

### **A NOTE TO THE READER**

This booklet contains an overview of *China and the Knowledge Economy: Seizing the 21st Century*. The full-length study has been published by the World Bank. To order copies, please use the form provided at the back of this booklet.

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**WBI DEVELOPMENT STUDIES**

# **China and the Knowledge Economy**

Seizing the 21st Century

## **OVERVIEW**

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Washington, D.C.

## Currency Equivalents

(As of June 4, 2001)

Currency Unit = RMB

\$1.00 = RMB 8.2770

RMB 1.00 = \$0.1208

## Abbreviations

<b>FDI</b>	Foreign direct investment
<b>GDP</b>	Gross Domestic Product
<b>IT</b>	Information technology
<b>R&amp;D</b>	Research and development
<b>WTO</b>	World Trade Organization

## Overview

For a large part of the last two millennia, China was the world's largest and most advanced economy. Then it missed the Industrial Revolution and stagnated. Only after opening to the outside world in 1979 was China's economic performance again impressive (figures 1 and 2): its achievements in increasing welfare and reducing poverty are unparalleled. But China cannot sustain such progress without major changes in its development strategy, as elaborated recently in the tenth five-year plan.

China faces daunting internal challenges compounded by the knowledge and information revolution. To overcome these challenges the Chinese government must take on a new role to quickly exploit the knowledge revolution—architect of appropriate institutions and provider of incentives to promote and regulate a new socialist market economy based on knowledge.

China's strategy will have to build solid foundations for a knowledge-based economy by:

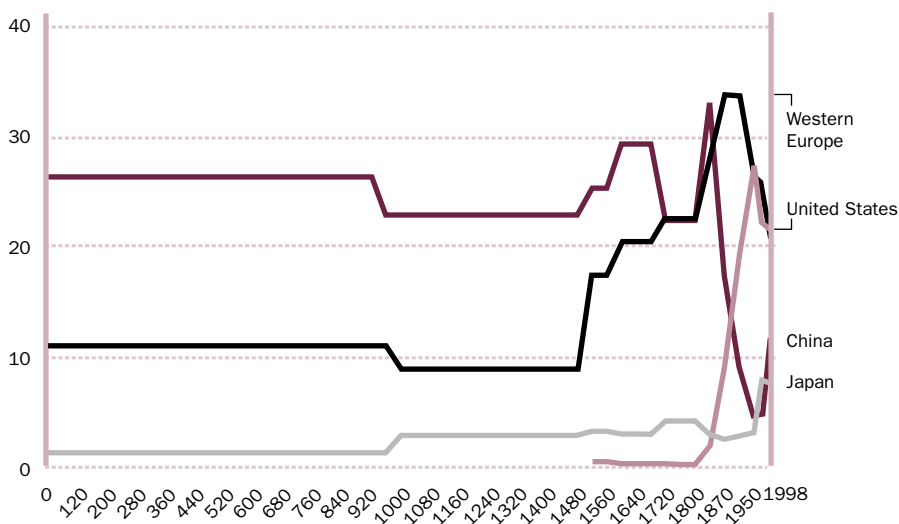
- Updating the economic and institutional regime.
- Upgrading education and learning.

**China faces  
daunting internal  
challenges  
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revolution**

FIGURE 1

### China leading, stagnating, recovering

Share of world GDP in PPP by selected country or region, year 0–1998

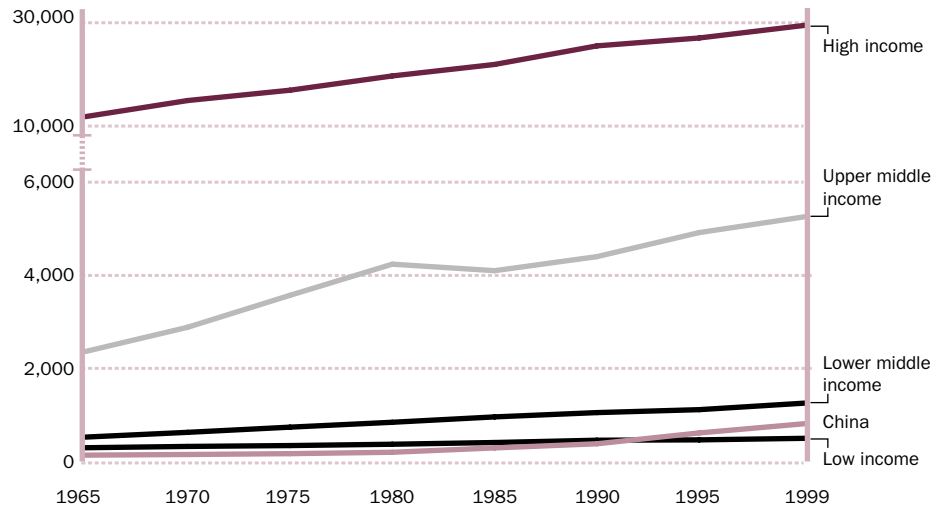


Source: Angus Maddison, *The World Economy: A Millennial Perspective*, OECD: Paris, 2001.

**In this decade China  
needs to provide  
between 90 to 300  
million new jobs  
depending on  
different estimates**

**FIGURE 2  
China's GDP per capita: moving to convergence**

GDP per capita (1995 constant US\$, 1965–99)



Source: World Bank staff analysis.

- Building information infrastructure.  
China must also raise the technological level of the economy by:
- Diffusing new technologies actively throughout the economy.
- Improving the research and development system.
- Exploiting global knowledge.

**FACING DAUNTING INTERNAL CHALLENGES**

China faces two dramatic economic transitions: from an agricultural to an industrial and service economy—and from a command to a socialist market economy. In addition, it faces other challenges due to its large size and present growth trajectory.

*PROVIDING EMPLOYMENT*

In this decade, conservative estimates place necessary job creation within China at 90 to 100 million to take in the projected 40 to 50 million people released from agriculture, those from state-owned enterprises and town and village enterprises, as well as the new entrants to the labor force. However, other estimates have placed required job creation much higher—anywhere from 200 to 300 million. Already, effective unemployment is about 10%, and regardless of which figures are accepted, the creation of job opportunities is on the top of policymakers' list of priorities.

Most jobs created have come from low-skill industries. China's share in services is smaller than would be expected for a country at its stage of development due to past policy biases toward industry and against the service sector (figure 3).

Most new jobs will be in informal service employment, basic infrastructure services (construction, transport, telecommunications), retailing, tourism, and commerce. But many should also be in small, private high-value business services—such as marketing, logistics, distribution, finance, consulting, and management. And many should be in other professional services historically underdeveloped in China but critical in knowledge-based economies.

#### *MAINTAINING GROWTH AND INTERNATIONAL COMPETITIVENESS*

China's fast growth has been possible thanks to shifts of workers and resources from low productivity agriculture to industry—and to very high rates of both domestic and foreign investment. But maintaining economic growth will be difficult with the drag of large, inefficient state-owned enterprises and a financial sector burdened with nonperforming loans.

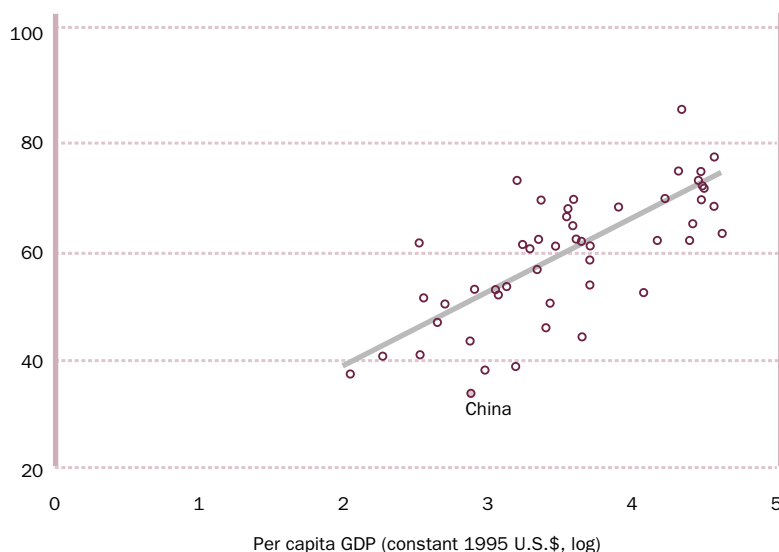
Furthermore, according to some rankings China's international competitiveness is declining, so it needs to improve its productivity. Average worker productivity in agriculture is a mere 0.8% that in the United States; and in manufacturing, 3.6%. Ironically, as China boosts productivity it will need less labor,

**China's international competitiveness is declining, so it needs to improve its productivity**

FIGURE 3

#### **Policy biases have constrained growth in services**

Services as a percentage of GDP, 1999<sup>a</sup>



a. For some countries, data are from 1998 or 1997. Note: On the X-axis, 1 roughly corresponds to \$1, 2 to \$100, 3 to \$1,000, and 4 to \$10,000.

Source: World Bank staff analysis.

exacerbating unemployment, unless there is increased demand for Chinese goods and services. A critical element of China's new strategy will be to diversify its goods and services by taking advantage of new knowledge.

#### *REDUCING INCOME AND REGIONAL INEQUALITIES*

**China must shift away from natural resource-intensive development and move efficiently into services and knowledge-based development**

China's fast growth has been concentrated in the coastal regions, those most open to international trade and receiving the most foreign direct investment. GDP growth rates in the central and western provinces have been significantly slower. Inequalities are also growing. Some people have access to capital, education, and other assets—and connections to use them to exploit business opportunities. Others still rely primarily on their own labor in subsistence agriculture or in low-productivity enterprise.

China's diversity is exceptional. It is a very large country with considerable disparities among regions, cities, and industries. The third world coexists with the first world in China's advanced regions. In the vibrant cities of the east extremely dynamic enterprises and universities operate in high tech parks benefiting from brand new infrastructure. In nearby cities, and of course in distant western provinces, poverty is broadly spread, not only in terms of income but also in knowledge, education, and information infrastructure. Any knowledge strategy will have to take full account of such diversity.

#### *SUSTAINING THE ENVIRONMENT*

Degraded water quality has damaged agriculture, ecosystems, and fisheries—with industrial and indoor air pollution becoming serious threats to the economy and the people. More than 2 million deaths occur each year from air and water pollution, the result of rapid industrialization and urbanization. The depletion of China's already scant supply of forests, water stocks, and other natural resources is adding to the significant constraints on the enormous population. China must shift away from natural resource-intensive development and move efficiently into services and knowledge-based development.

#### *CONFRONTING THE GLOBAL KNOWLEDGE REVOLUTION*

Adding to the challenge of China's development is the "revolution" in the production and dissemination of knowledge. Effective use of policy and technical knowledge has always determined the process of economic development, explaining in large part the differences in countries' levels of development. Today, that knowledge is even more important:

- Advances in scientific and technical knowledge make possible the information communication technology revolution, the engineering of materials at the molecular level, and even the development of life forms through biotechnology.
- Rapid reduction in the costs of transportation and telecommunications spur the integration of previously disparate economies through trade and other international exchanges.
- Digitization and informatization of numerous activities reduce transaction costs and increase productivity.

These trends herald a new era characterized by:

- Development of a service-based economy, with activities demanding intellectual content becoming more pervasive and decisive.
- Increased emphasis on higher education and life-long learning to make effective use of the rapidly expanding knowledge base.
- Massive investments in research and development, training, education, software, branding, marketing, logistics, and similar services.
- Intensification of competition between enterprises and nations based on new product design, marketing methods, and organizational forms.
- Continual restructuring of economies to cope with constant change.

Knowledge and information are thus becoming the key drivers of international competitiveness and the global economy, making it crucial to respond rapidly and efficiently to changes. Partly as a result of a high growth rate, but also because of the knowledge revolution, China faces a period of wrenching and continual restructuring affecting all sectors, as noted in the tenth five-year plan.

To compete and prosper in this new environment, China has to open more and harness the forces shaping the global economy, leapfrogging to take advantage of rapidly evolving technologies. It must welcome the knowledge revolution, which, though it presents considerable challenges, also grants significant opportunities to make China's development sustainable by:

- Improving competitiveness of existing agriculture, industry, and services—and saving jobs.
- Developing new activities, services in particular, to create new jobs and new sources of wealth.
- Facilitating the transition to a more sustainable and environmentally friendly economy that makes more effective use of China's relatively limited natural resources.

#### **ADAPTING CHINA'S DEVELOPMENT STRATEGY**

China has already taken a number of measures to cope with these challenges and exploit these opportunities. Science, technology and education were put

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**China's tenth five-year plan clearly focuses on economic development and restructuring largely moving out of agriculture, upgrading industry, and moving into services**

at the forefront of development policy in the mid-1990s. Investments in information infrastructure have been considerable, and a reform process is actively pursued in a myriad of fields to adapt the economy and society and prepare them to enter the World Trade Organization (WTO).

China's tenth five-year plan clearly focuses on economic development and restructuring largely moving out of agriculture, upgrading industry, and moving into services. It emphasizes dealing with inequality and regional imbalances, sustainability, social security, and continuing market reform. Science, technology, and education are again given a prominent role for driving the change. The plan spells out China's goals, but does not detail a path to achieve them. This report, based on a World Bank methodology for analyzing the knowledge economy (box 1), offers specific policy recommendations in the context of the broader ideological and political shifts needed to address the growing social, political, and economic pressures of the 21st century.

The policy recommendations are primarily addressed to the central government, but some concern provincial and local governments, which play a

**BOX 1**

**Key elements of a knowledge-based economy**

All economies are knowledge-based. What is different today, however, is that rapidly growing economies depend more on the creation, acquisition, distribution, and use of knowledge. The effective use of knowledge is becoming the most important factor for international competitiveness—and for creating wealth and improving social welfare.

This does not mean that China must simply develop high technology. It means that China must encourage its organizations and people to acquire, create, disseminate, and use knowledge more effectively for greater economic and social development.

The four pillars of a knowledge-based economy are:

- An economic and institutional regime that provides incentives for the efficient use of existing knowledge, the creation of new knowledge, and entrepreneurship.
- An educated and skilled populace that can create and use knowledge.
- A dynamic information infrastructure that can facilitate the effective communication, dissemination, and processing of information.
- An effective innovation system comprising a network of firms, research centers, universities, think tanks, consultants, and other organizations that can tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new knowledge or technologies.

Economic institutions allow organizations, people, and other institutions to adjust to changing opportunities and demands in flexible and innovative ways. In a sense, they are the fundamental pillar of the knowledge-based economy, since only strong economic incentives and institutions can deploy these resources to productive uses, taking advantage of a strong educational base and a highly developed R&D infrastructure. It's also essential to be strong in education, information infrastructure, and the innovation system. All four pillars are essential in a knowledge-based economy.

significant role through control of some 70% of the national budget and through influence on local enterprises, judiciary systems, schools, and other aspects of Chinese society.

### UPDATING ECONOMIC INCENTIVES AND INSTITUTIONS

The main change will be the new role for the state. The government must move farther from controller and producer to becoming the architect of a new socialist market and knowledge-based system, a system that is more self-regulating through appropriate market-supporting institutions. The government has already been engaged in a vast array of bold structural reforms to adapt the Chinese economy. Market-supporting institutions need to be actively built in six areas that support and shape a vibrant knowledge-based economy.

- *Strengthening the legal and regulatory framework for supporting entrepreneurial capabilities.* To tap the creative and entrepreneurial capability of people, it is important to establish a clear rule of law and clear property rights that allow people to enter contracts and expect that they will be honored. This requires not just transparent and stable rules but also their fair enforcement, with no exceptions or special privileges. This also means reducing all forms of bureaucracy that impede innovation. Much further progress is needed on all these issues.

- *Promoting economic competition.* Providing stronger pressure to make effective use of knowledge for development involves reducing barriers to foreign trade, which China is addressing by joining the WTO. But it is also necessary to reduce the internal barriers to the free flow of goods and services across Chinese provinces—and establish effective competition-promoting agencies to address domestic and foreign competition.

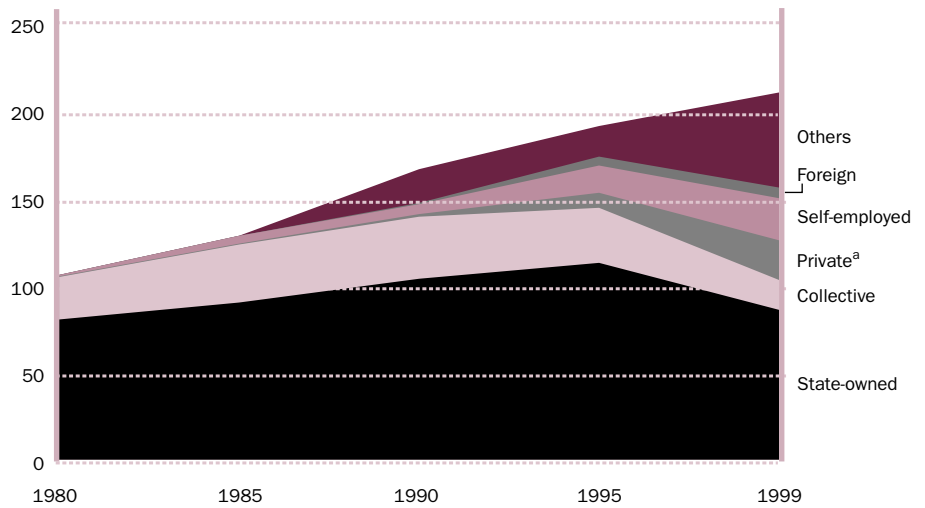
- *Strengthening the financial system.* Finance—and the key institutions and rules that regulate it—are the brains of a market and knowledge-based economy, because they process information to allocate capital to its most efficient use. What does this require? Improving the risk assessment and supervision capability of banks. Developing an effective stock market with appropriate disclosure rules and safeguards against insider trading and effective governance of traded firms and financial intermediaries. Encouraging the venture capital market—to finance entrepreneurs with new ideas. And putting in place appropriate bankruptcy legislation to redeploy the productive assets of failed enterprises to new economic uses.

- *Facilitating labor market flexibility.* The rapid transition from an agricultural to an industrial economy and now to a service economy—compounded by China's eventual full accession the WTO—creates a massive need for mobile labor. But its labor market is severely constrained by rules restricting

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**Improving education  
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**FIGURE 4**  
**The growing importance of the private and self-employed sectors**  
Structure of urban employment, by type of ownership, 1980–99 (millions of workers)



a. Under this heading are companies classified as private enterprises, plus those classified as joint-owned units, limited share holding corporations, limited liability corporations, and shareholding corporations. The last two categories appear only from 1998 on.  
Source: World Bank staff analysis.

mobility—and by the old system that tied the health and housing benefits to enterprises.

- *Developing an effective social security system.* Reforms in the unemployment insurance and pensions systems are critical to ensure that labor is redeployed to more productive activities. It will be necessary to facilitate productive employment of the millions of workers not yet part of the formal employment system, particularly the large floating population in urban areas and the millions of underemployed in agriculture.
- *Promoting the growth of small and medium-size enterprises.* A key element of the employment promotion strategy should be promoting small and medium-size industries (figure 4). Proactive measures will create a more even playing field by reducing the biases toward large state-owned industries and encouraging development of small and medium-size industries across all economic sectors. These measures include reducing the regulatory hurdles to establishing new enterprises and providing them access to finance, technical and marketing information, and business skills.

**UPGRADING EDUCATION AND LEARNING**

Higher education and greater skills are fundamental in a knowledge economy. But despite tremendous improvements, the average educational attainment in China is still low (figure 5). Improving education is perhaps the most critical reform

for the medium and long runs. China is endowed with a gigantic and growing population, the raw material for a knowledge economy. But people must be educated and taught to be creative, with the ability to learn through their lives.

Centuries of Confucian tradition, decades of planned-economy regime, and emphasis on rote learning rather than creative thinking has shaped Chinese philosophies and methods of teaching. Most government support has gone to basic education, creating a very literate population. Now there is demand for well-trained, state-of-the-art, business-oriented people. This demand is being satisfied in part by a thriving private higher education sector, which, for ideological reasons, is not officially recognized.

Some of the major initiatives needed:

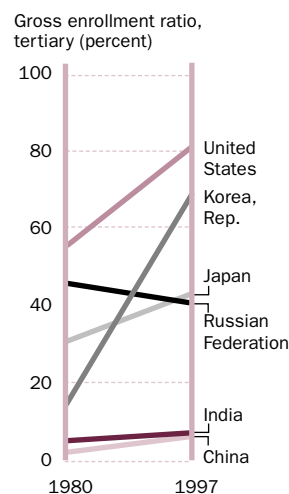
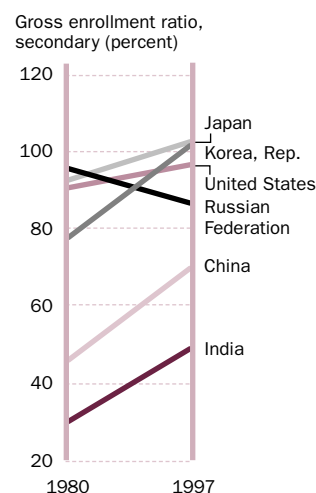
- Modernize the curriculum at all levels to provide the new basic skills that the knowledge economy demands. Beyond solid core skills in reading, writing, and arithmetic are computer and Internet skills—and the ability to think creatively to be able to adjust to constantly changing job needs and skill mixes.
- Increase the efficiency of current spending by introducing better outcome indicators.
- Integrate the private higher education system into the official system.
- Redirect the national and provincial ministries of education from primarily providing education to assuring the quality of the educational system and facilitating its proper functioning, particularly for higher education.
- Focus on equity and develop programs to ensure that talented but poor students have access to education, especially to higher education.
- Renovate the training and vocational education system to make it more responsive to local business needs and initiatives.
- Provide retraining programs for the millions of displaced workers so they can find alternative productive jobs.
- Tap the enormous potential of Internet-based education to provide the above-mentioned skills and to expand the outreach of formal education at all levels, making use of an already well developed distance learning infrastructure.

### BUILDING INFORMATION INFRASTRUCTURE

Dynamic telecommunications and information infrastructure is critical for leapfrogging into the knowledge economy, something the tenth five-year plan does not emphasize sufficiently. Such infrastructure reduces transaction costs, provides economies of scale, and overcomes some constraints of distance. But China still lags behind most East Asian countries in telephones, computer, and Internet connections per capita (table 1).

Most of the economy has limited and poor quality access to information infrastructure. Some actions to improve the situation include:

FIGURE 5  
**Secondary and tertiary enrollments are low, but improving . . .**



Source: World Bank staff analysis.

TABLE 1

**China still lags behind in information infrastructure, 2000**

Countries	Mainline per 100	Mobile per 100	PCs per 1,000	Internet hosts per 10,000
China	11.1	6.5	1.5	0.5
India	3.2	0.3	0.4	0.3
Indonesia	3.1	1.7	0.9	1.2
Japan	65.3	52.6	31.5	365.6
South Korea	46.3	56.6	19.0	84.1
Malaysia	19.9	21.3	9.4	29.3
Philippines	3.9	8.2	1.9	2.5
Singapore	48.4	68.3	48.3	437.5
Taiwan, China	56.8	80.3	22.4	492.3
All low/middle income countries	7.9	32	16.8	7.2

Source: International Telecommunications Union, *World Telecommunication Development Report 1999*, Geneva, 1999 and *Telecommunications Indicators* [<http://www.itu.int/ti/industryoverview/index.htm>].

**China needs to  
promote greater use  
of information and  
communications  
technologies  
throughout the  
economy**

- Promote greater competition by further opening markets dominated by China Telecom and other state-owned enterprises.
- Create an independent regulatory body.
- Open more to foreign investment as a source of capital and technical expertise for information technology services.
- Expand Internet access and promote development of domestic content on the Internet.
- Promote greater use of information and communication technologies throughout the economy, such as: giving technical support to small and medium-size enterprises; improving the efficiency of the banking system, including electronic banking, payment systems, and a national credit rating system; delivering Internet-based education and health services.
- Promote electronic commerce—business to consumer and business to business. This will require electronic payments systems, security, electronic signatures, and a proper legal framework to settle domestic and international electronic commerce disputes.
- Promote electronic government to improve the efficiency of interactions among government ministries, efficiency of tax collection and budget management, as well as accountability and interactions with the public.
- Promote massive training in information and communication technologies.

#### **DIFFUSING TECHNOLOGY THROUGHOUT THE ECONOMY**

Modern industrial infrastructure has been concentrated mainly in some 50 high tech zones found along the coast. China needs to dramatically improve dissemination and use of technology and related knowledge, including greater transfer of knowledge from the most efficient producers in each sector to the

least efficient. Performance disparities within industries among the different regions are daunting (figure 6) and contribute to severe economic and social tensions.

A better functioning market economy system is a prerequisite for efficient knowledge and technology dissemination. The most effective means of dissemination are expansion of efficient enterprise and promotion of private suppliers—of equipment, specialized inputs, and technical and managerial services for all sectors. Upgrading the economic incentive and institutional regime, as outlined above, is critical to stimulate the growth of these specialized providers and facilitate access to the capital and other resources they need to grow and thrive.

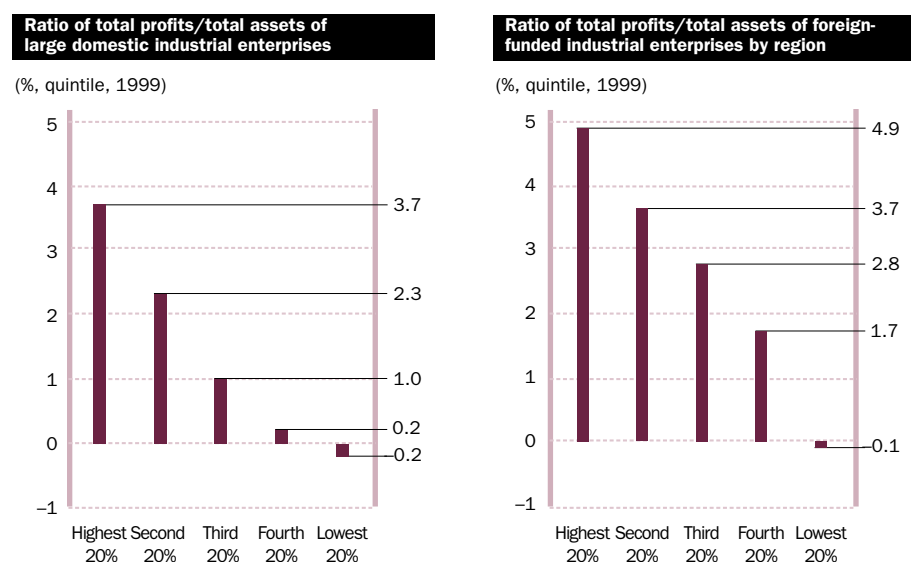
To complement this market-based technology diffusion process, the government, working in concert with local and provincial governments and through joint funding, should:

- Give higher priority and greater resources to technology dissemination schemes: engineering, research and productivity centers, renovated programs for rural industries, extension services in agriculture, and regional technical centers to support small and medium-size enterprises.
- Further support—by appropriate, decentralized funding schemes—innovative enterprises, particularly in the small-scale sector
- Facilitate the establishment of incubators—which can support new technology-based enterprises—throughout the country and the development of regional clusters for the renewal of local economies.

**There is a need to dramatically improve dissemination and use of technology and related knowledge**

FIGURE 6

#### Widespread performance disparities in industrial enterprises divide the economy



Source: World Bank staff analysis based on data from, China Statistics Bureau, *China Statistical Yearbook*, Beijing: China Statistics Press, 2000.

- Strengthen the development and use of technical standards, a critical mechanism to stimulate the diffusion of modern technologies, but considerably neglected in China.

#### **STRENGTHENING THE RESEARCH AND DEVELOPMENT SYSTEM**

**The government should increase public support for basic research, encourage the productive sector to do more research on its own, and promote greater awareness of the importance of intellectual property rights**

Important and drastic reforms have been implemented over the past decade to adapt the R&D system inherited from the planned economic regime and to reorient the research effort by launching significant government programs. These actions have contributed to dynamic and fruitful interactions among all participants, but problems remain. In the rush to the market, the government has strongly reduced funding for government institutes and encouraged them to privatize. But it may have gone too far. Basic and precompetitive research—and areas of special social concern, such as health and environmental research—are underfunded. In addition, government R&D programs are being designed and implemented with no involvement of the enterprise sector and other end-users. The government should:

- Increase public support for basic research and channel more public research funds to such pressing problems as promoting agriculture, protecting the environment, and exploiting China's traditional strengths.
- Reform applied and technical government R&D programs and involve enterprises in their design and implementation.
- Use technology foresights to identify areas where China should allocate its research efforts while improving the monitoring and evaluation of public spending.
- Strengthen the research capabilities at Chinese universities and better regulate their relations with the market.
- Encourage the productive sector to do more research on its own by incentives directed to smaller enterprises and improved government programs.
- Support greater collaboration among domestic researchers and with foreign researchers through expanded bilateral programs and development of information technology-based research networks.
- Promote greater awareness of the importance of intellectual property rights and encourage Chinese researchers and companies to patent more—in China and abroad—to protect their interests.

#### *EXPLOITING GLOBAL KNOWLEDGE*

One reason for the rapid increase in global knowledge is the massive investment in global R&D. China's R&D spending is only 0.66% of the world's, so China needs to tap into the rapidly growing stock of global knowledge (figure 7). Since opening to the world, China has been importing more capital

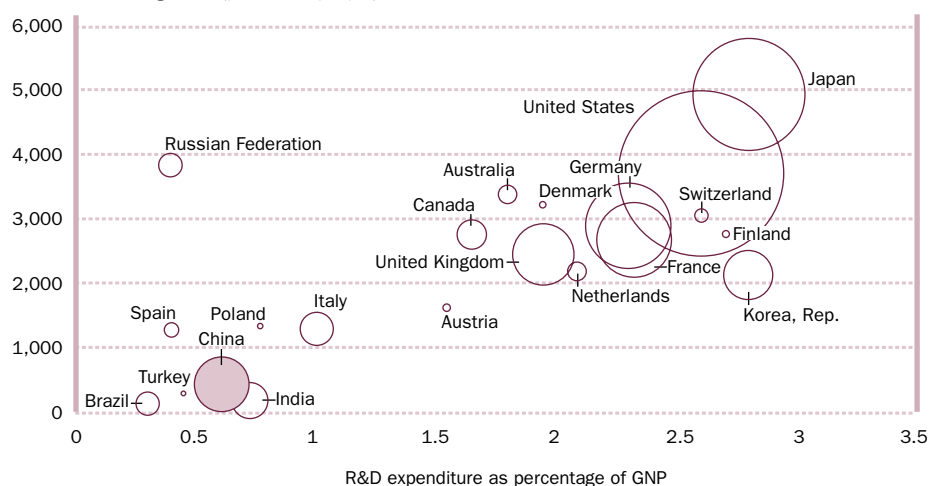
goods, components, and high-technology products—and increasing foreign direct investment, technology licensing, foreign study, copying, reverse-engineering, and acquiring technical publications. The tenth five-year plan appropriately emphasizes opening even more to the outside world, but China could be even more aggressive by:

- Improving the general business climate, the rule of law, and the enforcement of intellectual property rights—all important considerations for foreign investors.
- Attracting foreign investment in areas of strategic interest to China. So far foreign investment has been concentrated in manufacturing activities, along the coast, and more than 60% has been of Chinese origin (Hong Kong, Macao, Singapore, and Taiwan, China) (figure 8). Measures need to be taken to diversify sectoral distribution and origin of foreign investment.
- Opening more to foreign investment in services. Foreign investors have tremendous expertise in finance, insurance, logistics, sourcing, marketing, distribution, customer relations, branding, training, consulting, R&D, and managing intellectual capital—and China needs to take advantage of all of this intangible knowledge.
- Being more proactive in acquiring disembodied technology through licensing and other payments instead of relying so strongly on technology embodied in capital goods.
- Developing more strategic alliances with multinational corporations, particularly before fully opening to free foreign investment inflows—to build domestic capability in critical areas.

**China could be even more aggressive by attracting foreign investment in areas of strategic interest**

FIGURE 7  
**China's research and development effort in the world perspective**

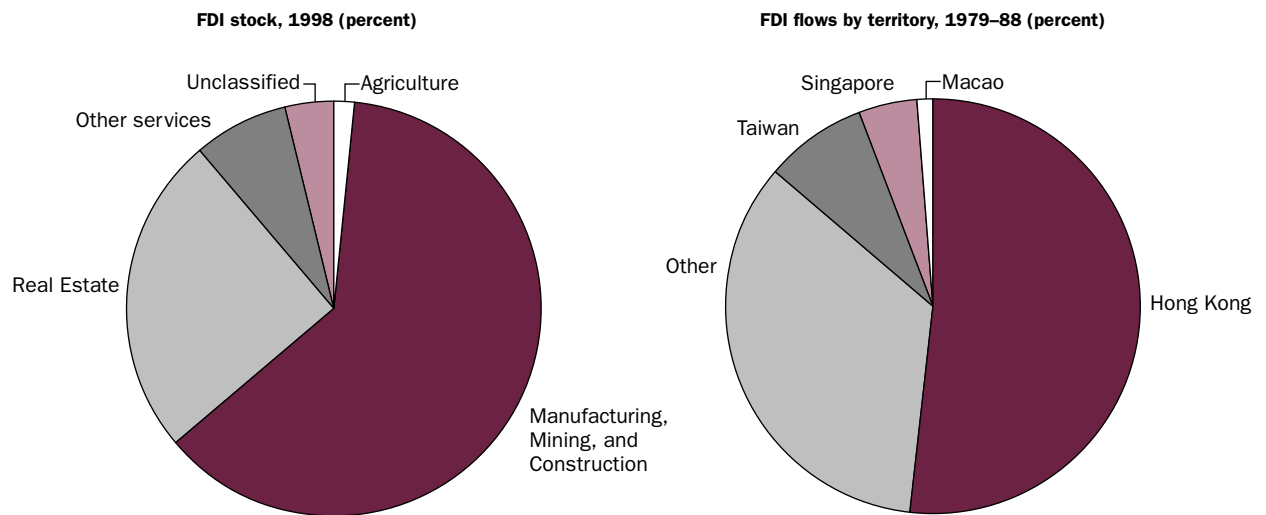
Scientists and engineers (per million people)



Note: Circles reflect relative size of GDP.

Source: World Bank Institute and World Bank staff analysis.

FIGURE 8  
**Most foreign direct investment flows to manufacturing with more than 60% of FDI originating from Chinese territories**



Source: UNCTAD, *World Investment Report 2000*, Geneva, 2000; China Financial and Economic Publishing House, *2000 Report on Foreign Direct Investment in China*, Beijing, 2000.

- Undertaking more joint public and private research with foreign firms and public R&D centers and buying foreign companies and research labs to acquire foreign knowledge, as was done by Japan, the Republic of Korea, and Taiwan, China.
- Turning the Chinese brain drain into a brain gain (of the 330,000 students sent overseas for training since 1978, only 110,000 returned) and using the technical and managerial capacity of the overseas Chinese community by providing a very receptive domestic environment to turn their ideas and expertise into value in China.

### MOVING TO ACTION

This report has a long list of recommendations. These include reforms that are fairly easy to implement and need no additional financial resources—only a slight change of emphasis or policy. The list also includes reforms that need financial resources, requiring budgetary priorities, as well as reforms that require major policy and political shifts. Perhaps the most difficult recommendations are the proposed change of the role of the government, the development of a dynamic private sector, and the establishment of a clear rule of law.

Such changes cannot happen overnight. They require a change of mindset that may not be consistent with past ideology and practice. And there is a delicate balance to be achieved. Moving too fast could risk social and political stability because of the adjustment costs. But moving too slowly could

cause social instability due to the pressure of rising unemployment.

There is thus no readymade solution. China should look at the experiences of other countries and adapt them to its context. China will have to find its own way of resolving the tensions and contradictions of moving from its past legacy to respond to the new demands. Some suggestions:

- *Prioritizing and budgeting.* Though reforms in all policy planks must proceed together in a systemic way, setting priorities and sequencing reforms in each of these planks are also indispensable. This action requires identifying the most pressing problems and the best solutions, with an estimate of resources needed and potential financing (including the private sectors and the foreign investors). Priority actions are suggested in box 2. Most of these measures have low costs in the short run. They have been selected because of their leverage on job creation—the most important challenge that China faces in the short and medium terms. The proposed actions have also been selected with a view to mobilizing resources for longer-term massive investments. The measures, which mostly address improving the institutional and regulatory framework affecting the different policy planks, will help involve non-state actors in all key areas: the innovation system, information infrastructure, and education. The efficiency of the economy should then be increased, facilitating funding for more expensive longer-term investments.

- *Coordinating action.* Promoting a knowledge economy, as most successful countries have shown, requires coordinated action across multiple domains: finance, trade, industry, science, education, infrastructure. This synchronization requires systemic action coordinated at the highest level—preferably the Premier of the State Council. Every effort should be made to foster this systemic approach—at the central, provincial, county, and municipal levels. Fast developing regions in China (and elsewhere) have clearly designed and implemented integrated programs.

- *Sharing experiences.* Given China's tremendous diversity, it already has many examples of successful knowledge strategies—such as Shanghai (table 3), Beijing, and some of the advanced coastal provinces, such as Jiangsu and Shenzhen. There should be regular forums for exchanging rich experiences across provinces or even smaller regions. Seeing what others have accomplished can motivate local governments to act.

- *Experimenting with reforms and programs.* Following a well-established Chinese practice, learning what works best under different circumstances and then expanding the successful cases is another important way to affect this transition. This should be done more aggressively by launching coherent programs to promote more effective use of knowledge in specific regions, building on their strengths.

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## BOX 2

**Priority actions in moving toward the knowledge economy**

- Pursue reform of the economic incentive and institutional regime through the rule of law and its enforcement, property rights, a clearer regulatory framework, stronger economic competition, and extracting political influences from business management.
- Take steps toward further reform of the education system, starting with a nationwide evaluation of students' literacy adapted to knowledge economy requirements. Establish regulations that facilitate integration of the private sector into the formal education system and exploit opportunities for a learning grid based on information communication and technologies.
- Improve the regulatory framework for the information infrastructure, with an independent regulatory agency; promote greater competition in the monopolized basic telecom market; open up more broadly to foreign investors; provide greater freedom on the Internet and expand access to it.
- Diffuse new technologies throughout the economy by strengthening technical standards and related infrastructure, supporting new businesses and other agents of technology dissemination, and multiplying local support structures of information and technical assistance.
- Reform government research and development programs to bring in the business sector, increase core funding to selected networks of public and university institutes, and use technology foresights to make informed choices with help from foreign and Chinese expatriate experts.
- Attract foreign investors in strategic areas, particularly service sectors; facilitate global technological alliances for Chinese enterprises; and intensify incentives for Chinese overseas to come home.
- Promote massive training of public officials to adapt the management of the economy and society to more knowledge-based development: the new party cadres, high-level civil servants, government program managers, and government officials from provincial townships.

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China is at a critical juncture in its development strategy, caught between daunting internal challenges and a demanding external environment driven by rapidly expanding knowledge. But it can seize the 21st century by making a concerted leap to a knowledge-based economy. The recommendations here should help provide the rough outlines of a strategy to overcome constraints and improve welfare. But these recommendations are just a starting point and need to be expanded and adapted to the Chinese reality by those who will implement them. Funding is another issue. The government needs to prioritize initiatives carefully and see how it can leverage its resources and those of the growing private domestic sector—as well as foreign investment and international finance.

China's leadership must not waver in driving this transition or backtrack on reforms already in place. There will be adversity along the way, but better to face it from a strong position than be overtaken. Launching a concerted and sustained effort is important. Perhaps a slogan such as "Seizing the

TABLE 2

**Elements of Shanghai's knowledge strategy**

Strategic elements	Details
1. Develop knowledge-based industries	To develop bio-tech as a mainstream industry in complement to IT.
2. Help enterprises to invest in R&D	Preferential tax regime and financial assistance help high technology startups invest in R&D.
3. Put more public resources in R&D	Public resources establish new basic research institutions focused on Shanghai's strengths and interests, to encourage cooperation between universities and corporations, and to reorganize old research institutes.
4. Encourage use of the Internet	Telecommunication and Internet access costs are lowered by government instructions given to monopoly, state owned companies.
5. Expand knowledge service industries	Specific areas of focus include education, software, consulting, design, advertising, culture, and health, attracting outside professionals and cultivating students' skills.
6. Attract high-quality professionals to Shanghai	Restrictions on wages and immigration should be gradually eliminated, with a market-oriented reward system to attract high-quality people.
7. Establish a venture investment system	Laws and regulations should normalize venture capital operations and management, with tax deductions, preferential loans, and risk compensation to encourage venture financing. The venture investment system comprises a venture capital market, venture capital funds, venture investment management corporations, and numerous high-technology firms.
8. Mobilize Shanghai's education sector	A highly educated labor force can be developed by increasing student intakes in universities and allowing private investment in education (reducing the fiscal burden). The market sense and managerial ability of educators should be strengthened to leverage education resources.
9. Establish a sound income redistribution system	To ensure balanced development and social fairness, governments should build an appropriate tax system on personal income and inheritance. Also to be emphasized is education and Internet access for low-income families.
10. Establish social security system, and efficient employment retraining	Unemployed people must be retrained to meet the demands of the new economy. For a stable social security system, government should provide incentives to enterprises that create new jobs. The employment system should be gradually changed from government-led to market-led, with many more employment opportunities in small and medium-size industries.

Source: Shanghai Science and Technology Committee, "Formation of Shanghai Knowledge Economy Strategies," Shanghai, 1999 (translated by World Bank staff).

"21st Century through Knowledge" can mobilize support for the changes required of government and civil society, forging a partnership to work toward a modern, knowledge-based China of tomorrow.

## OVERVIEW SOURCES

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