.D dissertations, at least one can be commercialized as new product, however, in China, this ratio is only 1 out of 500.²³ Meanwhile, the R&D efficiency is low, despite the rapid increase of inputs into the innovation process, the quality and relevancy of the outputs are still low though quantity seems improving significantly (but a large portion of

²¹ Farrell, Diana, and A. J. Grant, "China's Looming Talent Shortage", *McKinsey Quarterly*, No.4, McKinsey Global Institute, October 2005.

²² Dahlman, Carl, Douglas Zhihua Zeng, and Shuilin Wang, "Enhancing China's Competitiveness through Lifelong Learning", World Bank, 2006.

²³ Saxenian, AnnaLee, "The International Mobility of Entrepreneurs and Regional Upgrading in India and China", UNU-WIDER Project on the International Mobility of Talent, Santiago, Chile, May 2005.

it is done by FDI). In addition, the diffusion system is quite weak. The technologies in its elite R&D labs and high-tech parks are not effectively disseminated or commercialized. Although China is the largest recipient of FDIs, the technology transfer from FDI is rather limited.

B.3.2 Low productivity of R&D spending

Beyond the increased expenditures of R&D there also has been an increase in the number of persons doing R&D, and an increase in technical publications and in patents taken out domestically as well as internationally. However, it seems the increased output of technical papers and patents is not in proportion with the increase in inputs, and the output per unit of R&D input compares unfavorably with the relative output in other countries. This implies the need to improve the efficiency of the R&D system. A key element is to set up a sound monitoring and evaluation system for the allocation of public R&D resources.

B.3.3. Poor linkages among government R&D institutes, business and universities

Affected by the former planned economy, China's public R&D institutes, private sector and universities used to operate in their own silos. After a series of reform, the situation has improved, but joint research, vertical and horizontal collaborations such as personnel exchange, technical advising, joint training, etc. are still limited. Although government has launched many programs to strengthen the linkage, due to weak demand from the business sector, lack of market mechanism and mismatch of supply and demand, the effects of these programs are not very significant.

B.3.4. Lack of venture capital

In China, the venture capital (VC) market is only at the initial stage. Government is the dominant source of capital, which compromises the incentive for fund managers to make high-risk investments, particularly in private enterprises. The legal framework for VC is also not in place. For example, company law in China requires a minimum number of shareholders and a level of investment that exceeds the practice in the typical VC firm; similarly, it stipulates that the accumulated amount invested should not exceed 50% of

the company's assets, which again arbitrarily limits the role of venture capitalists.

Another problem is the lack of viable exit options, since access to public capital markets is very limited.²⁴

B.4. Information Infrastructure

B.4.1. Lack of a clear and efficient regulatory framework

In China, many government agencies are involved in the regulatory function, creating competition, confusion and unnecessary complexity. The most obvious area of overlapping responsibilities is the continued existence of both the Ministry of Information Industries (MII), China's telecom regulator, and the State Administration of Radio, Film and Television (SARFT), which regulates the cable TV industry among other industries. Without regulatory convergence of the MII and SARFT, the entry of cable TV operators into telecom remains clouded in uncertainty. In the online gaming industry, many regulatory bodies claim control.

B.4.2. Lack of focus on software outsourcing

The Chinese software outsourcing industry is highly fragmented and lacks large players dedicated to outsourcing. The top ten IT-services companies have only about a 20 percent share of the market, compared with 45 percent commanded by India's top ten. Fragmentation exacerbates the Chinese industry's other problems, including weak process controls and product management.²⁵

B.4.3. Limited application for e-commerce

Although China's Internet users have surpassed 100 million, however, according to a survey by the China Internet Network Information Center (CNNIC), in 2004, only about 7.3% of the internet users saw online shopping as one of their major online activities. The major constraints are issues with logistics (after-sale services), distribution, and payment system (lack of personal credit).

²⁴ Ibid.

²⁵ De Filippo, Giuseppe, Jun Hou, et al., "Can China Compete In IT Services?" The McKinsey Quarterly, No. 1, 2005.

C. Opportunities

With the success of economic development, China has the great opportunity to fully leverage its strengths to significantly enhance its overall competitiveness and rank itself into one of the major global players. This will require further reforms and major improvements in its weak areas.

C.1. Strengthen the institutional regime and improve governance

- Strengthen the rule of law and IPR protection

In order to enhance the legal enforcement, China needs to give more independence and authority to the judicial system, and minimize the intervention from the administration and party committee. This is especially necessary at sub-national levels, where the role of courts is much weaker. One option could be transferring some of the financing of courts to the central government to reduce their reliance to local governments. Another would be increasing the extent of specialization of the courts (notably in the area of bankruptcy and intellectual property).

- Establish a monitoring system to enhance government accountability and transparency

Such a system should involve the public media, civil society and NGOs. In addition, the monitoring and representative role of the People's Congress should be greatly strengthened so that it has some checking power over the administration to reduce the bureaucracy and rent-seeking.

- Strengthen the financial sector

Although major progresses have been made in improving the financial market, re-organization of the remainder of the banking system is still needed and would be better accompanied by a growing marketization of the banking sector. Almost 30% of the banking sector remains to be recapitalized. Broadening financial markets is a further crucial aspect of improving the allocation of capital. The equity market could be further developed, as the market value of freely tradable shares represented just 9% of GDP in 2004.

- Improve labor market flexibility

To encourage free flow of labor and better allocation of human capital and reduce income gap, further relaxation of labor market is needed. The combination of migration restrictions (Hukou) and land tenure restrictions appears to contribute significantly to rural urban differential and income inequality. Easing of these two policies might lead to 2% rise of output and significant drop of income inequality.²⁶

- Further restructure the state enterprises

Reforms of SOEs have improved their performance but there remains significant scope for further improvement. In addition to corporate governance reform, for loss-making enterprises, the government has announced a four-year program that will involve substantial additional restructuring. In some cases, asset sales may be possible. To ensure fair transactions, greater use could be made of the new property exchanges to ensure competitive prices. The government could also consider further sales of packages of distressed assets to companies with experience of restructuring.

- Further encourage the private sector development

The growing importance of the private sector in economy makes it all the more important to create a more conducive environment for the private sector development. The foremost thing is to improve the legal framework, such as the bankruptcy law and company law. A reduction in the barriers to the formation of both limited and joint stock companies should be a priority. Greater access to finance (such as loans and equity markets) and technologies should be allowed, especially for SMEs.

C.2. Unleash the human potential

- Strengthen compulsory education

China has made great progress in universalizing basic education; however, in the Middle and West regions, especially in rural areas, full access to compulsory education is far from being realized. Many local governments are suffering from a shortage of funding. To solve this problem, the Chinese government needs to increase the funding allocation and, meanwhile, improve the transparency and accountability

²⁶ OECD Economic Surveys: China, OECD, 2005.

in the use of educational funding. In addition, the compulsory education needs to extend from current 9 years to 12 years.

- Enhance the quality of tertiary education

Given the importance of tertiary education in providing a solid human capital base which is the key for long-term competitiveness, China needs to significantly improve the quality of its tertiary education. Key steps need to be taken to reform the curricula, pedagogy, and governance to make tertiary education more responsive to market needs. More emphases need to be put on fostering students' creative and innovative thinking, problem-solving skills, teamwork and communication abilities.

- Develop an effective lifelong learning system tapping the potential of private provision and distant education

Currently China's education and training system is quite fragmented and segregated. The linkage between formal and informal education is weak. While a lifelong learning encourage multiple providers and multiple pathways, it also requires better coordination among governments and between government and various stakeholders; better assessments, accreditation, certification and vocational qualification systems; and better information services.²⁷ In addition, China needs to fully tap into the potentials of private provision and distance education to expand the access to and enhance the quality of education and training.

C.3. Boost innovation capacity

To transform itself from a "manufacturing superpower" to an "innovation superpower", China needs to greatly boost its innovation capacity.

- Improve efficiency and quality of domestic R&D

In line with the funding increase in R&D, efforts need to be put on strengthening the market-orientation of public research institutes and universities. More joint research and collaboration, and even personnel exchange between research organizations and business sector should be encouraged. In addition, more cooperation with foreign R&D institutes and firms, including FDIs could be promoted. Meanwhile, policy

²⁷ Dahlman, Carl, Douglas Zhihua Zeng, and Shuilin Wang, "Enhancing China's Competitiveness through Lifelong Learning", World Bank, 2006.

incentives need to be designed or sharpened to encourage domestic private sector to do more R&D and innovation.

- Strengthen technology diffusion

To effectively disseminate the R&D results from elite labs/universities or technology parks to the production sector, China needs to put massive efforts to promote or strengthen:

- Technology and business incubators and regional clusters;
- Engineering research and productivity centers;
- Agricultural and industrial extension services at various levels or regions;
- Technical norms and standards.

- Strengthen financial support for innovation

In addition to further increase of R&D funding, China needs to leverage various financial instruments to encourage technology new ventures. This requires a sound venture capital market. To promote the VC business, China needs to improve the legal framework by removing many restrictions and limits on VC firm, and allowing more exit options, such as access to the stock market. More training needed to be provided to fund managers and more transparency, objective performance measures, and external oversight need to be brought in the government-run VC firms. A more favorable environment needs to be created to attract foreign VC investors. Except for VC, other financial tools such as grant, matching funds, angel capital, government purchasing, tax incentives, etc. should also be tapped.

C4. Further harness ICT for economic and social development

- Improve the regulatory regime

To better facilitate the rapidly developing ICT market, China needs to streamline the competing regulatory bodies, and increase the transparency in the decision-making process and clarity of agencies' responsibilities. The Ministry of Information Industries (MII) could possibly be rolled up into a State Communication Commission along the lines of the U.S. Federal Communications Commission (FCC). This could ultimately help to achieve convergence over the telecom and cable industries.

- Expand access for rural and local communities

Although the ICT penetration in China is improving very rapidly, it is still far from reaching the vast rural areas, especially in the poor regions. China can set up Universal Service Obligation (USO) funds, raised through tax on telecom companies' gross revenues, which is then redirected for wiring up rural areas, to help establish community tele-centers or IT centers for rural and poor regions. A USO fund could be adopted with competitive bidding among operators for contracts.

- Promote greater use of ICTs

Given China's vast population and territory, ICT will have a strategic role to play for its development. ICTs can be used more extensively to enhance the transparency and efficiency of government services at various levels and to encourage broad participation of citizens. They can be also used to expand and improve the education and public health services. As more people go online, the e-commerce will become more popular, but China needs to improve its credit system and logistic services to promote its further development.

D. Challenges/Threats

Despite the enormous progress China has made, and promising opportunities it can leverage, China still faces many challenges and threats at both global and domestic dimensions, which need to be taken into serious consideration for its long term development strategy.

D.1. Increasingly competitive and complicated global environment

With the knowledge revolution, the global competitiveness mainly hinges on a country's ability to create, disseminate and use of knowledge and technology. China is very successful in processing technology, but lacks strong indigenous innovation capacity where even India appears stronger. In order to fundamentally enhance China's global competitiveness, China needs major breakthroughs in this area.

Meanwhile, as China rises and increasingly becomes an important global player, the existing world economic and political structures are poised to change accordingly.

This will inevitably bring more challenges to China in the areas of trade, exchange rate, diplomacy, technology development, and energy, etc.

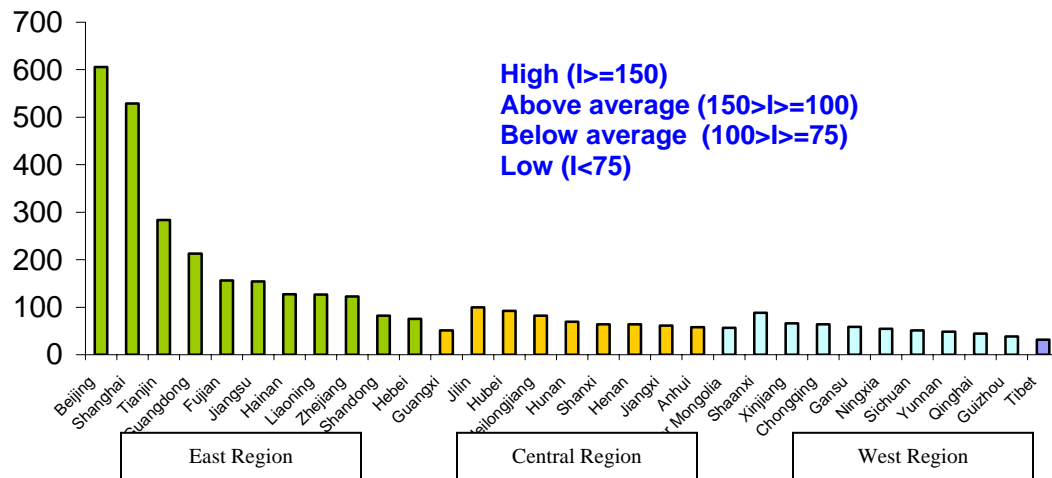
D.2. Risk of increasing regional and rural-urban development gaps

The widening regional and rural-urban divide is the predominant danger for China, and is manifested in many areas, such as knowledge, income, access to education and health and ICTs, etc.

Knowledge divide

China's knowledge divide across regions, especially between the East and the rest of the country is huge, and there is a tendency of widening. A provincial knowledge index comparison based on education, innovation, and ICT pillars reveals astounding results. The index varies from around 40 in the West region to around 200 in the East region where Beijing and Shanghai are above 500 (figure 6).

Figure 6. Knowledge Index by Provinces, 2000

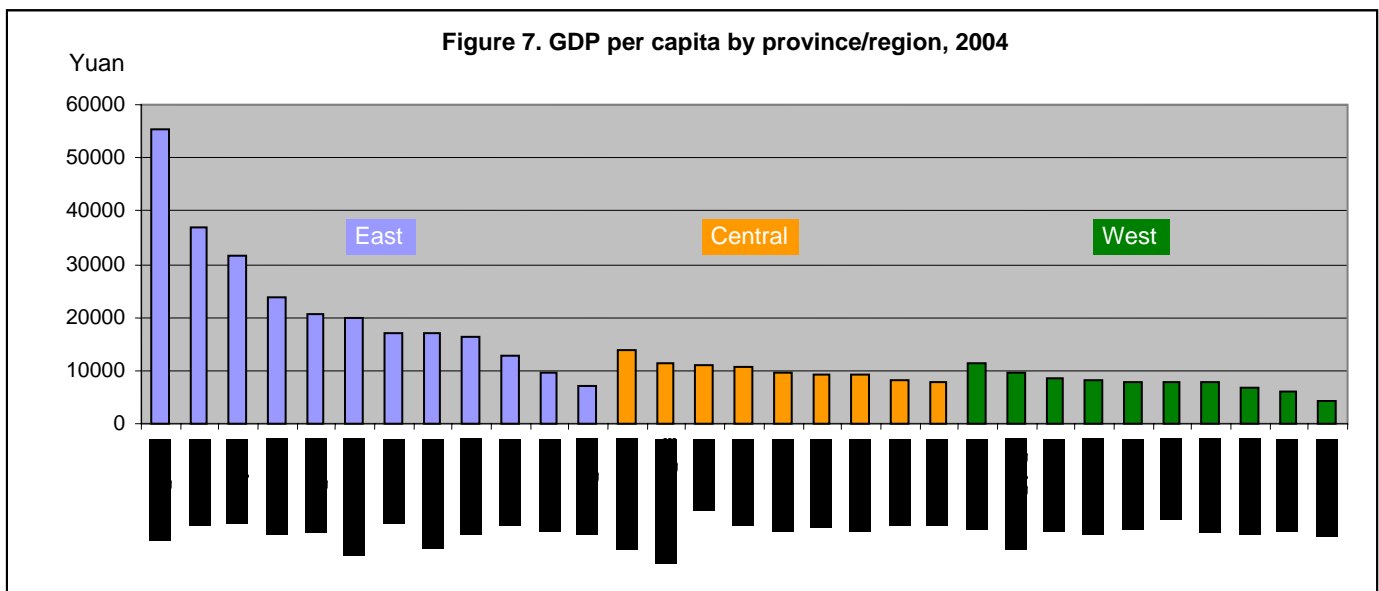


Source: Based on A. Hu and Y. Xiong (2000).

Income disparity

China has achieved unrivaled rapid economic growth, but at the same time, the inequality has also increased quite remarkably. China's income disparity has been worsening. World Bank estimates that China's national Gini coefficient for income distribution rose from 0.30 in 1982 to 0.45 in 2002 if living costs are not adjusted.

According to UNDP, of the 131 countries for which data are available, China ranks 90th in terms of the Gini coefficient for income distribution. Only 31 countries manifest higher income inequality than China.²⁸ GDP per capita ranged from CNY4,215 in Guizhou to CNY55,307 in Shanghai (over 13 times of Guizhou) in 2004, while the national average was CNY10,561 (figure 7). Meanwhile, the rural-urban income gap is also widening. In 2005, per capital disposable income reached \$1,310 in urban areas, while that of rural area was just \$405. Income disparity in 1984 was about 2:1, and now it is 3:1. According to a 2002 survey, urban and rural residents accounted for 93% and 7% respectively of the highest decile nationwide and 1.3% and 98.7% respectively of the lowest decile. This is an exceptionally sharp contrast.²⁹ In 2005, the poorest 10% of the population hold only 1% of the nation's wealth, and the richest 10% claims 50% of the total wealth.³⁰ And the current social security system barely covers the rural areas.³¹ This rise in inequality is of increasing concern to the Chinese authorities which see it as a threat for the harmony of the whole society and sustainability of long-term growth.



Source: Staff analysis based on data from China Statistic Yearbook 2005.

²⁸ China Development Research Foundation and UNDP, “China Human Development Report 2005”, UNDP, 2005.

²⁹ Ibid.

³⁰ Baker, Rodger, “China: Riding the Rural Tiger”, Strategic Forecasting, Inc., March 8, 2006.

³¹ Zeng, Douglas Zhihua, “China’s Employment Challenges and Strategies after the WTO Accession”, policy research working paper 3522, the World Bank, 2005.

Education inequality

In line with the income disparity, the education inequality is almost at the same magnitude. The adult illiteracy rate ranges from below 10% for most of the East region to above 20% in many West provinces. The level of education attained by the labor force also varies widely across regions (table 14). The education spending per student is also very unequal from province to province. For example, the per student spending in primary schools across provinces ranged from almost RMB 5,429 yuan in Shanghai to just RMB 520 yuan in Henan Province in 2003.³²

Table 14. Education level of the labor force by region (% , 2004)

Regions	Illiterate	Primary	Junior Secondary	Senior Secondary	College or above
East	4.1	20.8	45.6	18.0	11.6
Middle	4.5	25.7	49.3	13.9	6.6
West	14.2	35.7	33.2	10.2	6.7
<i>National average</i>	<i>6.2</i>	<i>27.4</i>	<i>45.8</i>	<i>13.4</i>	<i>7.2</i>

Source: Author's calculations based on the data from *China Labor Statistical Yearbook 2005*, National Bureau of Statistics and Ministry of Labor and Social Security of China, China Statistics Press, 2003.

The rural-urban gap is even worse. According to the fifth census, rural laborers in 2002 had 7.3 years of schooling on average, 2.9 years fewer than urban laborers. In the rural areas, only 8.5% were educated beyond high school, 35 percentage points lower than in the urban areas. Rural areas have also been slow to achieve the 9-year compulsory education: by 2002, 15% of counties had failed to reach this national goal. This affected 108 million people in poor and remote rural areas, roughly 9% of total population.³³

Discrepancies in health and medical care

³² Dahlman, Carl, Douglas Zhihua Zeng, and Shuilin Wang, "Enhancing China's Competitiveness through Lifelong Learning", World Bank, 2006.

³³ Basic Education Department of the MOE.

Significant gaps also remain in the health of urban and rural residents and among residents across regions. Child and maternal mortality are almost twice as high in rural areas (61.9 per 100,000 births) as in cities (33.1 per 100,000 births) in 2001. All indicators point to distinct gaps in nutrition between urban and rural children. Over 80% of urban households can get to the nearest medical institution within 10 minutes, while in rural areas, only 66.9% can. Regions also differ in the number of available medical personnel, with the Western region faring the worst. Health resources and services delivery are concentrated in large and medium-size cities, with 67.7% of government funding going to hospitals in these cities in 2002. In many rural areas, public health services are near collapse.³⁴

Digital divide

China's overall ICT penetration is growing very rapidly, but the rural-urban and regional gaps are still large. While the prosperous East coast and second-tier inland cities boast telephone penetration rates of 40-70% - well above the national average of 20% - some 15% of administrative villages, home to at least 124 million people, do not even have access to a public phone. The number of Internet surfers in Guangdong, Beijing and Shanghai accounted for 10.4 percent, 9.8 percent and 9.2 percent respectively of the country's total, whereas that of Tibet, Qinghai and Ningxia in west China was only 0.1 percent, 0.2 percent and 0.3 percent in 2002. In terms of Web domains, only a small slice - 7.4 percent - of the country's 940,329 domain names were grabbed by western regions, while eastern areas had a sizable 67.24 percent of the total in 2003.³⁵

The large and still widening regional and rural-urban gaps are becoming a major concern for China's social stability and long-term development. The economic and social inequalities, exacerbated by the massive unemployment, have caused increasing

³⁴ China Development Research Foundation and UNDP, "China Human Development Report 2005", UNDP, 2005.

³⁵ People's Daily, July 17, 2003.

number of social unrest. The Ministry of Public Security reported 87,000 cases of public disturbances in 2005, up from 74,000 in 2004 and 58,000 in 2003.³⁶

D.3. Imbalance between growth and the environment

China has made serious efforts to improve the environmental protection for at least a decade, with some success – including air quality improvement in major cities and reforestation to prevent flooding and desertification. But the environmental degradation is still a serious concern. The major environmental issues include: water stress and pollution; air pollution and acid rain; congestion; land degradation and desertification.

In China, almost 70% of its energy comes from coal, and much of it is burned for home heating and small industrial boilers. This has caused continuously high sulphur content in air. Nitrogen dioxide is another source of air pollution as the stock of private cars is increasing rapidly. Both levels of sulfur dioxide and nitrogen dioxide in many Chinese cities show a downward trend between the 1980s and the 1990s, but since 2003, concentrations of both have increased. Pollution in the expanding towns and townships is a major challenge because their environmental management is not well monitored and their development plans contain only limited provisions to address it. Many Chinese cities still rank among the most polluted in the world.

Water pollution is also very serious. According to an OECD study, almost one-third of major water basins are classified as highly polluted and 75% of the water flowing in urban areas is unsuitable for drinking or fishing.³⁷ In addition to the quality issue, the shortage of water has also become a problem, particularly in North and East China, which account for one-third of national GDP, but has only 7.7% of the national water resources. The situation is likely to deteriorate over the next decade, especially in the rivers north of the Yangtze.³⁸ In addition, there are also the problems of land degradation and declining forestry cover, etc. To solve these problems, there is a need for both technical progress and improvements in institutional, administrative and regulatory arrangements.

³⁶ Baker, Rodger, “China: Riding the Rural Tiger”, Strategic Forecasting, Inc., March 8, 2006.

³⁷ OECD Economic Surveys: China, OECD, 2005.

³⁸ World Bank, EAP Environment Department, 2006.

D.4. Increasing energy constraint

Rapid economic expansion has turned China into a major energy consuming country. Currently, at the aggregate level China consumes about over 10% of the world energy, ranked as the second largest energy consumer in the world following the U.S. Its overall consumption was roughly in line with its domestic production until 1991. But now, China's domestic energy supply can only meet 90% of its total demand. While before 2003, China's energy consumption increase was accompanied with improvement of energy efficiency, it is no longer the case in recent years – energy efficiency has declined, with a particularly large drop occurring in 2004. Oil demand was particularly strong in that year, increasing by 15%, with China accounting for 30% of the increase in world oil demand in 2004. A number of factors were behind this surge in demand. Increasing use of cars and the demand for oil to fuel electricity generators were the major drivers. This situation pushed energy security to the top of China's economic and foreign policy agenda. While the economy continues to boom, China will face an even bigger energy constraint, and will be inevitably put into competing position with other world powers, thus a more complicated and difficult international environment. There is room for China to do more to convince the world for its “peaceful rise” and improve its energy efficiency, but it is also important for other powers to correctly understand China's intention for energy security, and to help it meet its energy demands.³⁹

³⁹ Oxford Analytica, *China: A Five-Year Outlook*, Oxford Analytica Ltd., 2005.

E. Overview of China's SWOT Analysis:

Table 15 summarizes the SWOT analysis of China in the perspective of knowledge economy.

Table 15. A Summary for China's SWOT Analysis

	Strength	Weakness	Opportunity	Challenge/Threat (cross-sectoral)
Economic Inventive and Institutional Regime	<ul style="list-style-type: none"> - An effective leadership with strong vision and pragmatism - Open-door policy - Strong FDI presence - High saving and investment rates - An emerging private sector 	<ul style="list-style-type: none"> - Weak institutions, governance and IPR protection - Weak financial system - Inefficient labor market - Underperforming state business sector 	<ul style="list-style-type: none"> - Strengthen the institutional regime and improve governance <ul style="list-style-type: none"> -- Strengthen the rule of law and IPR protection -- Establish a monitoring system to enhance government accountability and transparency -- Strengthen the financial sector -- Improve labor market flexibility -- Further restructure the state enterprises -- Further encourage the private sector development 	<ul style="list-style-type: none"> - Increasingly competitive and complicated global environment - Risk of increasing regional and rural-urban development gaps <ul style="list-style-type: none"> -- <i>Knowledge divide</i> -- <i>Income disparity</i> -- <i>Education inequality</i> -- <i>Discrepancies in health and medical care</i> -- <i>Digital divide</i> - Imbalance between growth and the environment - Increasing energy constraint
Education and Skills	<ul style="list-style-type: none"> - A relatively skillful human capital base - Rapidly emerging private higher education 	<ul style="list-style-type: none"> - Low overall educational attainment - Low quality of higher education with inadequate relevancy to market needs 	<ul style="list-style-type: none"> - Unleash the human potential <ul style="list-style-type: none"> -- Strengthen the compulsory education -- Enhance the quality of tertiary education -- Develop an effective lifelong learning system tapping potential of private provision and distant education 	<ul style="list-style-type: none"> - Imbalance between growth and the environment - Increasing energy constraint
Innovation System	<ul style="list-style-type: none"> - Rapid increase of R&D investment - Critical mass of scientists and engineers in R&D 	<ul style="list-style-type: none"> - Weak indigenous innovation capacity - Low productivity of R&D spending - Poor linkages among 	<ul style="list-style-type: none"> - Boost innovation capacity <ul style="list-style-type: none"> -- Improve efficiency and quality of domestic R&D -- Strengthen technology diffusion 	

	<ul style="list-style-type: none"> - Strong business participation in R&D - Rapid increase of S&T capacity - Well-established state key labs and techno parks 	<ul style="list-style-type: none"> government R&D institutes, business and universities - Lack of venture capital 	<ul style="list-style-type: none"> -- Strengthen financial support for innovation 	
Information Infrastructure	<ul style="list-style-type: none"> - Rapid improvement of ICT access - Strong capability in ICT hardware manufacturing and exports 	<ul style="list-style-type: none"> - Lack of a clear and efficient regulatory framework - Lack of focus on software outsourcing - Limited application for e-commerce 	<ul style="list-style-type: none"> - Further harness ICT for economic and social development -- Improve the regulatory regime -- Expand access for rural and local communities -- Promote greater use of ICTs 	

Source: Douglas Z. Zeng's compilation, 2006.

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