The Aspen Institute India/Communications and Society Program

MINDS ON FIRE

Enhancing India's Knowledge Workforce

Richard P. Adler, Rapporteur

The Aspen Institute

A Report of the Second Annual
Joint Roundtable on Communications Policy

Minds on Fire:

Enhancing India's Knowledge Workforce

Report of the Second Annual
Joint Roundtable on Communications Policy

Richard P. Adler
Rapporteur

THE ASPEN INSTITUTE INDIA

in partnership with

THE ASPEN INSTITUTE

Communications and Society Program
2007

To purchase additional copies of this report, please contact:

In India:
The Aspen Institute India
c/o Sachin Khanna
249F, Sector 18
Phase 4, Udyog Vihar
Gurgaon, Haryana 122015
India
Phone: +91-124-4014060 ext. 352
Fax: +91-124-4014080
E-mail:
aspenindiaict@ciionline.org

In the United States:
The Aspen Institute
Fulfillment Office
P.O. Box 222
109 Houghton Lab Lane
Queenstown, Maryland 21658
United States
Phone: +1-(410) 820-5326
Fax: +1-(410) 827-9174
E-mail:
publications@aspeninstitute.org

For all other inquiries, please contact:

THE ASPEN INSTITUTE INDIA

The Aspen Institute India
c/o Vikram Tiwathia
249F, Sector 18
Phase 4, Udyog Vihar
Gurgaon, Haryana 122015
India
Phone: +91-124-4014078
Fax: +91-124-4014080

THE ASPEN INSTITUTE

The Aspen Institute
Communications and Society Program
One Dupont Circle, NW
Suite 700
Washington, DC 20036
United States
Phone: +1-(202) 736-5818
Fax: +1-(202) 467-0790

Lt. Gen (Ret.) Shamsher S. Mehta
PVSM, AVSM and Bar,VSM
Director General
Confederation of Indian Industry
and *Trustee*
Aspen Institute India

Charles M. Firestone
Executive Director
Communications and Society Program
The Aspen Institute (U.S.)

Published in India in 2007 by The Aspen Institute
and The Aspen Institute India

Printed in the United States of America

ISBN: 0-89843-477-7

07-013

1633CSP/07-BK

Contents

The reader should note that this report is written from the perspective of an informed observer at the conference. Unless cited to a particular person, none of the comments or ideas contained in this report should be taken as embodying the views or carrying the endorsement of any specific participant at the conference.

Foreword

The title of this report, *Minds on Fire,* is an apt description of the process that brought 29 Indian and American leaders in the communications and information related fields to recommend a significant new approach to learning in the digital environment. "Minds on Fire" symbolizes the passion-based learning approach that is possible from the combination of global connectivity and web-based collaborative learning processes—what we call **Learning 2.0.**

In the following pages, Richard Adler describes the economic promise that India offers, the workforce problems facing all industry sectors and in particular India's burgeoning information technology industry, and some solutions that could bridge the gap between the two. Specifically, the report and the appendix call for the Indian Government to enter into a pilot project of public private partnerships to encourage the creation of Knowledge Learning Centers in Special Economic Zones being created throughout the country.

The Problem. From afar, India's quickly expanding economy is the envy of countries around the world. Global industries and financial institutions cannot invest in India fast enough. India's economy is growing at the sustained rate of about 9 percent per year, and amidst this overall growth, its business process outsourcing, information technology (IT), telecom and information services sectors are booming—so much so, in fact, that a country of 1.1 billion people cannot adequately staff the growing hunger of these industries for qualified, problem-solving, creative IT-literate, employees having workplace skills.

As Richard Adler documents in the following report, the IT sectors in India expect to add about 1.5 million new knowledge workers in the next three years—more than double its current number. Yet India's universities graduate fewer than 100,000 students in computer sciences each year. Only 57 percent the 411 million school-age children in India enter school at all. Less than 20 percent reach high school, and only 10 percent go beyond.

Beyond the numbers, while it is well understood that education plays a pivotal role in a knowledge society, the Indian educational system underpays teachers, so many of them have two or more jobs, making teacher absenteeism a major problem, especially in the villages where about 70 percent of the population lives. At the college level, there are complaints that teaching is rote and out of date. Many Indian students go to "finishing schools" to gain the skills necessary to secure jobs in the information industries. There is an urgent need to bridge the increasing gap between the number of jobs being created by the fast paced IT and telecom led services sector and the availability of ready workplace skilled manpower.

The Conference. Resolution of this problem, which is particularly large in India because of the wide gap between the skills of its huge rural population and the booming IT industry, will have a significant impact on the future of India's industry and economy. This issue therefore posed a particularly relevant topic for the **Second Annual Joint Conference on Communications Policy** between the Aspen Institute India and the Communications and Society Program of the Aspen Institute.

The purpose of the conference is to convene leaders from India and the United States in Information and Communications Technology (ICT)-related industries, current and former public officials, and academic experts to address a significant policy issue facing the ICT sector. In 2006 the topic was the impact of ICT on sustained and inclusive economic development. In 2007 we turned to one of the most significant engines of growth and health in an industry: the development of the workforce—in this case, the knowledge workforce.

As the list of participants in the Appendix indicates, the roundtable was a very impressive gathering of leaders who applied themselves diligently for two and a half days in Chennai in early February 2007 to identify the problems and recommend solutions. Indeed, one could say that their minds were on fire—a phrase the group quickly adopted from Learning 2.0 evangelist John Seely Brown.

The Recommendations. The roundtable participants aimed for an approach that would begin around the edges of the existing education-

al infrastructure—that is, not threaten the existing power structure. They agreed that innovative ideas with an increased role of technology in human resource development and management has the potential to significantly enhance the pace of building skills and capacity. They saw the revolutionary potential of constructionist learning, whereby a person with access to the tools of the infosphere can follow his or her passion, gain access to content freely available worldwide, collaborate with others, and break out of a narrow mindset of low expectations and a set life in a poor remote village.

In the following report, Richard Adler provides context and definition of the problem and then describes the world of Learning 2.0. The strong recommendation of this conference, which engendered much enthusiasm, is to find ways to promote Learning 2.0 in India. This evolution is in its early stages, but there is no time to waste in at least moving onto the worldwide grid of open source learning, piloting projects that have the promise to break the rigid casts of little or no formalized education, inadequate teaching resources, stifling government controls, and disinterest beyond one's own well-being.

As Adler reports, the group latched onto the concept of Knowledge Learning Centers (KLCs), following up on the Hole-in-the-Wall Project that the National Institute of Information Technology (NIIT) pioneered. Participants married these KLCs with the Special Economic Zones (SEZs) that India has embarked on, somewhat controversially, to suggest pilot KLCs in a few of these zones. This approach is detailed in the Appendix created by a subsequent Working Group chaired by Vijay Thadani, Chief Executive Officer of NIIT and chair of the Education Committee of the Confederation of Indian Industry (CII).

Acknowledgements. This roundtable was extraordinary in terms of the excitement and insights it yielded and the enthusiasm it engendered. For that we thank our participants. Once again, we thank our sponsors: Accenture, AT&T, Cisco, Google, Hutchison Essar, Intel, Motorola, Qualcomm, and TCS.

We also thank Vijay Thadani for spending a great deal of time to chair the follow-up activity and the rest of the Minds on Fire team who

worked on the proposal: Armen Ovanessoff, Lokesh Mehra, Neeraj Agarwal, Deepti Bhatnagar, Alka Chaudhary, Stacy Standley (who initiated the working group report), Ann Pendleton-Jullian, Laura Ipsen, and John Seely Brown (who contributed conceptually to the proposal). We also acknowledge and thank Vikram Tiwathia of Aspen India, who led the pre- and post conference activities in India, along with Mansi Sharma, and Mridulika Menon, who managed the project on the U.S. side.

Lt. Gen (Ret.) Shamsher S. Mehta
PVSM, AVSM and Bar, VSM
Director General
Confederation of Indian Industry (CII)
and
Trustee
The Aspen Institute India

Charles M. Firestone
Executive Director
Communications and
Society Program
The Aspen Institute (U.S.)

Minds on Fire:

Enhancing India's Knowledge Workforce

Richard P. Adler

Minds on Fire:
Enhancing India's Knowledge Workforce

Richard P. Adler

A nation is empowered by its people. A people are empowered by their capabilities. People's capabilities are created by investments in their education, well-being and skills, and [by] providing them with opportunities for gainful productive employment.

—Indian Prime Minister Manmohan Singh, August 2005

Today, India is ahead. But it has to work very hard if it wants to keep this position.

—Tom Friedman, *The World is Flat* (2005)

Introduction

India's economy continues to grow at a remarkable pace. The country's gross domestic product (GDP) has been expanding an average of nearly 8 percent per year since 2002. In the fiscal year ending March 2007, India's economy grew at 9.4 percent. This performance means that the Indian economy met its own national five-year growth goal for the first time since the first five-year plan was issued by the government in 1950. At its current rate of growth, India will become a trillion-dollar economy by 2007–2008 and will overtake South Korea to become Asia's third-largest economy, after China and Japan.

The expansion of India's economy has brought substantial benefits to the population. For example, India's middle class (defined as Indians with annual household incomes of more than $4,500) increased from 15 million people in 1991 to approximately 100 million in 2005. At the same time, the country's poverty rate has declined over the past decade from about 40 percent of the population to less than 30 percent today. On the other hand, many Indians, particularly those living in the country's rural areas, have yet to benefit.

India's educational system is widely acknowledged as one of the engines of the country's expansion. The country's schools are responsible for producing a cadre of highly skilled, English-speaking workers who represent the human capital that has fueled economic growth—particularly growth of the country's world-class information technology (IT) sector.

To sustain its economic growth, India will have to keep expanding its labor force. The IT sector alone expects its workforce to nearly double over the next three years, from 1.6 million today to 2.9 million in 2009. While IT companies are seeking to recruit so many new workers, other sectors of the economy—including automobiles, aerospace, retail, construction, biotech, healthcare, financial services, travel, and hospitality—are beginning to grow rapidly and are joining the competition for top talent.

India's educational system is widely acknowledged as one of the engines of the country's expansion.

As India's economic boom rolls on, there are some signs of potential problems that could threaten its continued success. Some recent reports have indicated that in the not-too-distant future, the demand for qualified workers will exceed the supply. A 2005 study by McKinsey & Company forecast that India will experience a potential shortfall of nearly half a million qualified workers by 2010.[1] One major problem, according to this report, is only about one-quarter of India's college graduates are qualified to work in the IT, IT-enabled services (ITES), and business process outsourcing (BPO) industries.

The shortage of qualified personnel also appears in specialized areas. As India attempts to expand into higher value-added services, for example, it will be hampered by the fact that the country produces only 6,000 PhDs annually in all areas of science and engineering. Moreover, even qualified graduates need to update their knowledge after they complete their formal education to keep up with rapidly changing technology, industry, and world developments.

India's greatest educational challenge, however, concerns the large portion of its population who receive little or no formal education. More than one-third of India's 1.1 billion people, including a disproportionate number of women and rural residents, are still illiterate and thereby consigned

to a subsistence life. Despite the promise of universal education in the country's constitution, millions of Indians lack access to the kind of education that would enable them to participate in India's economic growth.

The state of education in India and what needs to be done to sustain and enhance India's global competitiveness were the focus of the second annual Joint Roundtable on Communications Policy sponsored by the Aspen Institute India and the Aspen Institute Communications and Society Program. Participants in the February 2007 meeting included business leaders and academic experts from India and the United States (see Appendix for a list of participants). The conference began in Chennai with discussions among the participants and concluded with a series of meetings with key ministers in New Delhi to present the group's recommendations to the government.

A Very Short History of the Indian Economy

A new account of India's recent economic development (*The Rise of India*, by Niranjan Rajadhyaksha) begins by pointing out that the country was once a major global economic power and that, after a long period of decline, its share of world output began to increase only in the 1990s. At that point, India began to take "the first tentative steps that could put it back on the long journey to prosperity."[2]

For the first half of the last millennium, India had the largest share of income of any country in the world. As recently as the 18th century, it accounted for nearly one-quarter of the world's output. India's fabled wealth under the Mughal and Maratha dynasties attracted traders and conquerors from Europe and elsewhere. By the beginning of the 19th century, however, India's share of the world economy began to decline—gradually at first, then more steeply; as other parts of the world surpassed India, its share of the global economy reached a low point of slightly more than 4 percent in the second half of the 20th century (see table below).

India's Share of the World Economy, 1000–2005

Year	1000	1500	1600	1700	1820	1900	1950	1990	2000	2005
Share	28.9%	24.4%	22.4%	24.4%	16.0%	8.6%	4.2%	4.1%	5.3%	6.3%

Source: Angus Maddison in Rajadhyaksha, *The Rise of India,* www.ggdc.net/maddison

India has enjoyed some periods of prosperity in relatively recent times. According to Rajadhyaksha, in the last half of the 19th century the country experienced a period of rapid growth not unlike that of the present, based largely on the export of cotton and textiles as well as highly prized spices such as pepper, cinnamon, and saffron:

> India was in the midst of the first wave of globalization. New technologies, falling transport costs and free capital flows were stringing together economies around the world. India, too, was breaking out of its old economic structure. The Great Indian Peninsula Railway was built in 1863 to connect Bombay to the cotton-growing districts of the interior. The first telegraph line between India and Europe was laid in 1866. The Suez Canal was opened to traffic three years later.[3]

As a result of these favorable developments, industrial production in India grew at an average rate of 8.4 percent from 1861 to 1900. Unfortunately, the era of open foreign trade did not last. In the early 20th century, countries around the world, including India, ignored the lessons of the past and began to erect barriers to foreign trade. By 1990, when India's share of the global economy was barely above 4 percent, the country had established one of the most protected economies in the world.

After India achieved independence in 1947, it chose to adopt economic policies that proved to be highly inefficient and failed to deliver robust economic growth:

> India was a keen follower of the economic consensus of the 1950s, which held that national planning and protectionism were the way forward. Suspicion of private enterprise, free markets, and foreign trade was endemic in the political class. … Domestic investment was shackled, foreign trade shriveled and foreign capital was kept out. The domestic economy too was bound in a complex and bewildering web of controls. Entire industries were reserved to the public sector and the small-scale

sector. Companies could not make things without a license from the government. Despite rampant shortages, it was a crime to produce more than what you were allowed.

As a result of these inefficiencies, the economy grew at less than 3 percent per year during the 1960s and 1970s. With the population increasing at 2 percent annually, there was little growth in individual income.

The situation improved somewhat in the succeeding decade. In 1980, the government of Indira Gandhi initiated an initial round of reforms that began to unshackle the economy, resulting in a growth rate of 5.8 percent during the 1980s. Unfortunately, government expenditures increased at an even faster rate, and public debt grew rapidly.

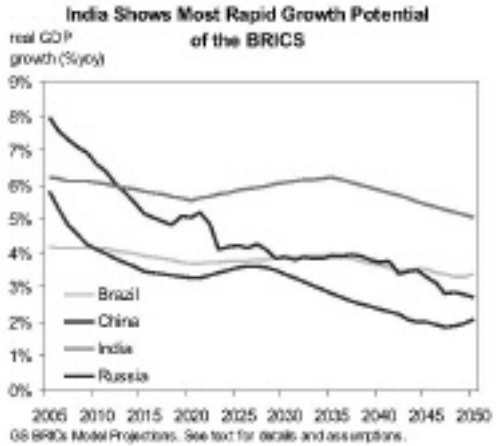
Today India's economic potential seems almost limitless.

In 1991, with the country's foreign currency reserves having fallen to less than $1 billion, the country faced serious financial problems. To avert a crisis, the new finance minister, Manmohan Singh, pushed through a series of far-reaching economic reforms that included lifting restrictions on foreign direct investment (FDI), simplifying the tax system, and abolishing much of the red tape (the "license raj") that had impeded business. The economy revived, industry picked up, inflation was checked, and the stage was set for India's current prosperity. The overall economy has grown at more than 8 percent per year for the past five years. Whereas average income rose just 1.2 percent per year between 1950 and 1980, it has increased more than 4 percent per year since 1991.

Today India's economic potential seems almost limitless. A 2003 study by Goldman Sachs of the economic potential of Brazil, Russia, India, and China (the "BRIC" countries) predicted that India's economy will be the third-largest in the world within 30 years, trailing only the United States and China (which is on the way to becoming the world's largest economy).

Source: Dreaming with the BRICs, Goldman Sachs, 2003

The same study concluded that although economic growth is expected to slow substantially in the other BRIC countries, as well as in the G6 countries, India "has the potential to show the fastest growth over the next 30 to 50 years [with] growth higher than 5% over the next 30 years and close to 5% as late as 2050" (see chart below).[4] India's GDP is projected to reach $27.8 trillion by 2050—nearly 35 times larger than its current GDP. The key factor that will allow India to continue to grow economically is that it is the only BRIC country whose population will continue to increase over the next half-century.



Source: Dreaming with the BRICs, Goldman Sachs, 2003

India versus China

For many years, whenever India was discussed in a global context, it typically was "hyphenated" with Pakistan in terms of the potential for regional conflict. Today, when India is discussed, it is most often linked with China, in terms of their rapid economic growth potential and seemingly unlimited potential. The comparative strengths and weaknesses of these two rapidly emerging Asian powers is a popular topic in discussions of global economic trends (see table below).

	India	China
Population	1.1 billion	1.3 billion
Median age	24.7 years	32.2 years
Population under 14	31.2%	21.4%
Rural population	72%	61%
Adult literacy rate	68%	95%
Number of college students	10.5 million	14 million
Female labor force participation	45%	79%
GDP (2006)	$796.1 billion	$2.512 trillion
GDP per capita (US$)	$675	$1,295
Portion of GDP spent on R&D	0.85%	1.5%
Internet users per 1,000 people	17	63
Mobile phones per 1,000 people	25	215

Source: China & India: A Visual Essay, Deutsche Bank Research, October 10, 2005; *CIA World Factbook*

In many areas—including population, overall economic size, and per capita GDP—China still overshadows India. China also has a distinct advantage in terms of population literacy, female labor force participation, and technology infrastructure. India, however, has a demographic advantage in the age of its population. It also enjoys a robust democratic government that may provide a long-term advantage over China's authoritarian system.

Education and Economic Growth

Education is one of four "core factors that can set the stage for economic growth," according to the authors of the Goldman Sachs report on the prospects of the BRIC countries. (The other three core factors are macroeconomic stability, institutional capacity, and openness.) The authors note that there is a positive correlation between the educational attainment of a country's population and the growth rate of per capita GDP. Studies have found that, on average, one additional year of schooling per child produces an increase of about 0.3 percent per year in annual growth rate over a period of 30 years. Although rising educational levels have contributed to the economic vitality of the BRIC countries generally, the report's authors conclude that, among these countries, "India receives low marks for educational indicators, particularly at the primary and secondary levels."[5]

India's IT Sector and the Looming Staffing Crunch

India's IT sector has been the most dynamic contributor to the country's growth, fueled in large part by the country's talented, well-trained, English-speaking workforce. Having developed a small but efficient domestic IT industry in the 1980s and early 1990s, India was well-positioned to take advantage of the rapid expansion of international telecommunications capacity that created a global market for BPO. Over the past decade, India has attracted a disproportionate share of this business. Initially the country's success was built on providing lower-level functions such as call centers and large but routine programming projects; over time, Indian companies have been taken on increasingly sophisticated projects.

The IT sector will grow as much in the next three to four years as it did in the past 25 years.

India's IT revenues (including ITES and BPO revenues) have nearly doubled in the past two years. Revenues are projected to increase 26 percent in fiscal year (FY) 2007, reaching a total of US$39.7 billion, up from just US$16.7 billion in 2004 (see table below).

Indian Information Sector Revenues (US$ billions)

	FY 2004	FY 2005	FY 2006	FY 2007(est.)
IT	$10.4	$13.5	$17.8	$23.7
ITES/BPO	3.4	5.2	7.2	9.5
Engineering/R&D	2.9	3.9	5.3	6.5
Total	$16.7	$22.6	$30.3	$39.7

Source: National Association of Software and Service Companies (NASSCOM)

As India's IT sector expands, the workforce it employs will also need to grow. The companies in this sector currently employ more than 1.2 million workers, according to S. Gopalakrishnan, President and Chief Operating Officer of Infosys Technologies Ltd. To sustain the growth they expect, IT companies will have to add 390,000 workers in FY 2007, more than 500,000 in FY 2008, and 660,000 workers in FY 2009 (see table below)—more than doubling the total workforce in just three years. In other words, the industry will grow as much in the next three to four years as it did in the past 25 years.

Indian IT Sector Employment

Current	1,287,000
FY 2007	+390,000
FY 2008	+507,000
FY 2009	+660,000
	2,844,000

Source: NASSCOM

According to Gopalakrishnan, IT industry leaders realized in the 1980s that Indian IT companies would not be able to continue to grow by recruiting only workers with formal training in computer science, electronics, and telecommunications. Initially, they began to recruit engineers from other fields—civil engineering, mechanical engineering, and aeronautical engineering—and then converting them into software engineers by providing them with additional training on the job.

Because many graduates lack the strong IT-specific skills that employers need, the amount of training that is being done by IT companies is substantial and growing. India's colleges and universities currently produce fewer than 100,000 graduates in computer science each year. The number of engineering graduates from four-year programs is about 270,000 people annually. Adding graduates of two- and three-year diploma programs, the total number of graduates is about 500,000. According to India's National Association of Software and Service Companies (NASSCOM), however, only about 150,000 to 200,000 of these graduates are fully qualified to work in the kinds of challenging jobs that exist in the IT sector—well below the number of new hires the industry needs to continue growing as fast as it believes it can.

As the economy expands, other sectors are beginning to grow and exert their own demand for workers.

S.S. Mehta

In the past five years, Indian IT companies have begun to recruit even more broadly for new hires, looking beyond engineering and technical graduates to students with degrees in management and other nonengineering fields. In addition to 500,000 "technical" graduates, India's higher education system produces 2.3 million graduates in the humanities and other nonscientific fields. To secure enough staff with the right skills, however, India's IT companies have had to make substantial investments in training and retraining workers. In the past four years, for example, Wipro, one of India's largest IT companies, has increased the size of the faculty in its internal training division from four people to 116 people. K. S. Vishvanathan, Senior Vice President and Chief Executive of India Operations for Wipro, noted that this massive expansion was directly related to the company's inability to recruit enough new workers who come to the company prepared with the right set of skills. Infosys is reported to have 4,000 workers in training at any one time to meet the company's staffing needs.

Even with these efforts to provide additional training, Gopalakrishnan acknowledged that finding half a million or more qualified new workers each year will not be easy. He also noted that by themselves, the companies represented at the roundtable in Chennai would probably be attempting to hire 150,000 to 200,000 new workers in the coming year.

India needs more than just technical workers; it also needs people with the management skills to help run its rapidly growing companies efficiently. Lakshmi Narayan, Vice Chairman of Cognizant Technology Solutions, estimated that his company needed to hire one MBA for every 40 technical people that it hired. However, the number of MBAs produced by the Indian educational system is not keeping pace with the needs of industry.

To further exacerbate the human resources challenge, many IT companies are attempting to move from providing low-cost, routine, "commodity" services to offering more value-added, knowledge-intensive services, such as research and development (R&D) and business process consulting. Increasingly, India is not only providing "back room" operations for companies in the United States and elsewhere around the world, it is becoming an attractive destination for major corporate operations, including R&D activities. How far India's high-tech sector has come is dramatically illustrated by the commitment that Cisco Systems has recently made to expanding its presence in the country. According to Laura Ipsen, Cisco's Vice President for Global Policy and Government Affairs, Cisco has decided to invest US$1.1 billion in India. The company will also locate one-fifth of its top talent in India and triple its total workforce in the country to 10,000 people over the next three to five years. In addition to establishing a pilot manufacturing capability in Chennai, Cisco is planning to make India the hub for developing key technologies in routing, software, and network management.

As companies such as Cisco expand into more sophisticated operations, they will have to recruit more workers with advanced degrees. However, India produces only about 6,000 PhDs each year in the sci-

ences and engineering (compared to about 25,000 science and engineering doctoral degrees granted in the United States in 2003).[6] Ironically, the IT industry's success has exacerbated the problem of recruiting people with advanced degrees: More Indian students would probably chose to enter PhD programs if they were not so heavily recruited to attractive jobs in IT when they receive their bachelor's or master's degrees.

Finally, although IT companies have led the revival of the Indian economy, they are no longer the only players in the field with regard to competing for qualified workers. Shamsher S. Mehta, Director General of the Confederation of Indian Industry (CII) and trustee of the Aspen Institute India, pointed out that as the economy expands, other sectors are beginning to grow and exert their own demand for workers. For example, the bio-pharmaceutical sector is beginning to grow rapidly. Repairing and improving the country's infrastructure is expected to involve approximately $350 billion in investments over the next five to seven years. Healthcare and financial services are also beginning to expand. General Mehta noted that engineers and other well-trained graduates who are choosing to work in the IT sector today because it offers the most attractive opportunities may make different choices in the future as other sectors compete more aggressively for new employees.

The Trouble with Higher Education

India's educational system is full of paradoxes. In terms of enrollment, India's higher education system is the third-largest in the world (only China and the United States are larger). Moreover, India has the largest number of higher education institutions of any country: more than 18,000 institutions (348 universities and 17,625 colleges). The overall size of the country's higher education system has increased substantially, driven primarily by the establishment of private institutions designed to meet the demand for more education. The number of Indians participating in higher education more than doubled from 4.9 million in 1990 to nearly 10.5 million in 2006. This increase in size has not been matched, however, with an improvement in the quality of higher education.

Table 1: Typology and growth trends of higher education institutions

Type	Ownership	Financing	Number of institutions*	Number of students*	Growth trends
Universities under the Government	Public	Public	240	1,000,000	Not growing
Private Universities	Private	Private	7	10,000	Emerging on the scene
Deemed Universities (Aided)	Private or Public	Public	38	40,000	Growing slowly
Deemed Universities (Unaided)	Private	Private	63	60,000	Growing rapidly
Colleges under the Government	Public	Public	4,225	2,750,000	Not growing
Private Colleges (Aided)	Private	Public	5,750	3,450,000	Not growing
Private Colleges (Unaided)	Private	Private	7,650	3,150,000	Growing rapidly
Foreign Institutions	Private	Private	150	8,000	Emerging on the scene
Total			***18,123***	***10,468,000***	

Source: Author [these are approximate figures based on analysis of primary data for the year 2005/06]*

Source: Pawan Agarwal, *Higher Education in India: The Need for Change.* Icrier Working Paper 180, June 2006

At the top level, the seven India Institutes of Technology (IITs) and six India Institutes of Management (IIMs) have produced a cadre of highly skilled graduates who are largely responsible for building India's vibrant high-tech industry. As *The Economist* has noted, "These elite institutions help to keep India plugged into the global knowledge economy."[7] The IITs can accommodate only 5,500 new students each year, however, and more than 300,000 individuals compete for these coveted slots each year.

Below the limited tier of top schools, the quality of Indian higher education falls off sharply. The 2006 "Report to the Nation" from the National Knowledge Commission provided a sobering assessment of the general state of technical education:

> Except in a few elite institutes, engineering education in India is often outdated and irrelevant. Most graduates do not possess

> the skills needed to compete in the economy, and industries have been facing a consistent skills deficit. Also, most institutes, including premier institutes, fail to attract and retain quality faculty. These deficiencies in technical and engineering education mean that India runs the risk of missing out on significant opportunities.[8]

Similar problems are evident in other areas of higher education. Although millions of students eagerly seek the advantages of a college degree or diploma, in many cases the education they receive does not give them the skills they need to get good jobs. A recent article in the *International Herald Tribune* offered a bleak assessment of the state of higher education in India:

> Most of the 11 million students in the 18,000 Indian colleges and universities receive starkly inferior training, heavy on obeisance and light on marketable skills.… All but a tiny handful of graduates are considered unemployable by top global and local companies.[9]

In contrast to the United States and most developed countries, the unemployment rate among Indian college graduates—17 percent in the 2001 census—is higher than the unemployment rate for high school graduates. For many Indian graduates, the problem is not just that they lack specific technical skills that industry needs but that they lack the "soft skills"—the ability to listen and to communicate well (in English), to solve problems, and to work collaboratively and creatively—that are among the abilities that many companies are seeking in their new hires.

A global ranking of "top world universities" reflects the weaknesses of higher education in India. Only two Indian universities appear in the 2006 list of 500 top universities prepared by the Institute of Higher Education at Shanghai Jiao Tong University, and neither of them appears in the top 300. By comparison, Israel, with 1/200th the population of India, has seven places on the list of top 500 universities, and China has 14.[10]

India's higher education system suffers from several handicaps. One problem is that the system is highly fragmented. The large number of institutions means that the average college in India has an enrollment

of fewer than 600 students—considerably lower than in the United States, where the average is closer to 4,000 students, or China, where colleges average almost 9,000 students.

In addition, whereas India's business sector has benefited from regulatory reform, the country's higher education system continues to be mired in a web of regulation—particularly on the university level, which remains essentially a government monopoly:

> The Indian education system is one of the most tightly controlled in the world. The government regulates who you can teach, what you can teach them and what you can charge them. It also has huge regulatory bottlenecks. There are considerable entry barriers: Universities can be set up only through acts of legislation, approval procedures for starting new courses are cumbersome, syllabi revision is slow, and accreditation systems are extremely weak and arbitrary. The regulators permit relatively little autonomy for institutions and variation amongst them.[11]

Unless ministries come together to forge a common policy approach, progress in education will continue to be slow.

Further complicating the regulatory picture, multiple government ministries are involved in setting educational policy. K. S. Vishvanathan of Wipro pointed out the ministries of education, labor, information technology, and human resource development all have stakes in education. Each has its own priorities and does not work effectively with other agencies. Unless these ministries come together to forge a common policy approach, progress will continue to be slow.

A final problem for India's higher educational system is the relatively low wages that these institutions are able to pay their faculty. As the report from the National Knowledge Commission noted, the country's colleges and universities—even the elite institutions—are not able to compete effectively with the private sector in attracting and retaining high-quality faculty members. Moreover, unlike schools in many Western countries, Indian colleges and universities do not provide a

culture that supports and rewards faculty members for engaging in research. Academic advancement is based strictly on seniority.

As a result, there is little incentive for faculty members to pursue the kinds of research interests that could provide a basis for collaboration with the private sector, as well as opportunities for additional compensation from consulting or the commercialization of faculty innovations.

There is a disconnect between the skills Indian industry needs and the skills many educational institutions provide.

In view of these problems, it is not surprising that there is a disconnect between the skills Indian industry needs and the skills many educational institutions provide to their students. For example, only about 15 percent of graduate students in engineering are able to pursue degrees in computer science, and the entire country produces just 300 PhDs in computer science each year. Although a much larger percentage of engineering students would like to study computer science—and good jobs would be available for many more computer science graduates than the country's educational institutions now produce—the limiting factor is the number of slots in the field that are available in the country's graduate schools.

The extent to which demand for quality education exceeds the available supply is evidenced by the fact that about 160,000 Indians choose to study overseas each year, at a cost estimated at approximately $4 billion annually. In fact, Indians constitute the largest group of foreign students in the United States. Although an increasing percentage of these students are now returning to India after receiving their degrees to pursue expanding opportunities at home, those students who choose to remain in the countries where they receive their higher education are resources that are largely lost to the Indian economy.

As noted above, many IT companies are making substantial investments in providing on-the-job training for their employees. Some IT companies are also offering internships to students to introduce them to the opportunities and challenges provided by the private sector and give them a chance to begin acquiring the skills they will need to be suc-

cessful in the business world. According to Manoj Varghese, Director of Human Resources for Google India, however, the curriculum structure at many schools does not allow students to take time from their studies to accept an internship, nor is there much interest among faculty members in encouraging students to pursue these opportunities.

In addition to the country's colleges and universities, an entire industry of private "finishing schools" has sprung up to provide graduates with the practical training that they have failed to get in their college educations. Although the training offered by organizations such as the National Institute of Information Technology (NIIT) and Globysn Technologies is not formally accredited by the government, these enterprises have been successful because they provide the specific skills that many employers want in new hires. NIIT, which was founded in 1981 by two IIT graduates, is now one of India's largest educational institutions. Over the past 25 years, this publicly traded company has provided training in virtually every area of technology through its corporate training program. The company currently has 500,000 students enrolled at more than 3,000 locations in India and claims to have provided training to "one out of three software professionals in India." Globsyn operates a "Software Finishing School" in West Bengal that provides a "globally benchmarked, industry relevant curriculum [that] reflects the continuous paradigm shifts in the IT industry." Both companies have divisions that provide outsourcing services that help keep them in close touch with the actual needs of industry.

Improving Higher Education

Several initiatives have been launched recently to expand higher education generally, and technical education in particular. According to Vikram Tiwathia, Chief Information Officer of the CII, the Indian Planning Commission is working on a plan to establish 20 new Indian Institutes of Information Technology (IIITs); six have already been set up in Hyderabad, Gwalior, Jabalpur, Bangalore, Allahabad, and Trivandrum. In addition, funds from a World Bank loan are being used to upgrade the quality of education at about 100 institutions. The National Knowledge Commission has called for India to have 1,500 universities, including 50 national universities, by 2015—almost a five-fold increase from the 350 universities in the country today. The com-

mission has also recommended creation of an independent regulatory authority for higher education that would substantially reduce government control over higher education.[12]

Efforts also are underway to use IT to expand access to education and to make up for the lack of enough qualified faculty. The National Program for Technology Enhanced Learning (NPTEL), launched in 2002, is intended to "enhance the quality of engineering education in India by developing curriculum-based video and web courses." The program is funded by the ministry of human resource development and is being carried out by the seven IITs and the Indian Institute of Science-Bangalore, along with several other technical institutions.

Higher education needs more autonomy if it is going to be able to innovate.

One of the oldest technology-based higher education initiatives in India is the Indira Gandhi National Open University (IGNOU). Established in 1985, IGNOU provides academic and vocationally oriented education in 125 fields of study, including environment and sustainable development, hospitality, HIV/AIDS, disaster management, public policy, power distribution management, construction, rural artisans, and motor mechanics. As Stacy Standley, Managing Director of ICG, pointed out, after more than 20 years of operation, the university is reaching a total of 1.5 million students in India and beyond. Although this number is not insignificant, it is small in comparison to the scale of the need for effective higher education. Standley suggested that IGNOU could serve as a platform to substantially increase the reach of higher education in India.

There was broad agreement among the roundtable participants that higher education needs more autonomy if it is going to be able to innovate and that more far-reaching changes are needed to modernize Indian higher education and enable it to scale up to meet the demands of a rapidly expanding economy. Several participants called for reform

of the regulatory framework that restricts the development of education, as government regulation hampered the growth of business before 1991. There also was general agreement that higher education would benefit greatly from more extensive cooperation between the public and private sectors.

As India attempts to develop a broad knowledge-based economy, there needs to be a robust infrastructure to support it.

R. Natarajan

One concept that has attracted attention and controversy has been a proposal to open India to foreign universities. A bill has been introduced in the Indian parliament that would make it easier for foreign universities to set up campuses in India. Several foreign institutions are already operating in India, generally in partnership with indigenous schools, but the legislation would permit foreign colleges and universities to operate independently and be formally accredited. However, opposition from parties that are concerned about the "commercialization of education" has kept the legislation from passing.[13]

S. Gopalakrishnan of Infosys described an innovative new public-private partnership to train 100,000 "tally professionals"—individuals with accounting and computer skills—in a period of one year. This collaboration between Infosys, the CII, and the state of Karnataka is designed to tap the energy of individual entrepreneurs who will be helped to set up local training programs across the state. The plan is to recruit and support a cadre of 350 entrepreneurs, each of whom will provide training to 300 students. Half of the student tuition of 6,000 rupees (US$135) will be subsidized by the government, with the expectation that students will be able to cover the other half of the tuition through loans or support from employers who need their skills. A pilot for this initiative has been completed, and the project is now being implemented on a broader scale. If it works as expected, the program should be self-sustaining, based on revenue from multiple sources, and it could serve as a model for expanding training in other badly needed skills.

R. Natarajan, former director of the IIT Madras, pointed out that as India attempts to develop a broad knowledge-based economy, there needs to be a robust infrastructure to support it. In part, this infrastructure is a matter of physical elements such as reliable telecommunications, a stable power supply, wider PC penetration, and broader access to education. It also will require an upgrading of higher education, however, to include research and support innovation as well as conventional teaching. S. Mahalingam, Chief Financial Officer of Tata Consultancy Services, called for development of mechanisms to compensate faculty members for consulting with industry and financial rewards for the commercialization of new products or services that are based on academic research.

Natarajan pointed out that the world continues to change rapidly, and global competition is becoming increasingly intense. Educational institutions need to continue to evolve to remain effective in preparing students to thrive in this world. He noted that the "half life of knowledge" in many technical areas is now less than four years. Hence, 50 percent of what students learn as undergraduates will be obsolete by the time they graduate and begin to seek employment. Therefore, colleges and universities must do more than provide students with knowledge and skills; they must teach them how to keep learning throughout their lives. As Harsh Manglik, Chairman of Accenture India, pointed out, "It is impossible to imagine what IT will be 20 years from now—perhaps even five years from now—so we have to give people a broad foundation and the flexibility to stay current to educate themselves."

Asian University for Women

A new type of higher education institution, the Asian University for Women (AUW), is scheduled to open in Bangladesh in 2008. Under development since 2002, this institution will serve women across Asia. According to Ann Pendleton-Jullian, Associate Professor of Architecture at the Massachusetts Institute of Technology, who has been involved in the design of the campus, the AUW is designed to provide educational opportunities for Asian women from diverse political and cultural backgrounds, including Hindu, Buddhist, Islamic, and Christian.

Bangladesh	25%
India	10%
Pakistan	10%
Afghanistan	5%
Myanmar	5%
Nepal	5%
Sri Lanka	5%
Vietnam	5%
Refugee	5%
Bhutan	1%
Cambodia	1%
Laos	1%
Maldives	1%
Other	21%

Projected composition of AUW student population

The AUW will provide undergraduate education as well as graduate programs in management, public policy, environmental engineering, and information technology. It will also offer a program in entrepreneurship that will actively involve industry representatives in its activities.

In planning the university's physical plant, considerable attention was given to the issue of ensuring environmental sustainability. The design of the campus has emerged from a multidisciplinary team of

international planners, engineers, and architects working in collaboration with local architects who are familiar with local materials and techniques that are being used to build the campus.

A key idea driving AUW planning is that women, who often have been marginalized in traditional Asian cultures, have a great unrealized potential for "breaking down the borders of silence and misunderstanding throughout the region." Although the school will accommodate only 2,500 students, the developers of the AUW expect that preparing even a small group of talented women for positions of leadership in the political, economic, and cultural spheres and then keeping them connected through a strong international network can lead to far-reaching changes.

John Seely Brown, director emeritus of Xerox Palo Alto Research Center (PARC), argued that to remain relevant and useful in the 21st century, education must respond to three challenges. First, it must shift from training people for discrete careers to preparing people for "career trajectories" that may consist of several distinctly different careers. Second, education must move from an emphasis on "schooling" to an emphasis on supporting "continuous learning." Finally, students must shift from "learning about something" to "learning to be." According to Brown, the essential element that is missed by most conventional classroom education is preparing students to be "practitioners in a field." This is not something that can be taught from a book or by rote learning; it comes from a process that is akin to apprenticeship—a process that allows students to work directly with practitioners in the field so they can begin to understand and acquire the practices and sensibilities required for active participation in that field. The model for this type of learning is the architectural "atelier," in which students work in open spaces where they can observe and interact with the work of fellow students and an instructor's critique of individual student's works can be heard by other students. This instructional method is effective because this process is carried over more or less intact to the way actual commercial architectural practices operate.

To illustrate how this transformation can happen and the benefits it offers, Brown cited the redesign of one of the fundamental undergraduate courses at the Massachusetts Institute of Technology (MIT). MIT's course on electricity and magnetism is a prerequisite for any student who intends to become an engineer. However, the course was so difficult that, according to Brown, "it did a brilliant job of convincing most kids [at MIT] not to go into engineering." One of the lead instructors decided that the course should not be such an ordeal and took on the challenge of finding a better way of teaching the material. Rather than continuing to follow the traditional "British model" of lectures and textbook learning, the instructor reorganized the course into a "studio model" of learning. In this new model, there is relatively little lecturing. Instead, students sit in groups where they conduct experiments and work on problems together and learn from and with each other. Not only did this new model improve results for most students, it produced the greatest gains in learning among the lowest-performing students. Studio-based learning has also been widely used at North Carolina State University, where the failure rate for lower-performing students was reduced by 80 percent.

Although the benefits of this type of collaborative learning are appealing, such an approach stands in stark contrast to the way the great majority of Indian college students are being educated today. Kanwalinder Singh, President of Qualcomm India, argued that India must change its mindset about the role of education if it is going to continue to grow. Ultimately, he suggested, India will need to train its own population and create an environment that will attract the best talent from anywhere in the world—as the United States was able to do in the twentieth century.

A Larger Challenge

India is a young country: One-third of its population of 1.1 billion is younger than 14, and more than 60 percent of the population is younger than 35. The median age of the Indian population is 23 years, compared to 35 for the United States and 41 for Japan.

India's young population represents a competitive advantage relative to much of the rest of the world. The size of its potential workforce will

continue to expand while the workforce in many other countries will be relatively static or begin to shrink (as Japan's has already begun to do). This demographic edge is the reason India's economy is expected to keep growing at a higher rate than that of China and other BRIC countries over the next several decades.

As S. S. Mehta of the CII noted, however, the quality and reach of Indian education will have to be dramatically improved at all levels if the country's demographics are to be an economic advantage rather than a burden. The evidence to date suggests that India is not doing a very good job of meeting this challenge. The country has a total of 1.1 million primary and secondary schools that employ a total of 2.9 million teachers. Only 234 million of India's 411 million young people enter school at all, however. Less than 20 percent reach high school, and less than 10 percent enter college. Only 50 million of India's 1.1 billion people— less than 5 percent of the total population— have degrees past high school. According to figures compiled by UNICEF, 35 percent of the Indian population is illiterate, compared to the global rate of approximately 20 percent.

India's young population represents a competitive advantage.

Although the Indian government is officially committed to providing "free and compulsory education" to all children, the quality of education available to the country's poorest residents living in rural villages and urban slums often is little more than "basic literacy instruction dispensed by barely qualified 'para-teachers.'"[14] One key problem is a shortage of qualified instructors. According to Vijay Thadani, Chief Executive Officer (CEO) of NIIT Limited, "We have a severe shortage of teachers. We have a severe shortage of students who want to take up teaching as a profession. Teaching is not considered as a preferred profession. So we have a severe problem of teachers, and the problem gets magnified by an order of magnitude when you look at rural settings."

Nearly three-quarters of the Indian population—700 million people—live in 600,000 rural villages, many of which still lack basic services such as electricity and clean water. Rural school teachers are paid so little they are often forced to take second jobs to make ends meet, which means that many of them only teach part-time. A study conducted by

Harvard University found that on any given day, "one out of four teachers in state-run primary schools is absent, and of those present half are not teaching."[15]

The difficulties that poor rural Indians face in getting a decent education were described by *New York Times* columnist Nicholas Kristof, who reported on a visit he made to the small rural town of Khawaspur in the northern Indian state of Bihar:

> The village has no electricity. It has a school with 600 students, but—as is common in Indian state schools—many teachers show up only rarely. "We go to school, but the teachers don't," explained Doli, a second-grade girl.
>
> On a typical day there will be just one or two teachers in the whole school, and the students learn next to nothing. "You have to bribe your way to be a teacher there," explained Yogender Singh, who tutors children for payment.
>
> … In a village in Gujarat that I visited, all the children were out of school because the teachers had decided to take a month-long vacation.[16]

The challenge of getting a good education is particularly difficult for young women. Whereas the illiteracy rate among the entire population is 33 percent, it is 40 percent among women. Approximately 70 percent of girls who begin primary school drop out before they complete it. Although women account for 48 percent of the total population, they represent just 31 percent of the workforce, and just 18 percent of the workforce in the country's "organized sector" (formal employment), where education is most important.

On the other hand, there is evidence that when women are given access to education, they can do very well. According to Vijay Thadani of NIIT, the scores of women on competitive national board exams have been improving steadily over the past 10 years as more women have gotten access to education.

Technology-Based Initiatives

By some estimates, eliminating illiteracy in India would require establishing up to 10,000 new schools each year. Given the problems with existing schools, India probably cannot afford such a solution. If India is to make progress in expanding access to education, technology will have to be part of the solution. Today, however, most Indian schools—particularly those in rural areas—are not connected to the Internet. Parag Kar, Senior Director-Government Affairs for Qualcomm India and the South Asian Association for Regional Cooperation (SAARC), noted that although several groups are producing excellent educational materials for the schools, more attention needs to be given on how to deliver this content efficiently.

"It's about scale. The challenge now is to take all of the great efforts we are doing individually and bring them together in a more coordinated manner to have the size to make a sustained impact."

Frank Jones

Some promising experiments have taken place in recent years. Roshni Venkatesh, Corporate Citizenship Lead for Accenture, described a project in Kuppam designed to spark interest in science among students and teachers. The project, sponsored by the Agastya International Foundation, uses mobile science labs that visit schools in rural areas where students can engage in hands-on scientific experiments and be exposed to sophisticated audiovisual materials about science. Each mobile lab can serve up to 300 students per day with more than 100 different experiments.[17]

Several innovative educational projects have been funded by companies represented at the roundtable in Chennai. Cisco is sponsoring 161 Cisco Networking Academies that have involved more than 7,700 students in 23 of India's 36 states. Since their inception in 2001, 4,800 students have graduated from these academies. Intel has worked with 40 schools to introduce programming courses that have been taken by some 5,000 students and has established Intel Computer Clubhouses in New Delhi and Bangalore. Frank Jones, President of Intel Technology India, said that although he was proud of his company's efforts, they represent just "a drop in the bucket." He explained that "it's about scale.

The challenge now is to take all of the great efforts we are doing individually and bring them together in a more coordinated manner to have the size to make a sustained impact."

One of the most provocative experiments in using technology to expand access to education has been the "Hole-in-the-Wall" project sponsored by NIIT Limited. In 1999, NIIT's chief scientist, Dr. Sugata Mitra, decided to find out what would happen if a computer was made freely available to poor young children. Under his direction, a hole was punched in a wall separating an NIIT office in New Delhi from a poor neighborhood that surrounded it, and a PC was installed in the hole. The computer quickly attracted a group of children from the neighborhood. After an initial period of unstructured experimentation and play, the children organized themselves to teach each other how to use the computer, with little or no outside intervention or instruction. The result of the experiment led Dr. Mitra to develop an approach that he calls "minimally invasive education" that is based on the following premise:

> The acquisition of basic computing skills by any set of children can be achieved through incidental learning, provided the learners are given access to a suitable computing facility, with entertaining and motivating content and some minimal human guidance.[18]

Hole-in-the-Wall Learning Station

Evaluations have shown significant improvements in academic performance in English, math, science, and social science among young people with access to a Hole-in-the-Wall computer. Based on the success of the

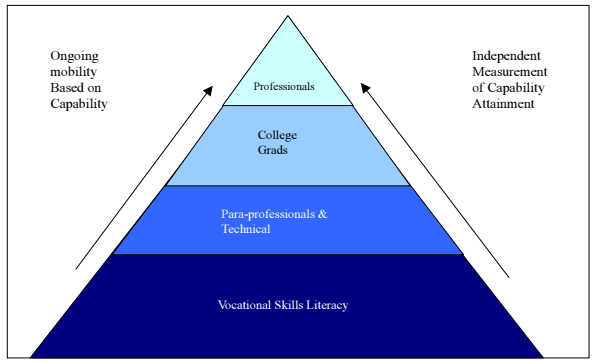
initial installation, 30 Hole-in-the-Wall Learning Stations have been set up in villages and urban slums around India. Some have been installed at schools, but in these cases, they are installed outdoors on school playgrounds rather than in classrooms or special computer labs. These informal settings are chosen to provide unstructured access that encourages the children themselves to "take ownership of the Learning Stations by forming self-organized groups that learn on their own." According to Vijay Thadani of NIIT, open access to the computers also encourages girls to get involved in using them, which is less likely to happen in more formal classroom settings. In fact, he noted, girls often take a leadership role in organizing access to a Learning Station so everyone in the neighborhood who is interested has an opportunity to use it.

J. Raghuram, General Manager-Human Resources for Hutchison Essar South, Ltd., suggested that instead of attempting to build enough schools and hiring enough teachers to educate the entire population, India should make a commitment to digitizing the best educational content and make it available to the whole country. At least part of the technology needed to distribute this content is already in place. In 2004, the Indian Space Research Organization (ISRO) launched EDUSAT, a satellite designed specifically to expand access to education across the entire country. This high-powered satellite contains a dozen transponders targeted to different areas of the country. The satellite can transmit programming that can be viewed on any television set with a small antenna and a low-cost receiver. The satellite has been used initially to distribute college-level technical courses, but applications are being developed that are aimed at providing "tele-education" to primary- and secondary-level students.

A Vision for Change

Participants in the Aspen Institute Roundtable in Chennai agreed that a broad new vision was needed to guide the evolution of education in India. The goal of education should be to provide all Indians with the skills they need to reach their highest possible level of attainment. At a minimum, everyone should be literate and have a chance to learn basic vocational skills. Beyond that, people should be able to get the education they need to move toward higher levels of ability, including paraprofessional and professional skills. Employability and economic mobil-

ity should be determined not by degrees earned but by attainment of specific capabilities as measured and certified by an independent body. Harsh Manglik of Accenture-India sketched out a "capability attainment pyramid" that illustrates the vision of providing all Indians with the skills they need to fulfill their potential (see figure below).



Capability Attainment Pyramid

This diagram is intended to capture three key concepts. First, "ongoing mobility based on capability" refers to both lateral mobility (across occupations and professions) and vertical mobility up an economic scale; second, the concept of "capability measurement" would be provided through a common nationwide assessment system, managed by an independent authority that would assess and certify skill levels across domains and professions; and third, that in addition to teaching professional skills, an ideal education system will also impart "critical" skills such as problem solving, communications, project management, conflict resolution, collaborative teamwork, and creative and critical thinking skills that are vital to high-level employment.

From Web 2.0 to Learning 2.0

The most difficult question that the roundtable attendees grappled with is how this appealing vision can be realized and how promising educational experiments and pilots can be scaled up to reach a majority of the population. Reed Hundt, Senior Advisor, McKinsey & Company, noted that the challenge of educating all citizens is a global challenge, not just an Indian challenge. Fortunately, an exciting new

movement, described by John Seely Brown as "Learning 2.0," is underway. The inspiration—and many of the actual tools—for this transformation comes from the emergence of the panoply of new resources that make up what has come to be known as the "Web 2.0."

The original World Wide Web, "Web 1.0," that emerged in the mid-1990s was a revolutionary development that vastly expanded access to information. Web 2.0, which has emerged in just the past few years, is sparking an even more far-reaching revolution by making it easy for any individual with access to the Internet not only to find existing information but to create and share his or her opinions, observations, ideas, and information with the rest of the world. New tools such as blogs, wikis, social networks, "tagging" tools, and content-sharing sites are creating a dramatically new user-centric information infrastructure.[19]

The open source movement has provided a powerful model for "open source learning."

To illustrate how new online tools enable a new kind of learning, Brown cited the example of the open source software movement. This global phenomenon is based on groups of contributors who work together to develop and maintain software and other information resources on a noncommercial basis. These resources typically are made available at no cost to potential users, who also are encouraged to change or improve the resources as long as they agree to share their contributions with others at no charge. Initially, the open source movement produced software products such as the Linux operating system and the Apache Web server, which have offered surprisingly robust alternatives to commercial software. More recently, the principles of open source have been expanded from the creation of computer software to the creation of information products such as Wikipedia that appeal to a much wider audience.

In addition to changing the economics of content creation, the open source movement has provided a powerful model for "open source learning." Each open source resource is the product of a community of creators who must learn how to work together with little or no formal structure. These communities have developed a set of practices that are very effective, however, in providing training for individuals who wish

to become members and contributors. In a 2006 article, Brown described how this process works:

> New members almost always begin by writing and patching non-kernel [i.e., noncritical] code. Having made enough contributions that are robust, useful, and done in the style of the community, neophytes are eventually allowed to make contributions to the kernel operating system code—a real achievement. This is how they become recognized as key members of the community.… Said differently, what has emerged is a powerful "distributed cognitive apprenticeship" that functions across the world. Today, there are about one million people engaged in developing and refining open source products, and nearly all are improving their skills by being part of these networked communities.… Although there is no formal credentialing process [in these communities], it informally exists.[20]

In this kind of process, Brown notes, "learning happens seamlessly as part of an enculturation process as the learner moves from the periphery to a more central position in the community."

Although the open source movement began with the development of computer software (which meant that participation was largely confined to people with programming skills), its principles have now been adopted in other domains. Perhaps the best-known example today is Wikipedia, the online "open source" encyclopedia that has become a widely used and widely accepted reference work and has, in fact, challenged the supremacy of commercial encyclopedias. Because it is continuously maintained and updated by a community of thousands of contributors around the world, Wikipedia is more comprehensive and timely than any commercial, print-based publication.

The Open Courseware Movement

In recent years, the open source movement has also had a direct impact on education. Perhaps the most dramatic step came in 2001, when MIT announced that it planned to make virtually all of its courses and course materials freely available on the Internet. Today MIT is nearing this goal, and the school's Open Courseware Web site now provides access to syllabi, lecture notes, assignments, exams, problem and

solution sets, tools and tutorials, and a growing library of video lectures for most of MIT's courses. In theory, the hero of *Good Will Hunting,* the 1997 film about a brilliant but poor scientific prodigy who lived near the MIT campus but had only limited access to its resources, could now get a complete MIT education over the Internet.

In fact, MIT's educational materials are being used not only by individual students but also by educators at MIT and elsewhere who can look at and learn from educational techniques being used by other teachers. The result is a virtuous cycle of development, use, evaluation, and refinement and redevelopment that has the potential to upgrade the overall quality of education.

MIT's bold move in opening access to its course materials has inspired other educational institutions to follow its lead and make their materials freely available. The Open Courseware Consortium now encompasses hundreds of colleges and universities in more than a dozen countries. John Seely Brown noted, however, that whereas more than 200 Chinese college and universities have joined the consortium, only a few Indian institutions have become members (for a list of consortium members, see Appendix).

A January 2007 news story about the consortium provides snapshots of a few of the disparate ways this expanding library of educational materials is being used:

> In Nigeria, Kunle Adejumo, an engineering student at Ahmadu Bello University, is using print and video materials downloaded from an American university to prepare for an exam in metallurgical engineering.
>
> In France, Brigitte Bouissou, a teacher at an elementary school, is logging on to an Internet video lecture being conducted by a professor of mathematics to prepare for the next day's lessons.
>
> In New York, a sixth-grader is in contact with a fourth-grader in Kenya—they are discussing the migration of wildebeest, both using handheld computers.

> In England, James Heywood, a 29-year-old web researcher, is solving his friend's computer security problems with knowledge gained from an online internet course run by a British university.[21]

Beyond Courseware

The open education movement has expanded beyond providing access to college-level courses to include an array of other educational resources for students of all ages. For example, a network of robotic telescopes located in Australia and Hawaii are now available online for educational projects, and the Internet-based "Bugscope" at the University of Illinois is providing K–12 students anywhere in the world with access to a state-of-the-art scanning electron microscope.

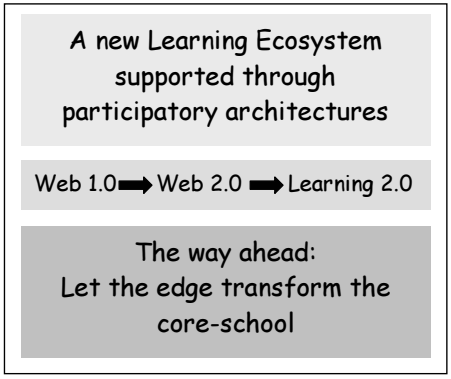
Other Learning 2.0 initiatives are providing tools that can be used to facilitate access to appropriate open source materials and to adapt these materials for specific purposes. These initiatives are based on the recognition that a course created to serve the needs of students at a particular school may not be suitable as developed for students at other schools (or for independent learners), and just putting a course online may not be enough to make it easily usable by others.

For example, the Connexions project based at Rice University in Houston, Texas, provides free authoring, course building, and publishing tools for educators. Rather than providing entire courses, Connexions is a repository for a collection of thousands of course "modules," along with tools that allow "authors" to combine different modules to create customized courses or curricula that can then be shared with others.

The Knowledge Media Laboratory (KML), funded by the Carnegie Foundation for the Advancement of Education, is intended to serve as an online "showcase" where educators can share examples of effective teaching practices. The KML's Gallery of Teaching and Learning includes case studies of successful initiatives and a toolkit for building these case studies. Moodle is a free, open source course management system designed to help educators make use of open courseware resources (for more examples of Learning 2.0 resources, see Appendix).

Learning 2.0 is about more than just providing free access to courses and educational tools. It also is a "participatory architecture" for creating and supporting communities of educators and learners. In the spirit of the open source movement, these online communities intentionally blur the line between creators and consumers of educational content to foster collaboration in learning and expanding the range of resources that are available to all. In addition to being a course management system, for example, Moodle is intended to "help educators form effective online communities." The Multimedia Educational Resource for Learning and Online Teaching (MERLOT) is a repository of higher education learning materials whose stated vision is "to be a premiere online community where faculty, staff and students from around the world share their learning materials and pedagogy." Curriki ("curriculum" + "wiki"), which has been championed by Sun Microsystems chairman Scott McNealy, is intended to be a global collaborative community for K–12 educators and students.[22] The result of all of these efforts, according to John Seely Brown, is the development of a rich "educational eco-system" that links educators with other educators, educators with students, and students with other students who share mutual interests in learning.

Learning 2.0 also is a "participatory architecture" for creating and supporting communities of educators and learners.



Source: John Seely Brown

Bringing Learning 2.0 to India

Although the Chennai roundtable participants were excited about the potential of Learning 2.0 to expand access to education in India, they also recognized that there are substantial barriers that will have to be overcome if this new approach is to gain traction.

Vanu Bose, CEO of Vanu, Inc., pointed out that the concept of open courseware is likely to encounter resistance from educators who now earn part of their livelihoods from selling textbooks, as well as from politicians who currently control education. Teachers who are already underpaid are not likely to support a movement to give away educational content at no cost, and politicians are likely to oppose any initiative that would dilute their control over the budgets for education. John Seely Brown acknowledged that open education is "incredibly controversial," and he noted that some leading U.S. schools, including Harvard University, initially opposed the concept of making any of their educational resources freely available. He also pointed out, however, that only a tiny fraction of educators actually receive any substantial income from textbook sales, so the real economic impact of open courseware should be negligible for most faculty members. Brown also argued that large changes cannot be brought about by "directly challenging the core of an institution." A much more effective strategy is to "build new things around the edges" of existing systems and institutions; as these initiatives succeed, they create a "forcing function" that build pressure for change.

Kanwalinder Singh of Qualcomm India noted that the network of private-sector "finishing schools" that provide millions of young people with training in practical skills needed by employers represents one "edge" that already exists in India. These institutions are growing rapidly and operate successfully with no government involvement in either financing or accreditation. Vijay Thadani of NIIT explained that the initial goal of his company was to develop an economically sustainable model that could deliver training at a fraction of the cost of existing government-funded universities. NIIT is now able to provide effective training at approximately one-fifth the average cost of university education ($2 per student per hour at NIIT centers versus $10 per student per hour at publicly funded universities). The company recognized, however, that to reach students in rural areas it would need to

devise an even more economical model for delivering education. Today, in partnership with Indian state governments, NIIT is providing IT training at a cost of about 30 cents per student per hour to 1.5 million children enrolled in 3,800 K–12 schools. NIIT's "Hole-in-the-Wall" initiative is an attempt to lower the cost of education even further. Thadani estimated that a network of more than 100 free-standing learning stations is currently reaching 30,000 young people at a cost of about 10 cents per student per hour.

A particularly difficult challenge in expanding education to embrace all Indians is how the millions who live in rural areas without access to reliable power or telecommunications can benefit from resources that are being distributed online. Ventures such as EDUSAT are underway to expand access to education and other types of information. According to Amit Sharma, Vice President for Strategy and Business Development for Motorola Asia Pacific, India is "on the brink of a broadband revolution." Although there are fewer than 3 million broadband connections in the country today, the government is planning to provide Internet access at a speed of 2 MB/s in 500,000 of the country's 600,000 rural villages by the end of 2008. Sharma noted that his company and others have done experiments that have shown that "e-education works." After the communication infrastructure is in place, the challenge will be to scale up these limited experiments to reach millions of students.

India is "on the brink of a broadband revolution."

Amit Sharma

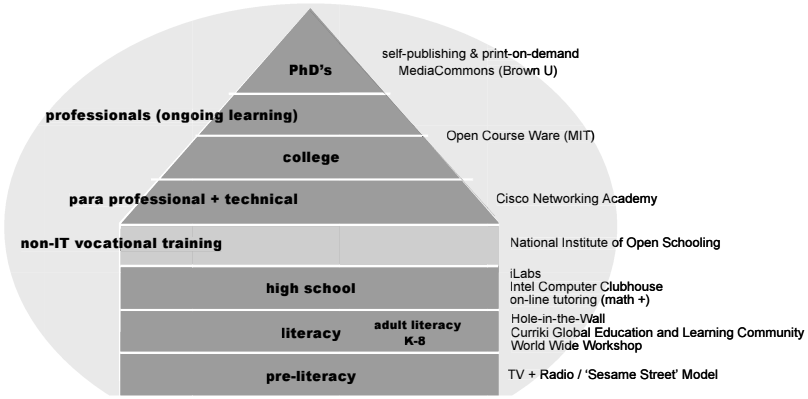
Mobile phones and inexpensive handheld devices may represent the best hope to approach near-universal access to open learning resources. Penetration of mobile phones has grown rapidly in recent years. In fact, India has become the fastest-growing market for mobile phones anywhere in the world. As of April 1, 2007, India had 166 million mobile subscribers—an increase of 68 percent over a year earlier—and 5 million new subscribers are being added every month. As mobile phones are spreading, they are also becoming less expensive and more powerful. A February 2007 report on open learning by John Seely Brown and others notes that by the end of this decade, "the typical mobile phone will have the processing power of today's desktop PC."[23] By that time,

most phones will have the capacity to play audio and video files and connect directly to the Internet through broadband wireless networks. They may also have voice recognition chips that can substitute voice input for keypad input and enough memory to store a week's worth of lessons. Motorola and Nokia have already developed "entry level" phones for developing countries at a cost of about $30, and this cost is likely to continue falling. The report concludes that "for the vast majority of people in developing countries, their 'PC' and Internet access device will be a mobile phone, a handheld computer, or a hybrid of these devices."

The great challenge is to organize and disseminate these resources.

Finally, Jonathan Aronson, Professor at the Annenberg School for Communication at the University of Southern California, reminded the roundtable participants that any initiative to reform education must "listen carefully to the young" in formulating its strategies. Young people have taken the lead in developing much of the new media on which these new educational concepts are based, and they will know what will work and what will not.

The figure below, created by Ann Pendleton-Jullian of MIT, shows graphically how Learning 2.0 resources (listed on the right side of the figure) map against the various levels of the capability attainment pyramid that represents the ideal system that would enable every Indian citizen to get the education or training he or she needs to reach his or her maximum level of accomplishment. As this figure clearly shows, open educational resources exist to support each level of the pyramid, from preliteracy through the PhD level. The great challenge is to organize and disseminate these resources so they are actually available to everyone who wants to take advantage of them.



Mapping Learning 2.0 resources, *source:* Ann Pendleton-Jullian

Roundtable Recommendations

The Roundtable participants distilled the ideas discussed during their sessions into nine recommendations that were presented to key government officials in New Delhi immediately after the meeting in Chennai. The nine recommendations are as follows:

Structural Recommendations

1. Promote competition in education through multiple models,
2. Provide autonomy to educational institutions,
3. Ensure mentoring and a safety net,
4. Enable equitable access to learning through skills vouchers,
5. Establish "Teach for India" for college graduates.

Technology-Based Recommendations

6. Implement universal broadband and e-education,
7. Sponsor self-directed open collaborative learning by establishing "Minds on Fire" Knowledge Learning Centers,

8. Exploit the 100,000 Common Service Centers (CSCs) currently under development as Knowledge Learning Centers (KLCs),

9. Incorporate Knowledge Learning Centers in Special Economic Zones (SEZs).

Structural Recommendations. The first set of recommendations focuses on structural reforms of the Indian educational system. The roundtable participants recognized that no single model would be sufficient to serve as a basis for expanding educational opportunities to a much larger share of the Indian population. Instead, competition can provide a spur to improving quality and efficiency in the delivery of educational services and generate multiple models that are more likely to be appropriate to different segments of the population.

A prerequisite for encouraging competition will be to reduce the burden of government regulation on education and provide greater autonomy to educational institutions, to allow them to innovate and experiment with new approaches. At the same time, roundtable participants agreed that a "safety net" is still needed to ensure that Indians who are most in need of education are able to get it.

A strong consensus emerged from the roundtable that ensuring that young people—at all levels of attainment—can acquire useful skills rather than formal degrees or credentials should be the cornerstone of a broad educational reform. To move away from the tyranny of degrees (which may actually mean little in terms of actual employable skills), the group recommended the creation of "skills vouchers" that could be used to finance education but could be redeemed only after a student demonstrated attainment of new abilities. A system based on providing vouchers for skills attained could be much more efficient than the current system, in which much of the funding for education is wasted.

A final structural recommendation called for the creation of a "Teach for India" program that would be modeled after the successful "Teach for America" program that has helped increase the visibility of teaching as a career choice by giving recent college graduates an opportunity to try teaching for a year or two. (Since Teach for America was launched in 1990, more than 17,000 young people have taken part in the program

and have taught more than 2.5 million at-risk students.) An important element in making a Teach for India program successful would be the participation of private sector employers who would underwrite students' participation and perhaps provide guarantees of employment at the conclusion of their service.

Technology-Based Recommendations. The second set of recommendations focused specifically on the role of technology in supporting expanded access to education. The roundtable participants recognized that simply expanding the scope of conventional education to every Indian is not practical, and approaches that leverage the power of technology must be pursued. Widespread deployment of broadband beyond the cities to reach India's vast rural population, an effort that fortunately is already underway, can provide critical infrastructure for the delivery of "e-education."

Still needed are mechanisms that will provide the appropriate educational content and the means that will allow millions of Indians to access it. There was a strong consensus among the roundtable participants that the principles of open collaborative learning—Learning 2.0—represent a powerful new paradigm that has the potential of scaling to meet the enormous challenge that India faces in educating all of its young people. A good deal of useful content is already available online as part of the open courseware/open educational resources movement, and more is being put online every day. A substantial effort will be required, however, to adapt these materials to the needs of India and make them widely accessible.

Perhaps the most novel recommendation from the Roundtable called for establishment of a network of Knowledge Learning Centers (KLCs) to support open learning. These centers would contain Internet-connected computers that would provide access to open learning resources. Even more important, they would be staffed by people who were attuned to the needs of the local residents served by each KLC. In some cases, this assistance could include technical training to "up-skill" workers to qualify them for jobs in the high-tech sector. In other cases, it might involve providing access to more fundamental skills such as basic literacy that could help millions of poor Indians to break out of the cycle of ignorance and limited opportunity that has trapped them for centuries.

One possibility for quickly realizing the potential of KLCs would be for the Indian government to expand the scope of the 100,000 CSCs it is committed to establishing in villages across the country by 2008 to include KLCs to facilitate access to open education resources. Each CSC would include several Internet-connected computers equipped with solar panels to provide reliable electrical power, and it would be staffed by personnel trained to help local residents use the center's resources.

A final recommendation was that KLCs be included in the SEZs that are being set up across the country. The Indian government's support for SEZs has generated political opposition because of the prospect that establishment of the zones will displace current residents who lack marketable skills and are unlikely to find gainful employment among the businesses that operate in the SEZs. Incorporating a KLC in an SEZ would:

- Provide displaced residents with useful vocational skills,
- Provide SEZ operators with workers who have skills applicable to their individual needs, and
- Defuse opposition to SEZ development by providing demonstrable benefits to local residents and help integrate rural India into the wider national and global marketplaces.

For more detail on this proposal, see Appendix.

Meetings with Government Ministers

On February 5, 2007, immediately after the roundtable in Chennai, members of the roundtable met with three government ministers in New Delhi to formally present the group's recommendations to them and hear their responses.

Dr. Montek Singh Ahluwalia, Vice Chairman of the Planning Commission of India, explained that the government is attempting to increase competition in education but noted that proposals for major changes in education will encounter strong opposition. He urged industry leaders to find the regions of the country that are most receptive to experimenting with new models and sponsor pilots that can demonstrate clear success. Dr. Alhuwalia also suggested that the round-

table's recommendations be shared with the National Knowledge Commission, whose recent report also included proposals for improving education.

Shri Kapil Sibal, Minister for Science and Technology and Ocean Development, also encouraged the roundtable participants to focus initially on one state and demonstrate the new concepts there before attempting to expand them to the entire country. Minister Sibal expressed his enthusiasm for the power of geographic information systems (GIS), which he has described as "a revolutionary tool to change the lives of common people." He noted that GIS can be used to excite students and engage them in new kinds of learning about their own communities.

Shri Kamal Nath, Minister for Commerce and Industry, noted that one of India's greatest challenges is to bridge the urban/rural divide. Minister Nath expressed interest in the idea of the KLC and asked the Aspen Roundtable members to develop a more detailed model of its components and its functions. The dialogue led to an agreement that the model would focus on including KLCs in one to three SEZs. A more detailed description of the KLC project, is the first result of that further effort, appears in the appendix.

Ideally, these recommendations will be a small but important step in setting young Indians' minds on fire to a lifetime of continuous learning, combining the best of new communications and information technologies with new pedagogy of Learning 2.0.

Notes

1. Tim Ferguson, "Nasscom Keeps Ringing Worker Shortage Warning Bell," CNET News.com, November 9, 2006. Online at: http://news.com.com/Nasscom+keeps+ringing+worker+shortage+warning+bell/2100-1011_3-6133979.html.

2. Niranjan Rajadhyaksha, *The Rise of India* (Singapore: John Wiley & Sons, Asia, 2007), pp. 3–4.

3. Ibid., p. 40.

4. Dominic Wilson and Roopa Purushothaman, "Dreaming with the BRICs: The Path to 2050", Goldman Sachs Global Economics Paper no. 99, October 1, 2003. Online at: www2.goldmansachs.com/insight/research/reports/99.pdf. As countries' economies develop and their populations age, their growth rate tends to slow. According to this study, India's economy is the only one among the BRIC countries that is expected to continue growing at more than 5 percent per year through 2050. Nonetheless, because India's GDP per capita is substantially below that of the other BRIC countries today, individual income in India will still be lower than in other BRIC countries even in 2050 (per capita GDP will be $17,366 in India compared to $26,592 in Brazil, $31,357 in China, and $49,646 in Russia—and $58,514 in the G6 countries).

5. Ibid.

6. *U.S. Department of Education, National Center for Education Statistics,* Postsecondary Institutions in the United States: Fall 2003 Degrees and Other Awards Conferred: 2002–03 (NCES 2005-154), 2005. Online at: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005154.

7. "A World of Opportunity: Developing Countries See the Point of Higher Education," survey of higher education, *The Economist*, September 10, 2005, p. 7.

8. National Knowledge Commission, *Report to the Nation 2006.* Government of India, January 2007, p. 16. Online at: http://knowledgecommission.gov.in/.

9. Anand Giridharadas, "For many Indians, higher education does more harm than good," *International Herald Tribune*, November 26, 2006. Online at: www.iht.com/articles/2006/11/26/business/india.php.

10. Institute of Higher Education at Shanghai Jiao Tong University, *Academic Ranking of World Universities 2006.* Online at: http://ed.sjtu.edu.cn/rank/2006/ARWU2006TOP500list.htm. The two Indian institutions on the list are the Indian Institute of Technology—Kharagpur and the Indian Institute of Science.

11. Pratap Bhanu, "Outsourcing of Indian Education: Rigid government control hobbles Indian universities' attempt to compete globally," *Yale Global*, June 2006. Online at: http://yaleglobal.yale.edu/display.article?id=7570.

12. "Knowledge panel wants 1,500 varsities by 2015," *Times of India*, January 13, 2007. Online at: http://timesofindia.indiatimes.com/NEWS/India/Knowledge_panel_wants_1500_varsities_by_2015/articleshow/1162099.cms.

13. Monobina Gupta, "Varsity bill hits Left wall," *Calcutta Telegraph*, May 8, 2007. Online at: www.telegraphindia.com/1070508/asp/frontpage/story_7748286.asp.

14. Marie Lall, *The Challenges for India's Education System* (Chatham House, April 2005). Online at: www.chathamhouse.org.uk/publications/papers/download/-/id/263/file/3899_bpindiaeducation.pdf.

15. Gurcharan Das, "Education: A Learning Curve," *Newsweek International*, February 28, 2006. Online at: www.msnbc.msn.com/id/11571960/site/newsweek/.

16. Nicholas Kristof, "In its Match with China, India Penalizes Its Own Team," *New York Times*, April 24, 2007.

17. Agastya Mobile Lab. See www.agastya.org/Mobile.htm.

18. To read more about the Hole in the Wall Project, see http://www.ncl.ac.uk/egwest/holeinthewall.html.

19. For more about the implications of Web 2.0, see Richard P. Adler, *Next-Generation Media: The Global Shift* (Washington, D.C.: Aspen Institute Communications and Society Progam, 2006). Online at: http://www.aspeninstitute.org/atf/cf/%7BDEB6F227-659B-4EC8-8F84-8DF23CA704F5%7D/NEXTGENERATION.PDF.

20. John Seely Brown, "New Learning Environments for the 21st Century: Exploring the Edge," *Change*, September/October 2006. Online at: www.johnseelybrown.com/Change%20article.pdf.

21. Shola Adenekan, "The Great Giveaway," *Education Guardian*, January 17, 2007. Online at: http://education.guardian.co.uk/higher/worldwide/story/0,,1992343,00.html.

22. Curriki's global perspective is evidenced by the makeup of its advisory board, which includes educators from Australia, Canada, China, Hong Kong, South Korea, Singapore, Spain, and the United Kingdom.

23. Daniel E. Atkins, John Seely Brown, and Allen L. Hammond, *A Review of the Open Educational Resources Movement: Achievements, Challenges and New Opportunities*, Report to William and Flora Hewlett Foundation, February 2007. Online at: http://hewlett.org/NR/rdonlyres/5D2E3386-3974-4314-8F67-5C2F22EC4F9B/0/AReviewoftheOpenEducationalResourcesOERMovement_BlogLink.pdf.

APPENDIX

PROPOSAL

Knowledge Learning Centers for Special Economic Zones in India

The Problem

India's Special Economic Zone (SEZ) policy aims to invest Rs.1 trillion, including foreign capital worth US$5-6 billion, by December 2007, and will create over 500,000 jobs by the end of that year. However the policy has attracted a lot of controversy after protests over land acquisition due to the concern over displacement of farmers and other inhabitants of SEZ locations. At the same time there is a widening gap between the demand for skilled human resources in India, as evidenced in the new SEZs, and the limited supply of qualified workers, in some cases from the very areas where SEZs are being established.

The Empowered Group of Ministers (EGoM) has approved 83 SEZ projects in addition to the already approved and announced 63 projects, with some changes in policies to better address social issues. But these policies do not appear to be effective enough. Eminent scholars have voiced support for SEZs, acknowledging the fact that they would create over 15,75,452 additional jobs. They have also advocated that, in view of global examples, the Government should ameliorate the problem regarding displaced people.

A Proposed Solution

The participants at the Second Annual Aspen Institute Joint Roundtable on Communications Policy proposed a solution to fulfill the requirements of building the knowledge and skills base within Special Economic Zones and address the Indian Government's interests in both economic development and social inclusiveness. The group suggested establishing *Knowledge Learning Centres (KLCs)* in SEZs for displaced residents. The KLCs would address the individual needs of companies in the SEZs and nearby areas, and prepare the local population with a host of skills to serve community needs within and outside

the SEZs. These skills include healthcare, education, agriculture, hospitality, catering and retail, among others. The proposed Knowledge Learning Centres would thus have accomplished two goals: provide the local population with more opportunities and reduce the shortage of skilled human resources, thereby beginning to bridge the gap between the supply and demand for skilled human resources.

The Knowledge Learning Centre would be a tripartite partnership between (1) industry that will serve as the coordinating and implementing partner, (2) a recognized institute as training partner, and (3) government as the funding partner. For the KLC to be successful, an industry partner and the Government would need to form a partnership and develop training modules based on the major focus area of that particular SEZ. The KLC would adopt both conventional teaching from tested models like NIOS, the NIIT Institute of Information Technology (TNI) and IGNOU. At the same time the KLC could also take advantage of new collaborative "Learning 2.0" models which exploit the potential of the inter-active Web 2.0. For example, they can take the approach of Hole in the Wall at one level, and of the freely available OpenCourseWare offered by MIT, and the Open Courseware Consortium of universities throughout the world, at the higher educational level.

The steps required to implement the KLC Proposal include:

1. mapping of target population and providers;
2. identifying relevant skills for the population and requirements of companies in SEZs;
3. developing suitable infrastructure, proper administrative structures, and friendly policies;
4. strategizing to reach out to target audience;
5. designing courseware as per the requirement of industry; and
6. identifying funding sources and recruitment of excellent resources for training.

Sustainability

To achieve its objectives of creating lifelong learning, and spurring a paradigm shift in the learning levels of the target population, the KLC requires:

- access over broadband connectivity,

- public private partnership, and
- open collaborative content from various available sources.

Though a Knowledge Learning Centre would initially train the displaced inhabitants of SEZs, the model needs to be scaled up for broader sustainability. It must also have full funding. In addition, the KLC must be made accessible and promoted throughout the entire population.

The Public Private Partnership (PPP) model proposed by the Task Force on Vocational Education & Training and constituted by the Planning Commission is an ideal model. The KLC Task Force proposes the provision of land by the State Government to the industry group with loans by the Central Government for setting up the Knowledge Learning Centre. The SEZ member company will fund the training at the subsidised rates quoted by the Government for displaced residents, or at normal rates for residents outside the SEZ. In addition the KLCs will also serve as placement centres for companies within the Special Economic Zone.

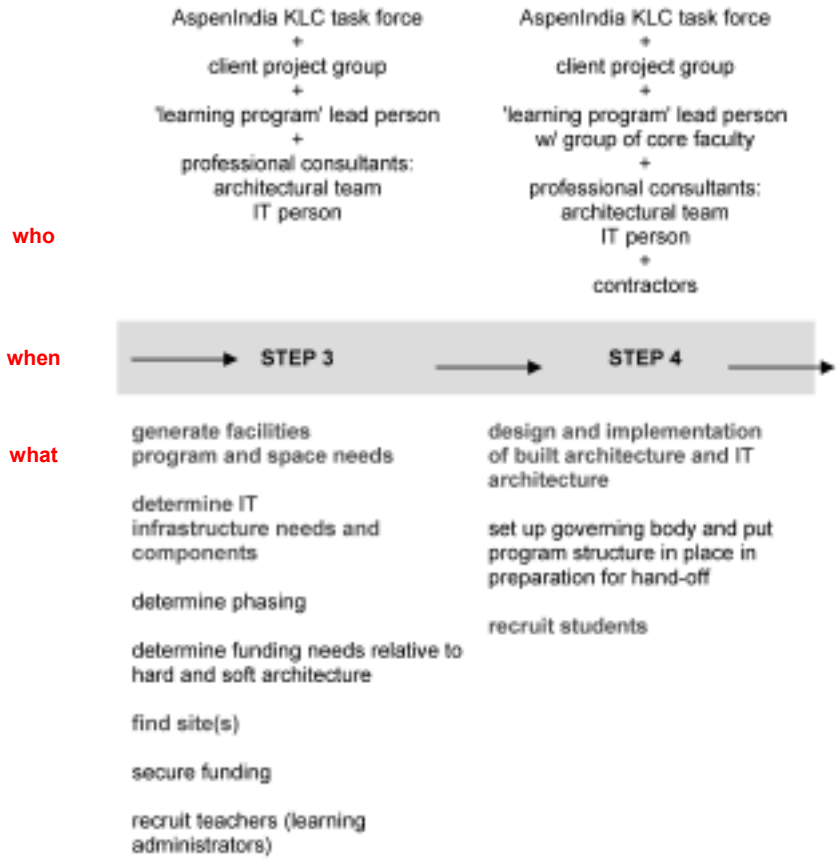
Proposal to Government: Proposed Pilot Project

SEZ Type	IT SEZ
Skill Sets	Problem-solving, Collaboration, Creativity, Critical-thinking, Communication, Entrepreneurship
Capacity of KLC	1000 Target Audience maximum (Alternatively can be based on the size of the SEZ)
Requirements:	
From Government	Allocation / Funding of land
From developer of SEZ	Infrastructure development
Companies in SEZ	Funding of training. Exploit the skill voucher method.
Certification	By independent agency

Upon success of the pilot program, the Government could consider making KLC a mandatory regulation—every SEZ developed should have a KLC that provides training at all levels dependant upon the employment requirements of companies in the SEZ.

Knowledge Learning Center (KLC) Pilot Project
Design and Implementation Map

who	AspenIndia KLC task force + SEZ entity + client	AspenIndia KLC task force + client project group + 'learning program' lead person
when	**STEP 1** →	**STEP 2** →
what	identify 'client'	design learning program
	providers	content + delivery
	joint venture or strong independent leadership funding body governing body 'learning' administrators (teachers)	assess existing core resources + supplemental needs
	learners	design method of delivery traditional + Open Source IT
	skills resource assessment to determine target constituencies	determine human resource requirements
	(training for SEZ construction) training for SEZ skill needs training for future (school children) training for global community (continued mobility)	design monitoring and evaluation framework
	establish representative client project group	determine phasing
	recruit lead person for 'learning program' design	determine funding needs relative to the learning program (admin + content + human resources)
		if funding is not provided directly and fully by the SEZ entity, recruit development person


AspenIndia KLC task force
+
client project group
+
'learning program' lead person
+
professional consultants:
architectural team
IT person
AspenIndia KLC task force
+
client project group
+
'learning program' lead person
w/ group of core faculty
+
professional consultants:
architectural team
IT person
+
contractors
who
when
STEP 3
STEP 4
what
generate facilities program and space needs
determine IT infrastructure needs and components
determine phasing
determine funding needs relative to hard and soft architecture
find site(s)
secure funding
recruit teachers (learning administrators)
design and implementation of built architecture and IT architecture
set up governing body and put program structure in place in preparation for hand-off
recruit students

Aspen Institute India
in partnership with the
Aspen Institute Communications and Society Program

Joint Roundtable on Communications Policy

"Enhancing India's Knowledge Workforce"

Chennai & New Delhi, India
February 1-5, 2007

Roundtable Participants

Richard Adler
Research Affiliate
Institute for the Future
UNITED STATES

Jonathan Aronson
Professor and
Executive Director
Annenberg Center for
Communication
University of Southern
California
UNITED STATES

Dorothy Attwood
Senior Vice President,
Regulatory Policy
AT&T
UNITED STATES

Vanu G. Bose
Chief Executive Officer
Vanu, Inc.
UNITED STATES

John Seely Brown
Director Emeritus
Xerox Palo Alto Research Center
(PARC)
UNITED STATES

Jeff Brueggeman
Vice President Regulatory Policy
AT&T
UNITED STATES

Charles M. Firestone
Executive Director
Communications and Society
Program
The Aspen Institute
UNITED STATES

S. Gopalakrishnan
President and Chief Operating
Officer
and
Joint Managing Director
Infosys Technologies Ltd.
INDIA

Note: Titles and affiliations are as of the date of the conference.

Reed E. Hundt
Senior Advisor
McKinsey & Company
UNITED STATES

Laura Ipsen
Vice President
Global Policy and Government Affairs
Cisco Systems
UNITED STATES

Murugavel Janakiraman
Chief Executive Officer
BharatMatrimony Enterprise
INDIA

Franklin Jones
President
Intel Technology India Pvt. Ltd.
INDIA

Parag Kar
Senior Director, Government Affairs
Qualcomm India and SAARC
INDIA

S. Mahalingam
Chief Financial Officer
Tata Consultancy Services
INDIA

Harsh Manglik
Chairman
Accenture India
INDIA

Shamsher S. Mehta
Lieutentant General (Retired)
and
Director General
Confederation of Indian Industry
and
Trustee
The Aspen Institute India
INDIA

Lakshmi Narayanan
Vice Chairman
Cognizant Technology Solutions India Pvt. Ltd
INDIA

R. Natarajan
Former Director
Indian Institute of Technology—Madras
INDIA

Ann M. Pendleton-Jullian
Associate Professor of Architecture
Massachusetts Institute of Technology
and
Principle Architect
Ap-J Architects
UNITED STATES

Robert Pepper
Senior Managing Director
Global Advanced Technology Policy
Cisco Systems
UNITED STATES

Note: Titles and affiliations are as of the date of the conference.

J Raghuram
General Manager—Human Resources
Hutchison Essar South Ltd.
INDIA

Amit Sharma
Vice President
Strategy and Business Development
Motorola Asia Pacific
INDIA

Kanwalinder Singh
President
Qualcomm India
INDIA

Stacy Standley
Managing Director
ICG
UNITED STATES

Vijay K. Thadani
Chief Executive Officer
NIIT Limited
INDIA

Vikram Tiwathia
Colonel (Retired)
and
Chief Information Officer
Confederation of Indian Industry
INDIA

Manoj Varghese
Director, Human Resources
Google India
INDIA

Roshni Venkatesh
Corporate Citizenship Lead
Accenture
INDIA

K S Vishvanathan
Senior Vice President and Chief Executive
India Operations
Wipro Infotech
INDIA

Staff:

Mansi Sharma
Executive
Confederation of Indian Industry
INDIA

Mridulika Menon
Senior Project Manager
Communications and Society Program
The Aspen Institute
UNITED STATES

Note: Titles and affiliations are as of the date of the conference.

Members of the Open Courseware Consortium (July 2007)

Australia
- University of Southern Queensland

Austria
- University of Klagenfurt

Canada
- Capilano College

China
- China Open Res. for Education
- Beijing Hang University
- Beijing Jiao Tong University
- Beijing Normal University
- Beijing Science & Tech. Univ.
- Central Radio and TV Univ.
- Central South University
- China Mining University
- China People's University
- China Science & Tech. Univ.
- Dalian University of Tech.
- Fu Dan University
- International Business & Econ. Univ. of China
- Nanjing University
- North-East University
- North-West University
- North Western Polytech. Univ.
- Peking University
- Shanghai Jaiotong University
- Sichuan University
- Tianjin University
- Tsinghua University
- Xi'an Jiao Tong University
- Zhejiang University

Plus more than 200 others

France
- ParisTech "Graduate School"
  École Nationale du Génie Rural, des Eaux et des Forêts (ENGREF)
- École Nationale des Ponts et Chaussées (ENPC)
- École Nationale Supérieure d'Arts et Métiers (ENSAM)
- École Nationale Supérieure de Chimie de Paris (ENSCP)
  École Nationale Supérieure des Mines de Paris (ENSMP)
- École Nationale Supérieure des Télécommunications (ENST)
- École Nationale Supérieure de Techniques Avancées (ENSTA)
- École Polytechnique (EP)
- École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI)
- Institut National Agronomique Paris-Grignon (INA P-G)
  École Nationale de Statistique et d'Administration Économique (ENSAE))

India
- National Programme on Technology Enhanced Learning
- IIIT Bangalore

Japan
- Japan OCW Consortium
- Doshisha University
- Hokkaido University
- Kansai University
- Keio University
- Kyoto University
- Kyushu University
- Nagoya University
- National Institute of Multimedia Education
- Osaka University
- Tokyo Institute of Technology
- University of Tokyo
- University of Tsukuba
- Waseda University

Spain and Portugal
- Universia OCW
- Universidad Alicante
- Universidad Aveiro
- Universidad Barcelona
- Univ. Carlos III de Madrid
- Universidad Islas Baleares
- Universidad Jaume I
- Universidad Murcia
- Universidad Oviedo
- Univ. Politécnica de Madrid
- Univ. Politécnica de Valencia
- Universidad Rovira i Virgili
- Univ. Santiago de Compostela
- Universidad Sevilla

Saudi Arabia
- Alfaisal University

South Africa
- University of the Western Cape

Peru
- Univ. Nac. Mayor de San Marcos

United Kingdom
- Open University UK

United States
- Defense Acquisition University
- Harvard Law School, Berkman Center for Internet and Society
- Johns Hopkins Bloomberg School of Public Health
- Massachusetts Institute of Technology
- Michigan State University
- Tufts University
- University of California, Irvine
- University of Michigan School of Information
- University of Massachusetts Boston
- University of Notre Dame
- Utah State University
- Utah Valley State College
- Wheelock College

Venezuela
- Univ. Central de Venezuela

Vietnam
- Fulbright Econ. Teaching Prog.
- Vietnam OpenCourseWare
- Can Tho University
- Da Nang University
- Hanoi Agriculture Univ. No. 1
- Hanoi Education University
- Hanoi Medical University
- Hanoi Nat. Univ. of Economics
- Hanoi University of Technology
- HCMC Education University
- HCMC Medical University
- HCMC University of Economics
- Hue University
- Thai Nguyen University
- Vietnam Nat. University—Hanoi
- Vietnam Nat. Univ.—HCMC Affiliates

Affiliates

African Virtual University
Chulalongkorn University
Creative Commons
Fahamu
Opensource Opencourseware Prototype System
Thailand Cyber University
WiderNet Project eGranary Digital Library
United Nations University

Learning 2.0 Resources

U.S./Global Resources

Bugscope

The Bugscope project is an educational outreach program for K–12 classrooms. The project provides a resource to classrooms so they may remotely operate a scanning electron microscope to image "bugs" at high magnification. The microscope is remotely controlled in real time from a classroom computer over the Internet, using a Web browser. The Bugscope project is primarily oriented toward K–12 classrooms; there is no cost to participate in the project.

URL: http://bugscope.beckman.uiuc.edu

Carnegie Mellon Open Learning Initiative

Carnegie Mellon University's Open Learning Initiative (OLI) is a collection of "cognitively informed," openly available, and free online courses and course materials that enact instruction for an entire course in an online format. OLI courses include several innovative online instructional components, such as cognitive tutors, virtual laboratories, group experiments, and simulations.

URL: www.cmu.edu/oli/

Connexions

Connexions is an environment for collaboratively developing, sharing, and rapidly publishing scholarly content on the Web. The Content Commons contains educational materials for everyone from children to college students to professionals, organized in small modules that are easily connected into larger courses. All content is free to use and reuse under the Creative Commons "attribution" license.

URL: http://cnx.org

Curriki

Curriki is a community of educators, learners, and committed education experts who are working together to create quality materials that will benefit teachers and students around the world. Curriki is an online environment created to support the development and free distribution of world-class educational materials to anyone who needs them.

URL: www.curriki.org

Faulkes Telescope Project

The Faulkes Telescope Project is the education arm of Las Cumbres Observatory Global Telescope Network (LCOGTN). It provides access to robotic telescopes and a fully supported education program to encourage teachers and students to engage in research-based science education. Access is provided at no charge to teachers and students.

URL: http://faulkes-telescope.com/news/1232

GLOBE

The Global Learning Objects Brokered Exchange (GLOBE) is an international consortium that strives to make shared online learning resources available to educators and students around the world. The consortium provides a distributed network of learning objects that meet quality standards. GLOBE aims to connect the world and unlock the "deep web" of quality online educational resources by brokering relationships with content providers.

URL: www.globe-info.net/globe/go/pid/2

Carnegie Foundation Knowledge Media Laboratory/ Gallery of Teaching & Learning

The goals of the Knowledge Media Lab (KML) are to develop digital tools and resources that help make knowledge of effective teaching practices and educational transformation efforts visible, shareable, and reusable; to build the capacity for faculty and teachers to take advantage of information and communications technologies that enable them to

reexamine, rethink, and re-present teaching and student learning and share the outcomes in an effective and efficient way; and to sustain communities of practice engaged in collaboratively improving teaching and student learning.

The KML is a program of the Carnegie Foundation for the Advancement of Education. The KML includes a Gallery of Teaching and Learning that contains collections of work created by the foundation's programs and partners, as well as case studies of how technology-enabled educational knowledge representation and sharing helps advance teaching and learning.

URL: www.carnegiefoundation.org/programs/index.asp?key=38

MERLOT

MERLOT is a leading-edge, user-centered, searchable collection of peer-reviewed higher education online learning materials created by registered members, as well as a set of faculty development support services. MERLOT's vision is to be a premiere online community where faculty, staff, and students from around the world share their learning materials and pedagogy.

URL: http://taste.merlot.org/index.html

MOODLE

Moodle is a free, open source course management system (CMS) designed to help educators create effective online learning communities. It can be downloaded and used on any computer (including Web hosts), yet it can scale from a single-teacher site to a 50,000-student university.

URL: http://moodle.org/

National Science Digital Library

The National Science Digital Library (NSDL) was established by the National Science Foundation (NSF) in 2000 as an online library that directs users to exemplary resources for science, technology, engineering, and mathematics education (STEM) and research. The NSDL pro-

vides an organized point of access to STEM content that is aggregated from a variety of other digital libraries, NSF-funded projects, and NSDL-reviewed Web sites. The NSDL also provides access to services and tools that enhance the use of this content in a variety of contexts. The NSDL is designed primarily for K–16 educators, but anyone can access NSDL.org and search the library at no cost.

URL: http://nsdl.org

Open Educational Resources

The Open Educational Resources (OER) Commons is an open learning network where teachers and professors (from pre-K to graduate school) can access their colleagues' course materials, share their own, and collaborate on affecting today's classrooms. It uses Web 2.0 features (tags, ratings, comments, reviews, and social networking) to create an online experience that engages educators in sharing their best teaching and learning practices.

URL: www.oercommons.org

OpenCourseWare Consortium

The OpenCourseWare Consortium is a collaboration of more than 100 higher education institutions and associated organizations from around the world creating a body of open educational content using a shared model. The mission of the consortium is to advance education and empower people worldwide through open courseware.

URL: www.ocwconsortium.org/index.html

Sakai Project

Sakai is an online collaboration and learning environment. Users of Sakai deploy it to support teaching and learning, ad hoc group collaboration, support for portfolios, and research collaboration. Sakai is a free, open source product that is built and maintained by the Sakai community.

URL: www.sakaiproject.org

India: Government/Academic Initiatives

Digital Library of India

The mission of the Digital Library of India is to create a portal that will foster creativity and free access to all human knowledge. A proposed first step in realizing this mission is to create the Digital Library with a free-to-read, searchable collection of one million books, predominantly in Indian languages, available to everyone over the Internet. This portal will also become an aggregator of all the knowledge and digital contents created by other digital library initiatives in India.

URL: http://dli.iiit.ac.in

National Program on Technology Enhanced Learning

The objective of NPTEL is to enhance the quality of engineering education in India by developing curriculum-based video and Web courses. This program is being carried out as a collaborative project by seven IITs, the Indian Institute of Science, and other institutions. The goal of the project is to provide learning materials, digitally taped classroom lectures, supplementary materials, and links to state-of-the art research materials in every subject possible. Samples from approximately 70 courses offered by faculty in various departments to students at all levels are currently available, and approximately 140 courses are in various stages of preparation and distribution.

URL: http://nptel.iitm.ac.in/

India: Corporate Education Initiatives

Cisco Networking Academy Program

The Cisco Networking Academy Program is a public-private partnership between Cisco Systems, education, business, government, and community organizations around the world aimed at nurturing IT professionals. The education program uses an e-learning model, with a combination of Web-based and instructor-led training, along with a hands-on lab environment to teach students how to design, build, and

maintain computer networks. Cisco currently operates 155 Networking Academies in 23 states in India.

URL: www.cisco.com/web/learning/netacad/academy/About.html

HeyMath!

HeyMath's mission is to establish a Web-based platform that enables every student and teacher to learn from the "best teacher in the world" for every math concept and to be able to benchmark themselves against their peers globally. The HeyMath platform includes an online repository of questions, indexed by concept and grade, so teachers can save time in devising homework and tests.

URL: www.heymath.com/index.jsp

Hole-in-the-Wall

Breaking the traditional confines of a school, Hole-in-the-Wall Education Limited (HiWEL) takes the Learning Station to the playground; uses a unique collaborative learning approach; and encourages children to explore, learn, and just enjoy. The first Hole-in-the-Wall computer was installed in 1999 in New Delhi; today, more than 100 are in operation around India.

For experts, Hole-in-the-Wall is a "shared blackboard" that children in underprivileged communities can collectively own and access to express themselves, learn, explore together, and at some stage even brainstorm and come up with exciting ideas. For villagers, it is more like a village well, where children assemble to draw knowledge and, in the process, engage in meaningful conversation and immersive learning activities that broaden their horizons. For children, it is an extension of their playground where they can play together; teach each other new things; and, more important, just be themselves. Established in 2001, HiWEL is a joint venture between NIIT Ltd. and the International Finance Corporation (a part of the World Bank Group).

URL: www.hole-in-the-wall.com/

Intel Computer Clubhouse

The Intel Computer Clubhouse is an after-school program where youth ages 8 to 18 have access to high-tech equipment and mentoring to develop skills that open up opportunities, encourage self-confidence, and foster creativity. Youth who visit the Computer Clubhouse learn by doing. They create digital artwork, produce their own music CDs, film, write and edit their own short movies, and design Web sites. The first Intel Computer Clubhouse in India was launched in New Delhi in December 2001 at the Katha Khazana, a nongovernmental organization (NGO)-run school that is open to children from the Govindpuri slum area in Delhi. The second clubhouse was opened in Bangalore in December 2002.

URL: www.intel.com/cd/corporate/education/APAC/ENG/in/communityed/communityed2/239088.htm

Shiksha India

Shiksha India is an initiative of the CII and is managed by the Shiksha India Trust. Shiksha India works with schools and institutions across India to promote the use of technology to make teaching and learning more effective. Shiksha operates a portal, built with open source tools, to allow teachers to collaborate and engage in discussions concerning e-learning, e-teaching, and creative teaching and learning.

URL: www.shikshaindia.org

About the Author

Richard Adler is principal of People & Technology, a research and consulting firm based in California's Silicon Valley. He is also a Research Affiliate at the Institute for the Future (IFTF) in Palo Alto, California. His current work focuses on the implications of the aging of baby boomers and the impact of technology on the delivery of healthcare.

Mr. Adler was one of the first staff members of the Aspen Institute Communications and Society Program. He served as Associate Director under Douglass Cater, the program's founder. He has also written reports on several Aspen conferences over the past decade including *Next-Generation Media: The Global Shift.*

Mr. Adler has taught communications at Stanford University and UCLA and was a Research Fellow at the Harvard Graduate School of Education.

Mr. Adler's recent publications include *Anytime, Anyplace Health: How Mobile Applications Are Expanding Access to Healthcare* (IFTF, 2006); "Reinventing Retirement" (Aging Today, 2005); "The Age Wave Meets the Technology Wave: Broadband and Older Americans" (SeniorNet, 2004); and *Telecommunications 2010* (Institute for Information Policy, 2001).

Mr. Adler holds a BA from Harvard, an MA from the University of California at Berkeley, and an MBA from the McLaren School of Business at the University of San Francisco.

About the Aspen Institute India

www.aspenindia.org

In collaboration with the Confederation of Indian Industry (CII), the Aspen Institute launched its newest international partner with the opening of Aspen Institute India in New Delhi on February 3, 2004. The Aspen Institute India is a non-profit organisation dedicated to in-depth discussion of global issues, development of values-based leadership, and a high-level exchange of opinions, information and values.

The Institute focuses on the most important problems and challenges facing Indian society, the business community, and the individual, inviting top industrial, economic, financial, political, social and cultural leaders to discuss these issues in settings that encourage frank and open debate.

The Aspen Institute India pursues its objective by organizing value-based leadership seminars, policy programmes, and public activities.

About the Communications and Society Program

www.aspeninstitute.org/c&s

The Communications and Society Program is an active venue for global leaders and experts from a variety of disciplines and backgrounds to exchange and gain new knowledge and insights on the societal impact of advances in digital technology and network communications. The Program also creates a multi-disciplinary space in the communications policy-making world where veteran and emerging decision-makers can explore new concepts, find personal growth and insight, and develop new networks for the betterment of the policy-making process and society.

Ongoing activities of the Communications and Society Program include annual roundtables on journalism and society (e.g., journalism and national security), communications policy in a converged world (e.g., the future of video regulation), the impact of advances in information technology (e.g., "when push comes to pull"), advances in the mailing medium, and diversity and the media. The Program also convenes the Aspen Institute Forum on Communications and Society (FOCAS), in which chief executive-level leaders of business, government and the non-profit sector examine issues relating to the changing media and technology environment.

Most conferences utilize the signature Aspen Institute seminar format: approximately 25 leaders from a variety of disciplines and perspectives engaged in roundtable dialogue, moderated with the objective of driving the agenda to specific conclusions and recommendations. In 2007, FOCAS has emerged as a larger event.

Conference reports and other materials are distributed to key policy-makers and opinion leaders within the United States and around the world. They are also available to the public at large through the World Wide Web, *www.aspeninstitute.org/c&s.*

THE ASPEN INSTITUTE

Publications Office
P.O. Box 222
109 Houghton Lab Lane
Queenstown, MD 21658

THE ASPEN INSTITUTE INDIA

249F, Sector 18
Phase 4, Udyog Vihar
Gurgaon, Haryana
India-122-015

07-013