

WBI Development Studies

China and the Knowledge Economy

SEIZING THE 21st CENTURY



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Carl J. Dahlman
Jean-Eric Aubert

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The World Bank

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Foreword

China has made impressive achievements in economic growth and poverty reduction over the last quarter century. Now it faces daunting internal challenges such as ensuring employment to millions over the coming decade, continuing to maintain high growth, increasing its international competitiveness, and reducing income and regional inequalities. Compounding these challenges is the new knowledge and information revolution. To prosper in this new era, China must welcome the knowledge revolution and make effective use of knowledge in its agricultural and industrial sectors, and especially in developing its service industry. China also needs to manage the transition to an environmentally sustainable economy that better utilizes its relatively limited natural resources.

This book outlines the main challenges that China faces in its future development, and the importance of shifting from a factor-based to a knowledge-based strategy. It presents a long term strategy for China that integrates key knowledge-related policy components, improving relevant economic incentives and institutions, upgrading the education and training system, building the information infrastructure, and strengthening the innovation and research system. It concludes by suggesting concrete steps for implementing the proposed strategy.

To take advantage of this unprecedented opportunity, the book recommends that the government withdraw further from hands-on management of the economy and take on a new role—that of an architect of appropriate institutions and provider of incentives to establish a new socialist market economy based on knowledge.

China and the Knowledge Economy: Seizing the 21st Century has been developed by the World Bank Institute in collaboration with the East Asia and Pacific Region of the World Bank. These two groups have been working closely together over the past years to support East Asian countries in developing knowledge strategies and pioneering new approaches to remain competitive in the Knowledge Economy. Our hope is that this book will provide useful insights for Chinese policymakers and other countries as they embark on transforming their economies to ones based on knowledge.

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During the course of preparing this report, several missions visited five Chinese cities (Beijing, Guiyang, Shanghai, Suzhou, and Wuhan) to collect information and conduct broad consultations with Chinese officials, entrepreneurs, managers of foreign-owned enterprises, scientists, diplomats, and staff from international organizations. We are also indebted to the high level Chinese team that attended the Policy Forum on *Using Knowledge for Development*, at Wilton Park, United Kingdom, March 19–25, 2001. We would like to acknowledge the contributions made by Ma Songde, Vice Minister, Ministry of Science and Technology, Angang Hu and Lan Xue, Tsinghua University, Tian Xiaogang, Ministry of Education, and Huijiong Wang, Development Research Center of the State Council. Useful comments have also been received from Justin Lin, Peking University, Xiaoxi Li, State Council Research Office, and from Xiuyu Chen, Ministry of Information Industries.

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Abbreviations

CURRENCY EQUIVALENTS

(As of June 4, 2001)
Currency Unit = RMB
\$1.00 = RMB 8.2770
RMB 1.00 = \$0.1208

CAMP	China Accelerated Management Program
DGT	Directorate General of Telecommunication
ETRC	Engineering Technology Research Center
FDI	Foreign direct investment
GERD	Gross Domestic Expenditure on Research and Development
GDP	Gross Domestic Product
GNP	Gross National Product
HEIs	Higher education institutions
ICRG	International Country Risk Guide
ICT	Information and communication technology
IMD	International Institute for Management Development
IT	Information technology
KBE	Knowledge-based economy
MII	Ministry of Information Industry
MNCs	Multinational corporations
MOE	Ministry of Education
MOST	Ministry of Science and Technology
NERCs	National engineering research centers
NETRC	National engineering technology research centers
NNSF	National Natural Science Foundation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
S&T	Science and technology
SME	Small and medium-size enterprises
SOEs	State-owned enterprises
TVEs	Township and village enterprises
WBI	World Bank Institute
WHO	World Health Organization
WTO	World Trade Organization

Executive Summary

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. And 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.
- 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

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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. But China's share in services is smaller than would be expected for a country at China's stage of development due to past policy biases toward industry and against the service sector.

Most new jobs will be in informal service employment and 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, financial, 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; in manufacturing it's 3.6%. Ironically, as China boosts productivity it will need less labor, 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'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 air pollution becoming a serious threat 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 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 and communication technology revolution, the engineering of materials at the molecular level, and even the development of new 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.

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- 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 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 offers specific policy recommendations in the context of the broader ideological and political shift 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 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 to the WTO—creates a massive need

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for mobile labor. But its labor market is severely constrained by rules restricting 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. 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 achievement in China is still low. This 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 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. China still lags behind most East Asian countries in telephones, computer, and Internet connections per capita.

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

- 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; and 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.

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- Promote electronic government to improve the efficiency of interaction among government ministries, efficiency of tax collection and budget management, as well as its accountability and interactions with the public.
- Promote massive training in information and communication technologies.

DIFFUSING TECHNOLOGY THROUGHOUT THE ECONOMY

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

Modern industrial infrastructures have been primarily concentrated in some fifty “high tech” parks established along the coast. But these are small islands in the less productive economy. There is a need 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 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—to 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.
- 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

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 government programs. These actions have contributed to dynamic and fruitful interactions among all actors, 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. Moreover, 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.

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

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. 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 and 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.