India and the Knowledge Economy: Leveraging Strengths and Opportunities

Carl Dahlman and Anuja Utz

World Bank Institute

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Structure of Presentation

- India in Long Term Context
- Why Focus on Knowledge Strategies?
- Benchmarking India on the Four Pillars of the Knowledge Economy
- Key Issues in the Economic and Institutional Regime
- Key Issues in Education and Training
- Key Issues in Information and Communications
- Key Issues in the Innovation System
- Strengths, Weaknesses, Opportunities and Threats
- Moving Forward
India's Changing Share of Global GDP

Share of Global GDP (%): Year 0-1998

- Western Europe
- United States
- Japan
- China
- India
Growing Differences in GDP/Capita

Per Capita GDP for Selected Regions or Countries
(1990 international $, 1480-1998)

Real GDP 2003 (Trillions of 1995 US$)

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP (Trillions of 1995 US$)</th>
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<tbody>
<tr>
<td>United States</td>
<td>$9.46t</td>
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<tr>
<td>Japan</td>
<td>$5.88t</td>
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<tr>
<td>China</td>
<td>$1.32t</td>
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<tr>
<td>India</td>
<td>$0.56t</td>
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<tr>
<td>South Korea</td>
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<td>Brazil</td>
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<tr>
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<tr>
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<tr>
<td>Canada</td>
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<tr>
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<tr>
<td>France</td>
<td>$1.83t</td>
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<tr>
<td>Germany</td>
<td>$2.71t</td>
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</tbody>
</table>

Real GDP per capita 2003

Ave RGDP per capita growth 1991-2003 (%)
Real GDP 2003 (Trillions of 1995 international $)

- China: $5.60t
- India: $2.69t
- Brazil: $1.19t
- Mexico: $0.81t
- Russia: $1.15t
- Japan: 3.12t
- Canada: $0.84t
- Germany: $1.98t
- France: $1.42t
- Italy: $1.36t
- United Kingdom: $1.40t
- United States: $9.45t

Real GDP per capita (constant 1995 international $) 2003

Ave RGDP per capita growth 1991-2003 (%)
Implications for India

- By global measures, India’s economy is relatively small:
  - with 17% of the world’s people, it accounts for less than 2% of global GDP and 1% of world trade.
- It has had impressive growth: 6.7% (1992/93 to 96/97), 5.5% (1997/98 to 2001/02), and rebounded to 10.4% in 3Q of 2003/04.
- But, growth has lagged behind China’s, which had an annual GDP growth rate of 10.7% in 1991–99.
- India’s GDP per capita has also been increasing, albeit at a much lower rate than in China or Brazil.
- India has made good progress in increasing incomes and in improving living standards (HDI), moving from 132nd place in 1997 to 127 in 2001.
- In terms of a purchasing power comparison of economic size, India is already the fourth largest economy in the world, and if it continues at current rate, will become the third largest within the next 3 years.
- But it faces increased competition, especially from China.
Global Competition

Share of World Merchandise Exports (1960-2003)

- India
- China
- Brazil
- Korea, Rep.
- Poland
- Russian Federation

Source: World Bank SIMA Database
Why Focus on Knowledge Strategies

- We are in period of very rapid creation, dissemination and use of knowledge.
- There is risk of growing gap between advanced countries at the forefront of creating and using that knowledge, and developing countries, which have more limited means to take advantage of potential of rapid development and use of knowledge.
- Effective use of knowledge, broadly defined to include policy and technical knowledge, can have major impact on economic growth and development.
- Therefore India needs to develop explicit strategies to make more effective use of knowledge for its economic and social development.
India: Real GDP Per Capita - Alternative Projections 2001-2020

- Actual
- Projection 1: 2.09% TFP Growth (Actual)
- Projection 2: 1% TFP Growth (India 1961-70)
- Projection 3: 3% TFP Growth (India 1981-90)
- Projection 4: 4.25% TFP Growth (Ireland 1991-2000)
Four Key Functional Areas

- Economic incentive and institutional regime that provides incentives for the efficient use of existing and new knowledge and the flourishing of entrepreneurship
- Educated, creative and skilled people
- Dynamic information infrastructure
- Effective national innovation system
Knowledge Assessment Methodology

- KAM: 76 structural/qualitative variables to benchmark performance on 4 pillars
- Variables normalized from 0 (worst) to 10 (best) for 121 countries
- www.worldbank.org/kam
- Basic scorecard for 14 variables for two points in time, 1995 and most recent
- Knowledge economy index (KEI) which includes 3 variables for each of the four pillars: economic and institutional regime, education, innovation and ICTs.
Knowledge Economy

India, China (most recent)
India and the world: Knowledge Economy Index

Source: Knowledge Assessment Methodology (KAM: www.worldbank.org/kam)
India’s Position in the Global Knowledge Economy Comparison

- India is in the bottom 1/3 of the distribution, but leading among South Asia’s countries.
- In spite of its impressive growth in the last few years, and of absolute advances in many areas such as education and ICT, there has not been any significant improvement in India’s overall position over past half decade.
- In fact, in ICT, despite significant advances in telephone, computer, and internet penetration, India has fallen slightly behind because so many other countries have advanced even faster.
- Overall, some countries such as China, Brazil, Jordan, Poland have made significant improvements.
- This is indicative of the rapid changes which are taking place and of the importance of monitoring developments closely and constantly adjusting strategies.
India leads the South Asia region, and has several strengths in EIR as compared to China:

- Democracy; a tradition of entrepreneurship; a much stronger infrastructure supporting private enterprise; capital markets that operate with greater efficiency and transparency than in China; a legal system that is considerably more advanced; flourishing entrepreneurship and free enterprise; and an independent judiciary.

- Property rights are quite secure; the protection of private ownership is far stronger than in China; and the rule of law generally prevails. Corporate governance has also improved dramatically.

India also has macroeconomic stability, a large domestic market, and a large and relatively low-cost and skilled workforce.
Variables of Economic Regime

Source: Knowledge Assessment Methodology (KAM: www.worldbank.org/kam)
Benchmarking Key Elements of EIR for India

- India is a relatively closed economy, as seen by its low ranking on tariff and non-tariff barriers.
- It also has relatively low levels of investment (23%) as compared to China (38%), but it comparable to Poland (22%) and Brazil (21%).
- It needs to do more to strengthen property rights, regulation, and its IPR regime.
- Qualitative surveys by the WEF suggest that India ranks at the 50th percentile when it comes to soundness of its banks but does much better when it comes to the intensity of local competition in the country.
- India presents a mixed picture on governance: between 1998 and 2002, it maintained its rankings on only three of the six variables: government effectiveness, regulatory quality, and voice and accountability.
Variables of Governance

Source: D. Kaufmann and A. Kraay, 2002: Growth Without Governance
Key Elements of EIR for India

- Despite recent economic growth, multiplicity of regulations governing product markets, distortions in market for land, and widespread government ownership of businesses have been inhibiting GDP growth, by some estimates by about 4% a year.

- Removing these barriers and fostering a stronger investment climate could allow India to grow as fast as China’s—10% a year, and create some 75 million new jobs outside agriculture.

- Some reasons for India’s less competitive markets include:
  - Excessive regulation of the entry and exit of firms, which face stiffer requirements for obtaining permits and take much longer to get under way than do the firms in many other countries.
  - Entrepreneurs typically have to go through 11 steps to launch a business in an average of 89 days at a cost equal to 49.5 percent of gross national income (GNI) per capita.
  - Restrictions on the hiring and firing of workers are also a great obstacle to doing business in India.
  - Enforcing contracts is a major problem: it takes almost a year to resolve a payment dispute.
Possible Steps to Strengthen EIR

Foster a better investment climate to enhance overall economic performance and increase productivity of both public and private investment. This includes:

- Reducing inefficiencies in factor markets by easing restrictions on hiring and firing of workers, improving the access of small and medium enterprises to credit, addressing problems in the use and transfer of land, and updating bankruptcy procedure.
- Speeding up trade reform by reducing tariff protection to create a level playing field for investment, both domestic and foreign.
- Ensuring access to reliable power at reasonable cost by rationalizing power tariffs and improving the financial and operational performance of state electricity boards.
- Addressing capacity and quality constraints in transport by improving public sector performance and developing speedy, reliable door-to-door transport services (roads, rail, and ports) to enhance India’s competitiveness.
- Simplifying and expediting all procedures for the entry and exit of firms—for example, through “single window” clearances.
Encourage FDI and increase its contribution to economic growth by phasing out remaining FDI restrictions and increasing positive linkages with the rest of the economy.

Stimulate growth of manufactured and service exports. In so doing, India could drive down global costs in services, just as China drove down global costs in manufacturing.

Strengthen IPRs and their enforcement.

Improve governance and the efficiency of government, and encourage the use of ICTs to increase government’s transparency and accountability.

Use ICTs for more effective delivery of social services, especially in health and education, empowering India’s citizens to contribute to and benefit from faster economic growth.

- India 1982
  - Communications, computer, etc.: 1.56
  - Insurance and financial services: 0.96
  - Transport services: 0.12
  - Travel services: 1.98

- India 1995
  - Communications, computer, etc.: 2.58
  - Insurance and financial services: 1.89
  - Transport services: 0.17
  - Travel services: 2.13

- India 2002
  - Communications, computer, etc.: 3.01
  - Insurance and financial services: 2.53
  - Transport services: 0.37
  - Travel services: 18.95

- China 1982
  - Communications, computer, etc.: 1.74
  - Insurance and financial services: 2.71
  - Transport services: 0.23
  - Travel services: 1.18

- China 1995
  - Communications, computer, etc.: 8.73
  - Insurance and financial services: 1.85
  - Transport services: 5.20
  - Travel services: 0.26

- China 2002
  - Communications, computer, etc.: 13.38
  - Insurance and financial services: 5.72
  - Transport services: 1.74
  - Travel services: 20.38

Billions of US$
India has made substantial progress in increasing literacy, and in increasing primary and secondary enrollments.

But the country still accounts for one-quarter of the world’s 104 million children out of school.

The Indian leadership is committed to increasing educational attainment and has launched program for universal elementary education: SSA-Sarva Shiksha Abhayan

India also possesses a large pool of highly educated and vocationally qualified people who are making their mark, domestically and globally, in science, engineering, IT, and R&D, but they make up only a small fraction of the population.
Human Capital

India (most recent)
Adult literacy rate (% age 15 and above) (58.00)
(3.13) Well educated people do not emigrate abroad
Average years of schooling (5.06)
(4.10) Public spending on education as % of GDP
Secondary enrollment (48.70)
(40.00) Primary Pupil-teacher ratio, pupils per teacher
Tertiary enrollment (10.49)

China (most recent)
Adult literacy rate (% age 15 and above) (84.80)
(3.65) Well educated people do not emigrate abroad
Average years of schooling (6.35)
(2.90) Public spending on education as % of GDP
Secondary enrollment (62.82)
(22.00) Primary Pupil-teacher ratio, pupils per teacher
Tertiary enrollment (7.45)
India has maintained its position on the KEI for education: it leads South Asia and Africa Regions, but lags Sri Lanka and China.

The SC shows a mixed picture: progress in literacy, but average years of schooling are lower than in China and other comparators.

Same true for primary and secondary enrollments. And although India led China in tertiary enrollments until 2000, China surpassed India thereafter with GERs of 12.7% compared to 10.6% for India.

WEF and IMD data show that India ranks quite highly as compared to Brazil or China on flexibility of its people to adapt to new challenges; its national culture is also quite open to foreign influence; and management education is perceived to be available in first-class business schools.

But its well educated people do tend to emigrate abroad, more than in Brazil, China, or Korea.
Possible Steps to Strengthen Education

- Improve quality of primary and secondary education, with emphasis on ameliorating teacher vacancies and absenteeism, reversing high dropout rates, developing high quality teaching and learning materials.
- Ensure consistency between the skills taught in primary and secondary education and the needs of the knowledge economy, introduce materials and methods to teach students “how to learn” rather than stressing occupation-specific knowledge.
- Reform the curriculum of tertiary education institutions to include skills and competencies for the knowledge economy (communication skills, problem-solving skills, creativity, and teamwork) that also meet the needs of the private sector.
- Raise the quality of all higher educational institutions, not just a few world-class ones (such as the IITs, IIMs)
Possible Steps to Strengthen Education

- Establish partnerships between Indian universities and foreign ones to attract and retain high-quality staff, and provide opportunities for students to receive internationally recognized credentials.
- Invest in flexible, cost-effective job training programs that are able to adapt quickly to new skill demands generated by changing markets and technologies, aligned with the needs of firms.
- Align formal and non-formal education and training systems toward a lifelong learning system that helps people develop new competencies and provides opportunities to meet the learning needs of all, both within and outside the school system.
- Involve the private sector more in education and training and putting in place better accreditation systems for private providers of education and training.
- Make effective use of distance learning technologies to expand access and the quality of formal education and lifelong training.
Key Elements of ICTs for India

- India’s telecom sector has registered rapid growth in recent years, spurred by reforms to introduce greater competition.
- Many domestic and international private sector entrants are now providing consumers with higher-quality services at low prices. Some 2 million mobile subscribers are being added every month!
- India can also boast of remarkable global achievements in the IT sector. The IT market has grown to $16.5 billion in 2002–03, accounting for 3% of India’s GDP and providing employment opportunities for almost 700,000 people.
- India is making an impact not only in software, but also in IT consulting, where companies such as Wipro, Infosys, and Tata are managing United States IT networks and re-engineering business processes.
- In chip design, Intel and Texas Instruments are using India as an R&D hub for microprocessors and multimedia chips.
Benchmarking ICTs in India

The benchmarking shows that:

- India does better than the South Asia region on KEI for ICTs, but lags all other regions and comparators.
- Although progress has been made on telephones (both fixed lines and mobile), computers and internet hosts, India’s information infrastructure will need to be further strengthened if India is truly to transform itself into a knowledge-based economy.
- Explosive growth of ICTs is mainly in urban areas.
- Government should implement policies to enhance the reach of IT to groups not well served by the market. This includes
  - increasing access to ICTs;
  - enhancing ICT literacy and skills among the population; and
  - developing ICT applications that can provide much-needed services to citizens.
**Possible Steps to Strengthen ICTs**

- Enhance regulatory certainty to facilitate new services to reap benefits of convergence of existing and new technologies and enable the sector to contribute more to economic growth.
- Resolve regulatory issues in communications and reduce and rationale tariff structures on hardware and software.
- Expand suitable training opportunities at home to meet the expected growth of IT in coming years.
- Create opportunities for local communities to benefit from ICTs by providing support, enhance private investment in ICTs.
- Develop IT applications for the domestic market, not just for exports.
- Strengthen partnerships among government agencies, research and academic institutions, private companies, and NGOs to ramp up the ICT infrastructure and achieve faster penetration of ICTs.
Range of Issues: Innovation System

- **Tapping into Global Knowledge**
  - Trade, foreign investment, tech transfer,
  - Technical journals, travel, internet, conferences

- **Creating and adapting knowledge**
  - Pubic vs private R&D; Basic vs applied R&D
  - From specialized research institutions to production

- **Disseminating Knowledge**
  - Growth of more efficient enterprises
  - Suppliers of equipment, technical services and info
  - Extension services: agricultural

- **Using knowledge**
  - Depends on cost and benefits
  - Depends on education, skills, complementary inputs
  - Depends on economic and institutional regime
Performance in Innovation Over Time
Global R&D Effort in Comparative Perspective

Total R&D Expenditure (PPP, 1996)

R&D expenditure as % of GNP

Source: World Bank SIMA Database

© K4D, WBI
Potential for Innovation

India (most recent)

Gross Foreign Direct Investment as % of GDP (0.40)
(3.60) Private sector spending on R&D
(3.70) Availability of Venture capital
(4.00) Admin. Burden for Start-Ups
(5.48) Entrepreneurship among Managers
(3.40) University-company research collaboration
(12.47) Manuf. Trade as % of GDP
Total expenditure for R&D as % of GNP (1.23)

China (most recent)

Gross Foreign Direct Investment as % of GDP (4.60)
(3.60) Private sector spending on R&D
(3.00) Availability of Venture capital
(4.30) Admin. Burden for Start-Ups
(5.02) Entrepreneurship among Managers
(4.50) University-company research collaboration
(36.79) Manuf. Trade as % of GDP
Total expenditure for R&D as % of GNP (1.00)
Key Elements of the Innovation System in India

- India is endowed with a critical mass of scientists, engineers, and technicians in R&D and is home to dynamic hubs of innovation, such as Bangalore and Hyderabad.
- It has vast and diversified publicly funded R&D institutions, as well as world-class institutions of higher learning that provide human capital.
- It is emerging as a major global R&D platform; about 100 multinational companies (MNCs) have already set up R&D centers in the country.
- General Electric (GE), for example, has 1,800 people in its R&D center in Bangalore, a quarter of whom have Ph.D.s!
- A new S&T policy has been formulated in 2003 to spur innovation and R&D to meet national needs in the new era of globalization.
- It has great strengths in pharmaceuticals; companies such as Ranbaxy, Dr. Reddy’s Labs, and Cipla are producing and exporting generic versions of off-patent drugs (such as for HIV).
- A huge reservoir of creativity exists in traditional knowledge and local entrepreneurship, which is being encouraged by various measures (including a recently created National Innovation Foundation).
- A series of laws on IPRs have been passed in the past two years.
Benchmarking the Innovation in India

- India does better than South Asia and Philippines, Indonesia on KEI for innovation but lags Brazil, China and other comparators.
- In absolute numbers, India is in a more advantageous position:
  - It has a critical mass of scientists and engineers and technicians in R&D
  - Its Science and engineering enrolment ratio matches that of Brazil.
- It spends a small fraction of its GDP on R&D: it spent 1.23% of GDP on R&D between 1989-00, more than Brazil (0.77% of GDP) and China (1% of GDP) during the same time period.
- It gets very little in worldwide royalty and license fees receipts
- In terms of outputs, its share of global patenting is small, as are scientific and technical journal articles (per million people).
- FDI is weak (0.4% of GDP between 1990-2000), availability of venture capital is low, as is private sector spending on R&D.
Relative Importance of FDI

Gross Foreign Direct Investment as % of GDP

Source: World Bank SIMA Database
**Possible Steps to Strengthen Innovation**

- Strengthen access to global knowledge through trade, FDI, licensing, and personnel movements, along with informal means through imitation, reverse engineering, spillovers.
- Tap the Indian Diaspora, entrepreneurs and venture capitalists in technology-intensive businesses to strengthen the knowledge linkages with India, and encourage investment in areas S&T and needed infrastructure.
- Spur the growth of the IT, biotechnology, and new materials sectors, which can stimulate other knowledge-based industries.
- Improve the allocation and use of public R&D by auditing and monitoring of S&T programs and redeploy resources to programs that have proven to be successful.
- Foster closer university-industry linkages, increasing the flow of information between the university and enterprise sectors, and undertaking R&D more relevant to the needs of the private sector and the economy.
Possible Steps to Strengthen Innovation

- Encourage more private spending on R&D, more than 70 percent of which is now performed by the (federal and state) government sector.
- Optimize links with the private sector to provide funding for R&D. In OECD countries most R&D is by the private sector, and India needs to put in place appropriate incentives to encourage the private sector to fund R&D.
- Strengthen patenting and exploit patents through commercialization and profitable applications.
- Improving access to venture capital, important for the startup of new knowledge-based businesses.
- Continuing to build linkages among different actors (government, national laboratories, universities, industries, and grassroots innovators) to strengthen the national system of innovation.
**Strengths**

1. **Basic endowments**
   - Large population, large domestic market,
   - Natural resources

2. **Economic and Institutional Regime**
   - Macro stability
   - Dynamic private sector
   - Well developed set of market institutions

3. **Education and Skills**
   - Critical mass of many well qualified persons
   - English language
   - Excellent premier higher level institutions

4. **Innovation System**
   - Critical mass of scientists and engineers doing R&D
   - Diversified public R&D infrastructure

5. **Information and Communications**
   - Strong capability in software development and it use
   - Strong reputation for providing outsourced services globally
Weaknesses

- **Economic and Institutional Regime**
  - Weak fiscal position, low investment rates
  - Weak integration into global economy
  - Low productivity of state enterprises and of state itself
  - Weak investment climate, onerous regulation

- **Education and Skills**
  - High illiteracy, low average educational attainment
  - Low secondary and tertiary attainment, gender imbalance
  - Underdeveloped system of life long learning
  - Brain drain with limited brain gain

- **Innovation System**
  - Limited use of foreign direct investment, technology transfer
  - Low R&D levels and productivity, low private R&D
  - Poor public, private, university linkages in innovation system

- **Information and Communications**
  - Still low penetration rates and use, especially in rural areas
  - Low application of ICT for domestic needs
Opportunities

- **Reduce Government Constraints and Strengthen Institutions**
  - Increase domestic competition, lower trade barriers, exploit exports
  - Reduce onerous bureaucratic regulation
  - Improve efficiency of government

- **Leverage Human Capital**
  - Improve quality and access to basic education
  - Expand secondary and higher education to produce more knowledge workers
  - Develop more effective system of lifelong learning tapping potential of private provision and of distance education

- **Deepen and Broaden Innovation System**
  - Tap FDI and other sources of foreign knowledge more effectively
  - Tap Indian Diaspora more systematically
  - Improve efficiency of domestic R&D, increase private sector effort
  - Strengthen domestic and foreign knowledge and innovation linkages

- **Harness ICT for Domestic Needs**
  - Improve regulatory regime, rationalize tariff structure
  - Expand opportunities for local communities to benefit from ICT
  - Use ICT more effectively to delivery social services
  - Expand ICT training and develop more applications for domestic use
**Threats**

- Increasingly competitive, demanding, and rapidly changing global environment
- Very uncertain global situation with risks of:
  - lower global growth,
  - increasing inequality across countries
  - fragmentation into regional blocks
- Risk of increasing knowledge divide between advanced and developing countries, across very diverse Indian states, and within states
- Risk of rising unemployment and increasing internal inequality, especially between urban and rural, and large marginalized population
The Way Forward

- Critical to go from analysis of problems to concrete initiatives to improve KE performance
- Successful further reform requires
  - Creating stakeholder awareness (government, private sector and civil society)
  - Consultation and discussion to create stakeholder ownership
- Monitorable goals and constant evaluation are key to improving performance
- Implementation requires three pronged strategy
  - Top down reforms in key areas of four pillars
  - Bottom up pilots at local and state level
  - Mechanisms to replicate and scale up successful pilots
- Rapid adjustment is needed in light of experience and changing circumstances