

Global Reach

Emerging Ties Between the San Francisco Bay Area and India

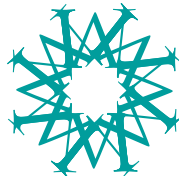
A Bay Area Council
Economic Institute Report



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Emerging Ties Between the San Francisco Bay Area and India

**A Bay Area Council
Economic Institute Report by**

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Rangoli Designs Note

The geometric drawings used in the pages of this report, as decorations at the beginnings of paragraphs and repeated in side panels, are grayscale examples of rangoli, an Indian folk art. Traditional rangoli designs are often created on the ground in front of the entrances to homes, using finely ground powders in vivid colors. This ancient art form is believed to have originated from the Indian state of Maharashtra, and it is known by different names, such as kolam or aripana, in other states. Rangoli designs are considered to be symbols of good luck and welcome, and are created, usually by women, for special occasions such as festivals (especially Diwali), marriages, and birth ceremonies.

Cover Note

The cover photo collage depicts the view through a “doorway” defined by the section of a carved doorframe from a Hindu temple that appears on the left. The carved basalt doorframe section, which is now part of the Avery Brundage Collection at the Asian Art Museum of San Francisco, originally came from Karnataka state in India and is dated circa 950–1050. The figures at the bottom of the doorframe, resting on the floor, include a door guardian (second from the left) and a Ganges River goddess (fourth from the left). (Temple doorways were commonly flanked by a pair of river goddesses.) Collaged on the “floor” in front of the doorway is a rangoli design, created using colored powders and typical of a rangoli that would be drawn on the floor at the entrance to a home during festival time or to symbolize good luck and welcome for a special occasion.

Preface

Relations between the San Francisco Bay Area and India are longstanding and multi-faceted, dating back to the beginning of the 20th century, and represent a valuable contribution to the Bay Area regional economy in terms of trade, investment, technological innovation, jobs and wealth creation.

This report follows *Ties That Bind*, a 2006 report by the Bay Area Council Economic Institute (formerly the Bay Area Economic Forum) on the Bay Area's economic and other ties with greater China, and completes a two volume series on the demographic, cultural, educational, trade, investment and other ties between the Bay Area—the world's technology capital and one of its most globalized economies—with China and India, the world's fastest growing major economies. In assessing the region's economic, academic and cultural ties to India, our intent is to highlight the Bay Area's outward-looking business focus; its extensive links to global markets; the vibrant international communities that comprise a unique economic asset in the region's development; and the concrete policy steps necessary to preserve and enhance that asset.

Nearly 200 business, government, academic and community leaders in the Bay Area and India were interviewed for this report, representing a high-level cross-section of individuals and organizations that are shaping both business and policy. It has not been possible to capture every company, organization or community leader with an active role or perspective on the relationship. The purpose of this study, however, is to paint a picture of the changing dynamic that defines the relationship between the Bay Area and India, and is exerting a growing influence on the shape of the world economy. While focused on the Bay Area, the report also provides a deep case study of the changing fabric of the global economy, the interconnection of developed economies such as the U.S. with rapidly emerging economies such as China and India, and the process by which technologies and services are increasingly being generated through complex global partnerships.

The report begins with a snapshot of India's economic landscape, to provide context. It then offers a profile of the evolving Indian community in the Bay Area; the two-way exchanges of students, scholars, travelers and workers; trade and investment trends; and an in-depth examination of key industry sectors where the cross-fertilization of knowledge, talent and capital have added particular value. Readers can review the full text for an in-depth panorama of India's economy and its ties to the Bay Area, or can move directly to the topics or business sectors that interest them most.

We conclude with a set of findings that identify key economic exchanges and benefits growing out of the relationship for the Bay Area and for India; future opportunities for mutually beneficial cross-border collaboration and innovation; and broad policy steps for decision-makers to consider that will both nurture the relationship and ensure the Bay Area's competitive position in the global economy.

Acknowledgements

This report was co-authored by Dr. Sean Randolph, President and CEO of the Bay Area Council Economic Institute, who managed its development, led the field research in India, and produced its final draft, and San Francisco-based international business consultant Niels Erich, who was the principal researcher and developed the baseline draft. Copyediting and layout were performed by Pam Winter.

Original research for this report included interviews and correspondence with experts in the Bay Area and India whose personal experiences as executives, entrepreneurs, investors, university researchers, representatives of government agencies and trade associations, and community leaders helped provide a richer, nuanced understanding of the Bay Area-India relationship.

Anupam Yog of Mirabilis Advisory, a business consulting firm based in New Delhi, guided our work in India, providing critical support and introductions to government, business, university, and media leaders and organizations.

Our analysis was reviewed by a panel of leading business and university economists, whose comments and insights made an important contribution to this effort:

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Contents

Executive Summary.....	1
Findings.....	11
1. Country Briefing: India.....	15
2. A Distant Dream: Indian Immigrants Arrive in California.....	23
3. A Diverse, Vibrant Community	27
TiE Re-Examines its Mission	33
Bay Area Cities Have “Sisters” in India.....	47
4. Indian Students: Innovation and Quality of Life Are Still a Draw.....	51
UC Berkeley and IIT-Kharagpur: In Search of Synergy.....	59
5. Two-Way Trade: Slow but Steady.....	67
Find a Need and Fill It.....	71
Today Almonds, Tomorrow Pistachios	73
Levi Strauss: Evolution of an Indian Brand.....	76
6. Cross-Border Exchanges Flourish	81
A: Banking/Financial Services.....	83
B: Legal Services	90
Dabhol: The Mother of All Cases.....	97
C: Semiconductors	102
D: Software/IT Services/Business Process Outsourcing	114
To H-1B or Not to H-1B	124
Salesforce.com: Build it Yourself.....	139
\$150 Million to \$2 Billion in Six Years: Vivek Paul Takes Wipro for a Spin.....	147
HCL Technologies: India’s Homegrown Hewlett-Packard Diversifies	150
E: Architecture/Urban Planning/Infrastructure	159

Nanocity: A Sustainable Urban Vision	171
F: Energy/Environment/Clean Technology.....	175
The 3-Lakh Electric Car.....	189
G: Computing/Networking/Internet.....	195
H: Biotech/Biopharma	213
7. M&A, Venture Capital, and Private Equity: A Thriving Investment Climate.....	219
Moore's Law Applied to Venture Investing	231
Up Next: Animation?.....	237
Findings.....	243
Interviews	249
Sources	255
Business and Organization Index	285
Credits	289

Executive Summary

Ties between the San Francisco Bay Area and India run broad and deep. Starting from the 1850s, the first Indian immigrants arriving in Northern California were Sikhs from northeastern Punjab. Initially settling in Canada—the Punjab was under British rule and many Sikhs who joined the military were posted to Canada—Sikh immigrants began drifting south, riding the rails to the Pacific Northwest and eventually California. Others later made the trip directly, by steamship via Kolkata and Hong Kong; the voyage took a month.

Jobs with the lumber mills and the Western Pacific Railroad, and the opportunity to lease or buy farmland in California, were a lure. In 1920, Indian immigrants owned 2,100 acres and leased another 86,000 in California, mainly in the Sacramento and Imperial Valleys. Today their descendants produce 95% of the Sacramento Valley's peach crop, 60% of its prune crop and 20% of its almond and walnut production.

At the turn of the 20th century, Indian engineering, medicine and agriculture students began coming to West Coast universities, including Stanford and, especially, UC Berkeley. The 1965 Hart-Celler Act responded to Cold War demand by eliminating country quotas and refocusing immigration policy on attracting engineers and other people with scientific training. The change prompted a spike in Indian immigration.

Changing Demographics

Many new immigrants engaged in small independent businesses—as truck and taxi drivers, or as restaurant and small business owners. Gujarati families—often named Patel, after the record-keepers appointed by rulers in ancient India to track crops and receipts—were drawn to the lodging industry, which offered cash flow and housing. More than half of all economy lodges and 37% of all hotels in the U.S. are now Indian-owned, representing \$38 billion in franchised and independent properties.

In the 1970s and 1980s, growing numbers of foreign-born engineers began coming to the U.S. on H1-B specialized skill visas to work in aerospace and defense. Technological competition with the Soviet Union and the space shuttle program, as well as telecommunications deregulation and the rise of personal computing, drove the trend. The first wave came from the U.K., then increasingly from Asia, and especially from India.

But a much broader convergence taking place in the emerging computing and software sectors would soon have dramatic impacts in both Silicon Valley and India.

Tech Immigration Explodes

In India, the 1969 decision by IBM to unbundle its computer hardware, mainframe operating system and applications software lines launched a tech revolution. Engineering and software graduates from Indian science and technical institutes pooled personal funds to start small computer and software companies. Others joined large, family-owned industrial conglomerates looking to diversify from steel or consumer products to computing and information technology.

In the U.S., hardware and software had become increasingly complex, and vendors had begun offering a wider choice of products that were compatible with IBM legacy systems only up to a point. Banks and other IBM end-users needed increased support and system integration for their off-the-shelf software. Despite India's considerable talent pool, however, strict joint venture rules and high taxes and tariffs were constraints, until Indian firms and their clients devised a solution: "exporting" Indian engineers and programmers to work in the U.S. at client sites.

By 1980, 21 Indian firms were actively sending programmers overseas. Many Indian programmers opted to stay abroad after their assignments had ended. By 1986, nearly 60% of Indian Institute of Technology (IIT) engineering graduates were migrating overseas, principally to the Bay Area. Limited options for graduate study at home, limited business opportunities in India, and the exciting new industries taking shape in Silicon Valley continued to draw Indian students, researchers and entrepreneurs to the region.

At the same time, a new set of forces was bifurcating the information technology/software sector. U.S. business had begun major restructuring, streamlining processes and introducing quality improvements that relied heavily on automation and integration. Demand grew quickly for mid-level and entry-level coders and programmers, which U.S. universities and Silicon Valley were not turning out in sufficient numbers. Competition was heating up for limited H-1B visas to bring in skilled workers.

Cheap telecommunications and networked Unix workstations enabled remote sharing of work worldwide. India, meanwhile, granted tariff exemptions and other incentives to the software industry in 1984, to reverse India's brain drain. Texas Instruments, Hewlett-Packard, Oracle, IBM and others began shifting their software R&D to India. Indian competitors, meanwhile, could keep more of their outsourcing work and employees at home. India's software industry grew from 35 firms in 1984 to 700 by 1990.

A Community Takes Shape in Silicon Valley

Research published in 1999 by AnnaLee Saxenian, now dean of UC Berkeley's School of Information, found that a third of the Bay Area's science and engineering workforce in 1990 was foreign-born. Nearly one-fourth (23%) of Silicon Valley engineers—more than 28,000—were Indian. Almost all were immigrants, more than half with advanced degrees.

Between 1990 and 2000, the number of Indians living and working in the U.S. more than doubled—including students; technology researchers; professionals in medicine, law and business; IT engineers and programmers recruited on H-1B visas; and their family members.

Executive Summary

By 1998, at the height of the tech boom, 774 of the 11,443 Silicon Valley tech firms started after 1980 had Indian CEOs. These firms employed more than 16,000 people and generated annual sales of \$3.6 billion. Fifteen percent of Silicon Valley startups in the 1995–2005 period were founded by Indians—a larger number than for any other immigrant group. California topped the list of states for Indian startups, with 26% of the U.S. total.

The Y2K scare put this trend on steroids. Lacking the domestic workforce to meet the Y2K demand, companies turned to India and its large pool of low-cost engineers. The experience increased India's credibility as an IT resource and propelled it to a new position of prominence in the industry.

By late 2001, however, the tech and Internet bubble collapsed, wiping out companies and share values, and drying up investment. The 9/11 attacks led to travel fears and tighter visa restrictions. Indians well-established in the Bay Area stayed on; others returned home or went elsewhere. Travel and immigration have since come back but in recent years have plateaued, as perceptions have grown that the U.S. welcome mat has been rolled up, and new opportunities have drawn many Indian students and professionals home.

Today the Indian immigrant population in the U.S. numbers 2.48 million. California's Indian community numbers approximately 475,000. Census figures indicate a population of Indian immigrants in the Bay Area of at least 215,000, making it the nation's second largest Indian-American community after New York-New Jersey. Broad-based organizations, such as the Indian Community Center in Milpitas, help bind the community, while a rich palette of cultural organizations supports residents from different regions and social and religious groups. By any standard, the Bay Area's Indian community is successful and affluent. Median income is more than \$107,000; 75% of adults have at least a bachelor's degree, and 70% are in management and professional positions. Roughly half are homeowners.

Bay Area-India Trade: Small, but Growing

Two-way merchandise trade with India moving through the San Francisco Customs District in 2008 topped \$966 million in value. This included \$336.9 million in imports and \$629.1 million in exports. Overall, the San Francisco Bay region has consistently maintained a trade surplus with India.

Totals for San Francisco Bay Area Merchandise Trade with India (\$ millions)

	2004	2005	2006	2007	2008
Total imports	\$275.1	\$272.8	\$328.1	\$329.4	\$336.9
Total exports	\$393.5	\$404.4	\$447.1	\$617.8	\$629.1
Total trade	\$668.6	\$677.2	\$775.2	\$947.2	\$966.0

Source: U.S. Census

Import numbers reflect, in part, contract manufacturing and imports by leading Bay Area retailers, including Gap and Levi Strauss (apparel), Williams-Sonoma (home furnishings, tableware, glassware, lamps, rugs and linens), Restoration Hardware (bath and kitchen fixtures), and Cost Plus World Market and Pier One Imports (clothing, furniture, cushions, linens, decorative items, window blinds, etc.).

Exports to India are led by agriculture and computers. California-grown almonds are the largest agricultural export to India, with a 2007 value of \$175 million, or 9% of California's almond exports. California's high-tech sales to India totaled \$606 million in 2008, according to TechAmerica (formerly the American Electronics Association). While this was a small fraction of the state's \$49.3 billion in worldwide tech exports (with India as California's 19th largest market), it represents a 58% increase since 2002.

Wine presents an opportunity for Bay Area exporters, but India's market is still restricted. U.S. wine sales to India grew 350% over 2000–05, after the government granted an import duty exemption for airports and luxury hotels. India is committed under World Trade Organization (WTO) rules to a 150% maximum duty on wines, but state excise and sales taxes—and, in some states, an outright ban on imports that protects India's 40 domestic wineries—raise the price of a bottle of wine an average 266%.

Trade in goods and agricultural products, however, represents only part of an expanding Bay Area-India economic relationship that is led by IT and includes financial, educational, and other services.

Tourism: A Very Long Flight

A profile of Indian visitors shows that California is a popular travel destination, but primarily for work and family visits, not for tourism. A February 2007 report commissioned by the California Travel and Tourism Commission showed that some 35,000 Indian nationals visited the Bay Area in 2005. More than 60% were visiting on business; a third booked their stay through a corporate travel department; just over half booked lodging and stayed in a hotel or motel, suggesting that many stayed with friends or family; and 91% of visitors were men.

The long flight and expensive airfare may discourage casual travel: all flights are indirect, and the shortest (on Lufthansa) are 21 hours long. Service runs through Asia (Singapore, Bangkok, Taiwan), Europe (London, Frankfurt, Munich), and the Middle East (Dubai). The Lufthansa "Bangalore Express" service from San Francisco International Airport (SFO) was introduced in 2001 with three flights a week, increasing to five flights in 2005, and daily flights since 2006. Most flights run 90% full or better, and the route has become famous for its tech networking opportunities, at the gate and on the plane. While three Indian carriers—Air India, Jet and Kingfisher—have at various times announced plans to serve the region, none currently have a presence at SFO.

Executive Summary

Hotels are another story, however. Tata Group's Taj Hotels and Resorts chain paid \$58 million for San Francisco's Campton Place Hotel, and family-owned Khanna Enterprises, headquartered in Delhi, recently bought San Jose's historic 86-room Hotel Montgomery.

The City of San Francisco has opened a Bangalore office to market the city and the Bay Area as a travel destination and is working with hotels, tour package operators, and others to develop new travel options. It has also recently formed a sister city relationship with Bangalore, adding to a list of Bay Area-Indian sister city relationships that includes San Jose-Pune and Fremont-Jaipur.

Students: Among India's Most Valuable Exports

India is the leading country of origin for international students in the United States, with 94,600 during the 2007–08 academic year, surpassing China's 81,100; 2007–08 was the seventh consecutive year that India has sent the most international students to the U.S.

Some 8,300 Indian students were enrolled in California universities and colleges in 2007–08, up from 6,800 in the previous year and 5,600 in 2005–06. They account for 11.5% of California's international students. Indian students' proportionate share of the estimated \$2.45 billion spent by international students in California on tuition, fees and living expenses in the past year amounts to \$240 million.

A survey of the UC and California State University systems, Stanford University, the University of San Francisco, and Santa Clara University done for this report suggests that about 3,500 visiting undergraduate and graduate Indian students are enrolled at major Bay Area institutions, with as many as 400 more visiting scholars and researchers resident at those campuses. Most are at the graduate and post-graduate level, studying computer science, engineering, and business.

UC Berkeley and Stanford each have special initiatives—the Berkeley India Initiative and Stanford's South Asia Initiative—that leverage campuswide interdisciplinary offerings through coordinated programs, research, and alumni activities. UC Santa Cruz plans to establish a South Asian Studies center by 2010.

The Rise of Entrepreneurial Networks

The first Indian community organizations formed in the 1970s were cultural, reflecting a diverse and divided community. These were largely benevolent associations that welcomed new arrivals, held classes and sponsored group events aimed at preserving traditional cultures far from home.

As the numbers of first-generation, college-educated professionals grew, organizations such as the Silicon Valley Indian Professionals Association (SIPA), Indian Business and Professional Women (IPBW), the South Asian Bar Association of Northern California (SABA), and the Network of Indian Professionals increased the focus on career development, social networking, and community service.

By the early 1990s, Indian immigrant tech entrepreneurs saw a need for a new kind of group aimed at business networking and mentoring. The Indus Entrepreneurs (TiE) was formed in

1992 by a group of Indian technology professionals. Most had encountered difficulties in starting their own companies in the absence of mentors and a strong professional network. They talked of the need to begin building such an infrastructure in the Indian community to encourage new business and wealth formation.

A core group of 20 entrepreneurs began TiE with monthly dinner meetings at the San Jose Hilton. Cirrus Logic founder Suhas Patil was instrumental in organizing the first TiE Annual Conference in 1994, which drew a surprising 500 attendees. By 1999, it was regularly drawing nearly 1,000. Today TiE is a global organization, with 53 chapters in 12 countries, 11,000 general members, and 1,800 Charter Members (experienced entrepreneurs and senior, established executives recruited by invitation only). TiE Silicon Valley remains the global headquarters and mother ship and has played an influential role in the development of many startup companies—both in Silicon Valley and in India—and in advising Indian universities and government agencies on entrepreneurial strategies.

Other major Indian organizations in the Bay Area include:

- the Global India Venture Capital Association (formerly the US-India Venture Capital Association), formed in 2002 as a forum to connect venture capital to entrepreneurs with technologies or business plans applicable to Indian markets;
- the American India Foundation, founded in 2001 in Silicon Valley, which has tapped into Indian professional networks nationwide to raise more than \$50 million for education, economic livelihood and public health projects in India;
- the Indo-American Council, an initiative launched in late 2007 by Bay Area Indian leaders to raise the political visibility and influence of the Indo-American community; and
- Enterprising Pharmaceutical Professionals from the Indian Sub-Continent (EPPIC), an association that brings together Indian professionals in the bio-pharma sector for networking, entrepreneurial mentorship and, more recently, to build bridges with India.

The Silicon Valley-India IT Hub

Nearly all major Bay Area technology companies have a presence in India. Many other Bay Area businesses, including firms not primarily focused on technology, have relationships with Indian IT service providers, drawing on those resources for call centers, back office IT, legal, financial, accounting, and design or other services. Across the board, these relationships have permitted Bay Area companies—like others around the world—to reduce costs, develop products targeted for Indian and emerging markets and, in many cases, free up U.S. personnel to focus on more innovative, higher-value activities. In that process, a symbiotic relationship has evolved in which value is created in both the Bay Area and India, based on complementary capabilities. The extensive cross-border networks that have evolved encompass:

Executive Summary

- Indian engineers, programmers and computer scientists in Silicon Valley and the Bay Area, engaged in the forefront of product and technology development;
- successful Indian technologists and entrepreneurs reinvesting in the region's economy as venture capitalists;
- Bay Area technology companies with R&D centers designed to access India's large, educated talent pool; and
- Indian IT service and software firms moving rapidly up-market from call centers and basic software coding to provide overseas companies with increasingly sophisticated software and systems integration services, in-depth sector-specific consulting and product engineering, and knowledge process outsourcing.

Innovation Drives New Business Models

As already noted, the Y2K scare of 1998 and 1999 drove many U.S. companies facing a shortage of engineers to turn to India, and the resulting relationships catapulted India's IT sector to global prominence. Cost arbitrage drove much of this early activity.

While India's elite science, engineering and technical schools only produce about 4,000 highly-skilled students annually, India overall graduates a pool of up to 400,000 engineers and programmers who often receive additional training from the companies hiring them. The ability to deploy dozens or even hundreds of tech workers on a software or systems problem for a client, at a fraction of the U.S. cost, has lured many "captive" (foreign-owned) R&D centers to India.

While cost is still an advantage, that model is rapidly changing as India's domestic costs rise, competition for basic Business Process Outsourcing (BPO) services is growing from places like the Philippines and China, and India's IT majors are moving aggressively away from strategies based on volume (throwing large numbers of engineers at a problem) to value (more sophisticated, high-end services such as systems integration, end-to-end product development, remote systems management, and consulting). India's IT community, both foreign and domestic, is now focused less on wage arbitrage and more on creating intellectual property. Many overseas companies that located in India solely for cost advantage have encountered difficulties. Demand has narrowed India's wage advantage from 6:1 to 2:1. Attrition rates can reach as high as 40%, particularly where companies outsource only routine work and limit opportunities for advancement. Ambitious workers frequently jump to companies offering higher pay or a better career track. For many companies, therefore, the cost of operating a captive center long-distance can outweigh the benefit.

Forrester Research reported in a May 2007 study that 60% of captive centers in India were struggling to remain viable, with annual costs for a 150-person operation running as much as a third higher than for a center operated by a third-party (Indian) outsourcing firm. Other analysts agree on the trend: many smaller captives are likely to close, bring in local partners, or be sold to larger and more efficient IT firms.

This is occurring even as India's leading IT companies are continuing to expand. These diverging trends are largely explained by issues of quality and efficiency. Small captives that conduct routine work and trade primarily on lower costs are often less efficient and more expensive to operate, particularly compared to IT majors such as Wipro, Infosys and HCL that benefit from deep infrastructure and economies of scale. On the other hand, captives that perform more advanced work, engage more deeply in product development, and offer more stimulating environments for their employees fare better. The best matches of Bay Area innovation with Indian talent have been made where the primary focus is on value creation—particularly where firms have assigned their Indian centers significant responsibility for product development. Many Bay Area firms follow a hybrid model, utilizing both their own R&D centers (particularly where intellectual property is a concern) and extensive partnerships with one or more Indian majors.

Often there is a social component as well: companies can benefit from motivated developer communities and product engineers, and from external activities that deepen community engagement, nurture developer communities, and build critical masses of skilled, high-value users, such as curriculum development or donating hardware and software to schools.

The Bay Area Leads the Way

Institutional cooperation between Bay Area and Indian universities and research centers is growing:

- Berkeley's Center for Information Technology in the Interest of Society (CITRIS), through the Intel Research Berkeley Lab, has designed and built a wireless communications network linking Aravind Eye Hospital in Tamil Nadu with five hospitals and 50 rural health clinics so that eye specialists can interview and diagnose patients by videoconference.
- Stanford's South Asia Initiative has advised the Prime Minister's Office and the Ministry of Communications in India on telecom industry reform, including licensing, bandwidth pricing, opening the telephony market to local franchisees and other practices to increase service.
- Lawrence Berkeley National Laboratory (LBNL), the California Energy Commission, the California Public Utilities Commission, and Pacific Gas and Electric Company are advising the Maharashtra Electricity Regulatory Commission (MERC) on strategies to improve efficiency, including metering, replacement programs for inefficient motors and industrial machinery, new irrigation methods, cool roof technology, green data centers, and other energy-saving measures.

Leading Bay Area companies have established early footholds in India's growing market. Their activity reflects the drivers of India's economic expansion—a globalized IT sector and dynamic consumer markets:

- Levi Strauss has 450 exclusive outlets in 80 Indian cities.
- Visa has issued more than 30 million debit cards and 14 million credit cards through 32 banks and 13 non-bank partners.

Executive Summary

- India represents Oracle's largest investment outside the U.S. (\$3 billion since 2002) and is now its fourth largest global market, with a workforce of 24,000 and a 53% share of India's relational database market—including 80% of India's banks, 6,700 technology and applications customers, 400 channel and alliance partners, and an online developer community numbering 700,000.
- India hosts Symantec's largest engineering site outside the U.S., performing work on more than 80% of its products.
- India accounts for one-third of McAfee's workforce, generated 100% of its patent submissions in 2007, and is credited with doubling the firm's global margins (from 13% to 25%). Half of McAfee's staff of worldwide antivirus researchers works in Bangalore, enabling a 24/7 worldwide response capability.
- India accounts for one-third of Adobe's global engineering workforce.
- Hewlett-Packard is the largest player in India's domestic IT market.
- More than half of India's developer community—about 740,000—works on Sun platforms.
- Cisco has placed its second global headquarters in Bangalore, to leverage India's engineering resources and develop products for Indian and other emerging economy markets.
- India is Yahoo!'s base for product and service development aimed at emerging markets.
- eBay counts 2 million regular users in 670 cities and more than 10,000 dealers across India. In August 2008, the company reported an item sold every minute on its India website.
- The San Francisco office of architecture firm Skidmore, Owings & Merrill is designing replacement housing for 22,000 slum dwellers in Mumbai, involving master planning, new housing prototypes and a team of sociologists and anthropologists working with slum residents.
- San Francisco-based architecture/design firm Gensler is part of the design team for the new \$300 million Chennai airport.

Bay Area venture capital (VC) firms are spearheading investment in India, identifying opportunities in sectors ranging from information technology to consumer goods:

- Draper International launched the first India-dedicated venture capital fund.
- Silicon Valley Bank led the migration of U.S. venture capital to India by organizing an exploratory delegation of Bay Area venture capitalists in 2003 and has established its both a consulting presence and an equity fund to invest jointly with VC clients.
- Evolve India Life Science Fund is the first India-dedicated fund focused on biotechnology.
- More than 40 Bay Area venture firms have Indian leadership and/or investment activity in India.

Global Reach

Venture firms from the Bay Area have invested in the first consumer Internet company in India to reach a \$1 billion market capitalization and in India's first on-line gaming company.

While some Bay Area venture firms are retaining their focus on technology, the wider trend is to invest in India's consumers. Most companies receiving funding from the Bay Area are not creating groundbreaking new technologies, but are providing low-tech responses to the opportunities presented by the India's fast-growing markets.

As the challenges of urbanization grow, climate change threatens India's water supply, and energy use increases, sustainable urban development and renewable energy technologies will be a growing priority for India. This presents unique opportunities for the Bay Area, with its strong cleantech base, and for venture investment in particular.

India's biotech sector is still small but growing in sophistication. With roots in India's long-established pharmaceutical industry, biotechs are moving into clinical trials, drug discovery and contract research. Bay Area biotech companies are using Indian resources to extend their limited investment dollars, increasing their chances of surviving and successfully bringing products to market. Bay Area venture and investment firms such as Burrill & Company and Lumira Capital are leading the way in U.S. investment in India's life sciences sector.

India is also starting to export capital. Global outbound investment from India grew sharply in 2007–08, to 2,200 ventures worldwide valued at \$23.1 billion—a 53% increase over 2006–07. Most of that is focused on Europe, the U.S., and Africa. Direct investment in the Bay Area remains light. Beyond the hotel investments mentioned earlier, Bay Area deals focus primarily on technology.

All of India's major IT services and software firms are present in Silicon Valley and, together with their U.S. counterparts, are among the top H-1B visa applicants. While they have invested in some small, specialized Bay Area business process IT startups, they generally prefer strategic alliances and technology licensing arrangements.



Findings

When the Bay Area's innovation infrastructure—research institutions, technology companies, and capital and risk-taking culture—comes in contact with India's talent and entrepreneurial energy, the combination has been explosive, unleashing powerful business and wealth creation.

India's current growth trajectory began in 1991 with economic reforms that lifted the heavy hand of control planning and stimulated a wave of dynamic business growth that continues to the present. India's development in this period parallels China's, but is based more heavily on services than on manufacturing.

As with China, the Bay Area's economic and cultural ties with India are a unique asset, manifested by value creation at both ends of the relationship. Distinct characteristics of India's economic environment support this growth:

- India's economy is privately-led, rather than government-directed, making India sometimes less focused, but at the same time more open and diverse than China.
- India's focus on IT services and software has provided its engineers and scientists with important windows into the full range of U.S. industry sectors—finance, energy, automotive, health care, aerospace and infrastructure—that are key to value-added innovation.
- English-language prevalence in India, along with Western legal and democratic traditions and business customs, has enabled deep relationships that link talent and innovation.

The Big Picture

A new transnational model is taking shape, in which companies source materials, components, technology, capital, and talent from the most capable cost-effective worldwide locations, to develop products and services on a global scale, that are tailored to address local needs and markets. Sourcing knowledge and talent in the most cost-effective locations worldwide lowers R&D costs and improves product time-to-market by directing larger numbers of people at a given technology solution. It also frees skilled talent in home countries to devote more energy to new innovations. In India's case, the pattern that is emerging suggests a deepening relationship between Bay Area and Indian companies, based on complementary capabilities and value co-creation.

A Complementary Relationship

In interview after interview, successful Indian engineers, programmers and scientists recount a similar narrative—of coming from a culture of bureaucratic obstacles, scarce credit, limited education and opportunities, and power and water shortages, to a place where infrastructure works, advanced research is supported, government generally stays out of the way, new ideas are embraced, and capital is readily available.

Leaving more “secure” jobs with established firms to pursue innovative new technologies and business processes, these entrepreneurs helped to launch iconic companies such as Sun Microsystems, Cirrus Logic, Sandisk, Brocade, and HotMail. Many are serial entrepreneurs, launching and supporting generations of companies, either directly or as venture capitalists. Their early innovations, the mentoring networks they have established and supported, subsequent investments in the next generation of entrepreneurs, and philanthropic contributions are a vital economic asset to the region.

But in the new global economy, as R&D becomes more distributed, as developed countries grapple with slower growth, and as emerging economies such as India and China continue to expand their base of human capital, where will the next generation of entrepreneurs see opportunity?

For now, the Bay Area’s leadership in advanced research and technology innovation appears secure, as innovation in India focuses more on business processes and models: India is not expected to become a source of breakthrough technology in the foreseeable future. At the same time, its growing capabilities, like China’s, suggest that in the future more R&D and product development will happen overseas, and that business, investment, and employment will migrate to global centers that offer a compelling combination of talent, domain expertise, and market scale. These factors are becoming even more compelling as significant numbers of Indian students and professionals trained in the Bay Area return home. Cross-border collaboration and the leveraging of competitive assets are critical in this environment, giving rise to a new set of competitive factors: education; immigration; workforce policies; tax and regulatory policy; and access to capital.

America’s turn to India and other countries for engineering talent is largely the result of the U.S. failure to generate an adequate number of home-grown scientists, engineers, and technicians. Workforce issues will remain a concern, as India’s large and growing pool of talent raises questions regarding future employment in the lower and middle range of the U.S. service sector.

In this regard, the Bay Area faces a number of competitive challenges, some within its power to influence, others not. Among the most significant:

- The region’s primary and secondary education system lacks qualified teachers and has failed to produce a critical mass of students grounded in science and math.
- U.S. visa and immigration policy unnecessarily restricts access to global talent, fails to compete aggressively for top foreign students and researchers, and discourages them from staying to contribute to the economy.

Indian technology and other professionals now in the Bay Area see growing entrepreneurial opportunities in India, leading students and recent immigrants to return home in significant numbers. This is happening at the same time the once-clear division of labor between Silicon Valley innovation and lower-end work performed in India is blurring.

This is an important time for the Bay Area and California to re-evaluate their roles in a global economy where value is increasingly created by and distributed across virtual communities of knowledge and expertise. To sustain their competitiveness and preserve high-quality jobs in this

Executive Summary

globally competitive environment, the region, state and nation need to invest in areas that build on competitive strengths and on their current leadership position as centers of global innovation. By building on and strengthening that competitive base, California and the Bay Area can more effectively compete and partner with emerging global players such as India and China. Failing that, the center of action is likely to switch elsewhere.

Interviews for this report generated a number of policy perspectives and suggestions. These focus on:

- increased emphasis on math, science and technology in primary and secondary education, including magnet charter schools, stepped up recruitment of fully-credentialed teachers, and partnerships with technology companies;
- high school and college-level business courses emphasizing entrepreneurship and global economics, along side traditional economics and management;
- immigration reform—to develop a J-1/L-1 visa program that allows graduate technology professionals and researchers to take jobs without first returning home; to facilitate family unification (e.g., with ageing parents) by reducing unreasonably long waits; and to provide a fast-track to green cards for foreign students who graduate from U.S. universities with advanced degrees in priority disciplines such as computer science or engineering.
- concern with Buy America provisions in federal stimulus policy that restrict the employment of foreign nationals, cutting off U.S. companies from the talent they need to compete and removing job opportunities for foreign-born graduates of U.S. universities;
- state and federal investment in R&D and higher education, to help bring technology to market and ensure the U.S. and California's continued technology leadership;
- development of R&D, investment, and export opportunities to address India's growing renewable energy, energy efficiency, and green urban design markets;
- development of travel and tourism opportunities, through expanded air service and marketing of the Bay Area's unique connections to India.

On the Indian side, this report's research points to:

- the need for India's IT companies, if they wish to become truly global enterprises, to expand their service centers outside India and increase their hiring of non-Indian nationals to serve those markets; and
- the need for India's government to sustain and accelerate economic reform, to improve government performance and efficiency, and to allow expanded partnerships and market access in a range of areas that are currently subject to major restrictions, including banking, retail trade, legal services, wine and agricultural imports, and higher education.

The Bay Area's economic and cultural ties to India are unique. Much of this uniqueness comes from the high levels of education, wealth, entrepreneurial activity and business leadership in the

Global Reach

region's Indian community. India's expanding economy, with its growing business and consumer markets, also anchors the relationship. The Bay Area's focus on innovation and entrepreneurship is mirrored in India's deep reservoir of human capital and its focus on technology and other services. Bay Area companies draw on both and have led the world in establishing strategic partnerships with Indian counterparts and service providers. This relationship, properly managed, can play a major positive role in positioning the Bay Area for continued success in the global economy.



1

Country Briefing: India

“China’s approach is top-down—the government decides. From a business point of view that’s a more efficient model, since the decisions get made fast and you are dealing with less uncertainty. India, on the other hand, is a more chaotic bottom-up model—the entrepreneur is the change agent here while the top is slow and bureaucratic, but that’s also a good thing because even though the change is slow it is deeply ingrained and hence more sustainable in the long-run.”

Vinod Dham, NEA Indo-U.S. Ventures

Any discussion of India’s dramatic economic rise during the past 15 years invites comparisons with China. With cultures dating back more than 5,000 years, India and China are the world’s two most populous nations and have emerged in recent years as leaders in the world economy.

The two countries’ recent histories show certain parallels, beginning with India’s independence in 1947, and the replacement of China’s Kuomintang government with communist rule in 1949. In the decades that followed, both India and China followed economic paths that emphasized central planning in pursuit of social objectives. Both have had deeply-held suspicions of Western free-market models—India as a non-aligned democracy dominated by a single political party, China as a Marxist-Leninist state.

Both eventually reversed course, adopting extensive economic policy and market reforms. China’s reforms began in the 1980s, culminating in membership in the World Trade Organization in 2001. India’s shift began later, in 1991, in response to a reform program imposed by the International Monetary Fund. Reform has benefited both countries, attracting investment, opening markets and unleashing energy and entrepreneurship that have created economic growth and new wealth.

However, these parallels go only so far in describing the patterns of China’s and India economic growth: cultural and political differences between the two countries have led to distinctive economic models and unique business environments.

Despite market reforms, China’s government remains highly centralized, with political power vested in the Communist Party and minimal public discourse. In this respect, the contrast with India, the world’s largest democracy, is striking. Policy decisions in India are hotly debated, internally and in public, with strong partisan and interest group pressures brought to bear. Add to this a vocal press, regional and linguistic differences, and a culture geared more toward individual than collective action, and the differences become even sharper.

Which model—the Chinese or the Indian—ultimately produces the greatest economic benefit remains to be seen: one manages from the top down in a way that is arguably more efficient but is largely driven by state policy objectives, strategic guidance and resource allocation; the other manages more haphazardly, from the ground up, and with the state often an obstacle, struggling to keep pace with changing conditions. In the long term, India's slower, more democratic processes may prove a source of either competitive weakness or strength.

A partial answer rests with India's focus on software and information technology (IT) services, rather than manufacturing—a logical development in a country with a deep intellectual tradition but unreliable water and power supplies, and poor infrastructure for physically getting goods to market.

The reach of India's engineers and programmers into core business processes across all sectors—energy, health care, transportation, urban planning, financial services, telecommunications, retailing—provides a competitive advantage in industrialized and emerging markets alike. This positions India as a potential strategic partner and competitor in much broader ways in years to come.

1991: An Economic Sea Change

Pre-1991, India's economy was centrally planned and regulated. Heavy industry was comprised of state monopolies. Private industry was subject to strict industrial licensing, with certain sectors, such as apparel, reserved for small-scale enterprises.

More than 7 in 10 import categories were subject to licensing restrictions or were banned outright. Most tariffs were in the 110–150% range, and nearly all exceeded 60%. Capital account and current account transactions were subject to exchange controls. Foreign investment was limited to 40% equity ownership except in technology or export industries. Foreign direct investment (FDI) hovered at a low \$100–200 million annually. India's foreign exchange reserves totaled \$1 billion.

Iraq's invasion of Kuwait, and the first Gulf War that followed, proved a tipping point for economic reform in India as oil prices rose, export markets in Kuwait and Iraq dried up, and remittances from Indian workers in the Gulf—which offset half to two-thirds of India's global trade deficit—slowed as workers fled home. An initial credit tranche from the International Monetary Fund (IMF) failed to take hold, amid political instability.

A second IMF package imposed tougher conditions, beginning with an 18% rupee devaluation, an end to import licensing (although import quotas continued until 2001), cuts in export subsidies, and reduced public lending to state industries. Foreign investment rules were eased, more than 60 industries were initially removed from the list reserved for small-scale enterprises, and the number of industries reserved for the public sector was scaled back from 18 sectors to four—minerals, railroads, munitions and nuclear power. In 2002, the maximum duty rate was lowered to 30%. India saw an immediate jump to 6.7% average annual GDP (gross domestic product) growth in the first 5 post-reform years.

The Shift No One Saw Coming

Beneath the economic radar, a generation of skilled engineers, technicians and managers were subtly changing the Indian economic landscape. From the 1980s onward, large numbers of Indian engineers and programmers, graduates of elite Indian technical and scientific institutes and of western universities, joined the global workforce. Large financial firms and their IT and software vendors began using Indian engineers, developers and programmers to automate their processes and to set up back office centers to cut costs. Technology vendors began relocating portions of their operations to India to serve multinational clients, both globally and in the domestic Indian market.

Demand for skilled technical workers escalated during the “Y2K” computer scare in 1998–99. Y2K gave rise to a number of powerful Indian software development and IT service and business consulting firms, as American and other companies turned to India’s large pool of engineers for technical support not available at home.

This situation also provided Indian developers and programmers with a unique window into business processes and future IT applications—financial transactions, global project management, remote claims processing and sales presentations, supply chain fulfillment, business-to-business auctions and exchanges, and more.

India’s IT revolution has since exploded on many fronts:

- Services companies have achieved global scale and reach.
- Traditional Indian heavy industries (automobiles, steel, energy) have modernized.
- IT and the Internet have enabled cross-border collaborations in diverse fields.
- India’s IT capability, English-speaking workforce, and comparatively low wage rates have allowed it to compete effectively for outsourced marketing, customer service, recordkeeping, billing, fulfillment and other business services worldwide.

The practical effect is that India has leapfrogged the traditional economic development progression from agriculture to manufacturing to services to knowledge industries. Services and knowledge-based sectors now make up 55% of India’s economy, with manufacturing and agriculture accounting for 19% and 26% of GDP, respectively. Manufactured exports account for a surprisingly small portion of economic activity.

India: An Economic Snapshot

GDP

India’s economy has more than doubled in size since 2001–02, from \$422 billion to \$1.16 trillion (USD) in fiscal 2007–08, which ended on March 31, 2008. GDP growth averaged 9.3% in the three fiscal years ending in 2007–08. The global financial crisis that began in 2008 has more recently slowed growth to a still respectable 6–7%. While developed countries today would find such a growth rate enviable, India is struggling to keep up with a young population that adds 9 million

new workers annually and urbanization that has led to rising unemployment in major cities. Pressure on the economy to produce up to 12 million jobs annually requires at least 9% annual growth.

Trade

India's two-way global merchandise trade reached \$414.9 billion in fiscal 2007-08, up 30% from \$319.4 billion in 2006; services trade added another \$125 billion. Merchandise exports rose 23%, while imports grew 31.5%, increasing the country's trade deficit by half from a year earlier, to \$93.3 billion.

The U.S. is India's largest trading partner. U.S.-India two-way trade was only \$10.9 billion in 1996, growing to \$41.6 billion in 2007. During the first three quarters of 2008, two-way trade totaled \$34.3 billion: \$19.5 billion in U.S. imports from India and \$14.8 billion in U.S. exports to India.

Foreign Reserves

India's foreign exchange reserves reached a high of \$313.5 billion in April 2008, but have since fallen to \$252.3 billion as of March 2009—the result of a 27% depreciation of the rupee against the dollar during 2008 (from 40 rupees to more than 50 rupees to the dollar) and a massive \$45 billion selloff by foreign institutional investors since September 2008. The selloff was in part to cover exposure at home but also came in response to emergency rules imposed by the Securities Exchange Bureau of India (SEBI) ordering hedge funds to unwind their positions. Though large by historical standards, India's reserves are still far smaller than China's \$1.95 trillion as of year-end 2008.

Foreign Investment

Private equity and venture capital investment in India began in earnest in 1996–97 with the expansion of the IT, telecom, and Internet sectors, culminating in \$1.16 billion in deals done in 2000—much of this activity relating to Y2K. A sharp dropoff followed the tech crash in 2001: late-stage and private equity deals fell from 138 to 74; investments in Internet companies declined from \$576 million to \$49 million.

After 2004, deal activity returned in full force. Overall foreign direct investment (FDI) increased from \$5.5 billion in 2005–06 to \$24.5 billion in 2007–08; private equity investment grew from \$2.2 billion to \$14.2 billion; and venture capital investment nearly doubled from \$268 million to \$543 million. Net portfolio investment inflows totaled \$20.3 billion in 2007–08 versus \$3.2 billion a year earlier. Remittances from Indian nationals working abroad have risen over time, from \$2.1 billion in 1990–91, to \$12.9 billion in 2000–01, to \$27 billion in 2007–08.

As the global economy slowed in 2008–09, institutional investment and IPO activity stalled but has subsequently rebounded. (See Chapter 7, *M&A, Venture Capital, and Private Equity: A Thriving Investment Climate*, for more information on the investment climate.)

Standard of Living

Per capita income in India is deceptively low in exchange rate terms, but has been rising rapidly—from the rupee equivalent of \$470 in 2002, to \$797 in 2006, to \$825 in 2007–08. Some 800

Country Briefing: India

million of India's 1.13 billion people live in more than 550,000 villages and rural areas in relative poverty (about 260 million are believed to live on less than \$1 a day), while the remainder live in some 2,000 towns and cities. Nearly a third of India's population—a number larger than the U.S. population—is under 15 years of age. Half is under 25, making India the youngest major economy in the world.

Education

India's education system is marked by vast disparities. Elite institutions of higher education, such as the famed Indian Institutes of Technology (IIT) and the Indian Institutes of Management (IIM), generate graduates that compete with the world's best and are in high global demand. The small number of such institutions relative to the demand for higher education has spawned a growing number of private colleges and universities—of variable quality. Competition for slots in the top 10% is intense, particularly in engineering and medicine.

Meanwhile, primary and secondary education fails at many levels. The half of India's population under twenty-five includes more than 360 million children of school age. Of those, half leave school by the eighth grade. UNESCO estimates that India will need two million more teachers by 2015. The curriculum for teacher training, however, is antiquated, and on any given day as many as 25% of teachers are absent. The problem is particularly acute in rural areas.

A Growing Middle Class

An estimated 60 million Indians have individual incomes at or above levels which the Indian National Council of Applied Economic Research uses to define middle class. Using the criteria in a CNN-IBN-Hindustan Times Study—ownership of a telephone, motorized vehicle and color television—as many as 200 million Indians fit the description.

As of January 2009, the Telecom Regulatory Authority of India (TRAI) put the nation's total telephone market at 400 million subscribers, with the wireless segment accounting for 362 million and adding an average 8-10 million new users per month. At the same time, telephones of any kind are in the hands of fewer than 35% of Indians, leaving room for further market growth. Internet use is estimated at around 45 million people, less than a 5% market penetration.

Goldman Sachs predicts that per capita incomes in India will multiply four-fold by 2020; McKinsey & Company expects the Indian middle class to grow to 583 million by 2025, with middle class consumers accounting for 59% of total consumer spending and urban dwellers accounting for 62%, up from 43% today. India's retail sector, currently around \$300 billion, is expected to more than double to \$637 billion by 2015.

Longstanding government policies protect small, often family-run, domestic businesses by imposing strict workplace rules on business beyond a threshold size, and by prohibiting foreign investment in “multi-brand” big box retail. Nonetheless, global players like Walmart and Tesco are making inroads through respective alliances with domestic multi-brand retailers Bharti Enterprises and Tata Group. Walmart and Tesco are opening large “cash-and-carry” wholesale outlets allowed by the government to supply retail and institutional customers and will provide

exclusive wholesale supplier and supply chain support to Bharti and Tata hypermarkets throughout India.

Property Market

The Housing Development Finance Corp. (HDFC) Bank estimates a shortage of 25 million housing units, growing to 27 million by 2102. Pent-up demand from an emerging middle class, mortgage rates at record lows in 2004, and an easing of rules in early 2005 allowing foreign investment in construction and property development, all combined to stimulate growth over 2005–07.

Demand pressures pushed home prices up four-fold, pricing coveted entry-level buyers out of the market. Large developers, partnering with foreign institutional investors—investment banks, insurance companies, private equity firms, pension and sovereign wealth funds—bought up land, where possible, at premium prices.

With mortgage rates at 12–13%, credit tight, lower share prices, an oversupply of high-end housing, and slowing economic growth, new home sales fell sharply in 2008 and projects of all kinds were idled. Many projects are mixed-use with a housing component—and the housing component, at bubble prices, was key to the development penciling out. With global financial markets stabilizing by late 2009, property markets have since recovered lost momentum. (See the *Architecture/Urban Planning/Infrastructure* section of Chapter 6, *Cross-Border Exchanges Flourish*, for more information on the property market.)

Taxes

India has a convoluted tax structure in which domestic corporations officially taxed at 35% often pay as little as 20%, while only 20 million Indians—less than 2% of the population—pay taxes. Farmers are exempt, and wealthy professionals and entrepreneurs resort to cash and barter in the informal economy to avoid complex reporting requirements and a 30% rate.

Salaried employees (whose taxes are deducted) and the poor (targeted by low eligibility thresholds) pick up the slack, along with foreign corporations taxed at a 40% rate. Low “direct” corporate and personal income taxes have also been gradually offset by ever higher “indirect” customs and excise taxes.

Less than 10% of India’s labor force, some 400 million workers, is on regular wages and salaries. Only about half of those are unionized; only 13% have pensions. The informal economy accounts for an estimated half to two-thirds of net GDP, income and savings. Agriculture still accounts for more than 60% of the country’s employment.

Governance

Reforms in 1991 went a long way toward dismantling the “license raj,” created by Prime Minister Jawaharlal Nehru after independence, which set licensing requirements for all businesses—regulating size, growth, output, product lines, hiring and firing of workers, and so on—in a planned economy. Even today, remnants of the system remain. Burdensome and inconsistent regulations, confusing jurisdiction among departments and ministries, and favoritism shown for

Country Briefing: India

public sector companies—often specific to an industry—discourage expansion, diversification, sourcing patterns or public listing.

Prime Minister Manmohan Singh promised civil service reform when he took office in 2004, but progress has been slow. The central government employs 3 million; the states employ another 7 million. Most civil servants are police and railway workers.

Senior bureaucrats complain about the declining quality of new recruits, as education standards are slipping nationwide, the private sector lures away the best and brightest, politicians intervene to hire cronies and family, and caste-based quotas erode the merit system. Absenteeism and corruption are common.

Once hired, senior Indian Administrative Service (IAS) bureaucrats are constitutionally tenured and cannot be fired. Instead they are subject to politically motivated transfers and suspensions after a minimum two-year tenure period. Thus, all senior administrative positions have come to be viewed as two-year postings, and bureaucrats, to keep their jobs or ensure a favorable transfer after two years, have a disincentive to make major decisions or advance new policies.

All of this makes it easier for interest groups and political parties to apply pressure in opposition to government planning and policies. In a recent example, rioting farmers in West Bengal, instigated by a dominant Communist Party, forced Tata Group to abandon an about-to-open manufacturing plant for its “one-lakh” (\$2,500) car, the Nano, and build the car in Gujarat instead.

Financial System

India overregulates and misallocates both savings and lending. The national annual savings rate of 22.3% is high relative to other countries, but nearly all of that savings comes from households, which manage to set aside 28% of total disposable income. Half of household savings go into the bank, while nearly a third (\$24 billion in 2005) are directly invested in some 44 million small family farming and business enterprises or in gold (\$10.3 billion), according to a 2006 McKinsey & Company study. This substantial economic activity takes place outside India’s banking and financial system.

Government policies, meanwhile, require banks to hold 25% of their assets in government bonds and direct 36% of lending to agriculture, household businesses and other “priority” sectors. The result: some 57% of bank loans are directed toward relatively inefficient state-owned enterprises, with the remaining 43% available for the private sector. Few private businesses borrow from banks or issue shares, but instead fund expansion through retained earnings.

Infrastructure

An ageing, overburdened infrastructure hampers India’s growth—a marked contrast with China’s aggressive program of infrastructure construction in the last ten years. Installed capacity of the nation’s electrical grid is about 129,000 megawatts, 10% short of the nation’s power needs overall and 15% short during peak periods, according to the Ministry for Power. New power projects are slowed by state and central government disputes, permitting delays, and citizen law-

suits and protests. Blackouts are common, and most major office buildings, industrial facilities and commercial complexes invest in backup generation.

The federal Planning Commission estimates that deteriorating, congested roads and bridges cost the Indian economy some \$6 billion annually. Traffic on many of India's highways creeps along at an average 20 miles per hour, and city traffic is typically gridlocked. As much as 40% of agricultural crops spoil in the fields or in transit due to poor roads and inadequate transport, contributing to rising food prices and inflation.

Subsidized water prices to farmers do not cover the cost of maintaining, let alone expanding, India's irrigation system of canals and groundwater supplies. Two-thirds of India's arable land is rain-fed, with inadequate storage and collection infrastructure and little emphasis placed on conservation. Urban water utilities and wastewater treatment systems lose 25–50% of their supplies to leaking pipes, illegal connections, unbilled water or unpaid water bills. The urban poor with no utility connections pay up to ten times more for a liter of water from private suppliers, with no guarantee of better quality.

Indian ports are expected to see freight traffic grow from 623 million tons in 2007 to more than 1 billion in 2011, yet current capacity at the 140 berths nationwide is about 400 million tons, with capacity for another 100 million on the drawing boards. Non-working time at berth ranges from 18–43%, depending on the port. Rail and ocean traffic growth has slowed steadily since 2004, in favor of air freight, which has grown by an average 9.5% annually since 2000.

The infrastructure picture is not without positive signs—with a modern, popular New Delhi subway system with first-phase construction completed, on budget, in 2005; the \$12 billion Golden Quadrilateral network of superhighways linking Mumbai, Delhi, Kolkata and Chennai, now under construction; and new airports going up in Bangalore and Hyderabad. In all, the government foresees \$330–500 billion in public and private infrastructure spending through 2011.

A New Mindset

The contrasts within India's economy are striking: educational institutions that rank with the best in the world coexisting with an elementary and secondary system that fails large segments of the population; corporate technology campuses employing thousands of engineers, accessible only by deteriorating and congested roadways and overburdened transit; cracked sidewalks and booming cell phone use; a middle class nearly the size of the United States, but another 800 million living in poverty.

What is perhaps most significant about India today, however, is a changed attitude on the part of its people. Spurred by successful reforms, for the first time in decades many Indians are optimistic about their own and their country's future, with their destiny in their own hands. This sea change translates into opportunity for both Indians and their global partners.

2

A Distant Dream: Indian Immigrants Arrive in California

The first report of a solitary Indian national in California was in the gold fields in 1857, but Indian immigrants did not begin arriving in significant numbers until the end of the 19th century.

Most of the first immigrants were Sikhs from the Punjab region in northeastern India, part of which is now Pakistan. The Punjab was annexed by Britain in 1849 and prospered from heavy British investment in roads, bridges, canals and railroads. Good rail connections to port cities on the coasts encouraged trade and travel. Punjabis found work and developed skills in engineering and construction. Many Sikhs joined the army and police forces, taking up posts throughout the British Empire, including Canada.

Word spread through returning soldiers of job opportunities working in mills or on railroad construction in Canada. The pay was \$2 a day, nearly 10 times Indian wages. Sikhs emigrating to Canada to earn more money, and to escape discrimination in the predominantly Muslim and Hindu Punjab, found harsh weather and prejudice on the part of locals. They began drifting south, typically riding the rails into the Pacific Northwest and, eventually, California. A sizable community of Punjabi farmers developed in the Sacramento Valley, and remains there today.

An April 1899 report in the *San Francisco Chronicle* noted the arrival of four Sikhs on a Japanese ship, the *Nippon Maru*, at the Pacific Mail dock. All were from Lahore, all had the last name Singh, all had served in the police force in Hong Kong, and all were looking to earn money and return home. The story was similar for most of the Indian immigrants that followed, nearly all of them men. Most traveled by steamship 12 days from Kolkata to Hong Kong, and then another 18–19 days to Canada or the U.S. Most hoped to earn money quickly, with which they could repay debts or buy property back in India.

By 1910, Indian immigration to the United States had risen to nearly 6,000. With it came discrimination from local laborers afraid of losing their jobs. A 1908 *New York Times* article reported that some 70 Indians laid off by the Southern Pacific Railroad were chased out of the town of Marysville and their money was stolen. They filed a formal complaint with the British Consulate.

Beyond jobs with the lumber mills and the Western Pacific Railroad in the Northwest, the opportunity to lease or buy farmland in California lured large numbers of Punjabis, many of whom had farmed back home. By 1920, Indian immigrants owned 2,100 acres and leased another 86,000 in California, mainly in the Sacramento and Imperial Valleys. Many of those families continue to run highly successful farming operations today: Sikh farmers account for 95% of the Sacramento Valley peach crop, 60% of its prune crop and 20% of almond and walnut production.

Farmers and Laborers Give Way to Students

Passage of the 1917 Immigration Act and the 1924 Oriental Exclusion Act choked off legal immigration, although Indians continued to reach the U.S. illegally via Panama and Mexico. The 1946 Luce-Celler Act reopened the door somewhat, but it was the lifting of country quotas under the Hart-Celler Act of 1965 that led to a steady flow of Indian students and entrepreneurs into the U.S. That flow ultimately reached 40,000 Indian immigrants per year during the 1990s.

Many in the new wave of immigrants were students. Beginning in the late 1800s, Indian engineering, medicine and agriculture students began coming to the West Coast, including Stanford University and, especially, UC Berkeley. The students were almost all men; women chose to study in Great Britain. A Sikh religious organization, the Pacific Coast Khalsa Diwan, bought a building in Berkeley that it converted to the first of several hostels, offering Indian students free rent. In 1912, California potato farmer Jwala Singh funded the Govind Singh Sahib Educational Scholarship to help deserving Indian students receive education abroad.

A New Political Activism Emerges

Around that same time, Indian students established a Berkeley chapter of the Hindustan Association of America. Students were becoming increasingly political, taking a nationalist position against British rule. Har Dayal, a Stanford lecturer in philosophy living in one of the Berkeley hostels, began organizing students, eventually forming the Pacific Coast Hindustan Association and the Gadar Party.

Students and activists began returning to India in 1915 in anticipation of a nationalist revolt. The revolt was frustrated and most returnees were jailed or executed, among them Jwala Singh. Members of the Gadar Party, with support of the German government through the Consulate in San Francisco, arranged for arms shipments to India. Under pressure from the British government, 150 party members and German consular staff were indicted for violating U.S. neutrality; 15 Indians and 14 Germans were found guilty.

A Sikh temple and community center built in Stockton in 1915 became a focal point for the community, as well as a Gadar Party headquarters. The temple functioned as a *gurdwara*, a meeting place in Punjabi tradition where members of all sects and castes were welcome. Many Punjabi men married Mexican women because of the shortage of Indian women, bringing the Sikh and Catholic communities together in Northern California. Indian Muslims in California formed the Moslem Association in 1919, and built California's first mosque at Fifth and V Streets in Sacramento.

A Berkeley graduate, Bhagat Singh Thind, was at the center of a 1923 case before the U.S. Supreme Court that affected the naturalization and land holdings of thousands of Indians in the U.S. Thind, who had served in the U.S. Army at the beginning of World War I and had been honorably discharged in 1918, was approved for citizenship by a U.S. District Court. The Bureau of Naturalization challenged his citizenship based on the meaning of "Caucasian" in the 1917 Naturalization Act, which reserved citizenship for Caucasians and African-American relatives or descendants of slaves.

The Supreme Court unanimously upheld a narrow meaning of Caucasian to include only European whites under the Act, thereby reversing the citizenship, as well the property deeds and leases, of naturalized Indians. Some held onto their property by listing it under the names of American lawyers, bankers or other farmers, until a 1933 ruling banned that practice. Many after that held land under the names of American-born children. Thind remained in the U.S., earned a PhD, made his living as an author and lecturer, and was eventually granted citizenship through New York state.

Another Berkeley graduate and member of the Hindustan Association, Dalip Singh Saund, earned his PhD in mathematics in 1924 and ultimately became the first American of Indian origin to serve in Congress, from 1956 to 1962. Saund's activism on citizenship issues contributed to the Luce-Celler Act, a major change in U.S. immigration policy.

Enactment of the Luce-Celler Act and repeal of the earlier exclusion laws in 1946 allowed Indians into the U.S. on a naturalization path—but only up to 100 annually—and allowed them to own property. In 1952, family members and persons with needed skills were allowed to immigrate. Prompted by the Cold War, the 1965 Hart-Celler Act eliminated unequal country quotas, focusing instead on immigrants with special skills, such as scientists and engineers. This change prompted a spike in Indian immigration, beginning in 1966.

The Next Wave: Small Business Owners and Engineers

Entrepreneurship has been a core characteristic of successive waves of Indian immigration. Initial post-war immigrants continued to be northern Indian, mainly Punjabi Sikhs. Gradually they branched out from farming and day labor into small independent businesses—as truck and taxi drivers, restaurant and small business owners, and franchise developers.

A sizable group, many from Gujarat, were drawn to the lodging industry, which offered franchising opportunities, ease of assimilation, cash flow and immediate housing. More than half of all economy lodges and 37% of all hotels in the U.S. are now Indian-owned, representing some \$38 billion in franchised and independent properties.

Families owning and operating hotels, motels and apartment buildings came to be known as “patels” named for the recordkeeper appointed by rulers in ancient India to keep track of crops and receipts on each parcel of land, or “pat.” A nationwide trade association for Indo-American owners, the Asian American Hotel Owners Association (AAHOA), began in Tennessee in 1985 as the Midsouth Indemnity Association, to provide financing and insurance to Indian hoteliers who had encountered economic discrimination in their local communities.

New Opportunities in Silicon Valley

As early as the 1970s, the U.S. began to attract foreign-born engineers on H1-B specialized skill visas for the aerospace and defense industries, at a time when fewer U.S. students were pursuing science, mathematics and engineering careers. Technological developments such as the space

shuttle program and commercialization of space, telecommunications and airline deregulation, and the rise of personal computing, all drew growing numbers of engineers, first from the United Kingdom, and later from Asia.

Research by AnnaLee Saxenian, dean of UC Berkeley's School of Information, shows that a third of the Bay Area's science and engineering workforce in 1990 was foreign-born. Two-thirds of those workers were from Asia; three-fourths of those, in turn, were from India and China. About 23% of Silicon Valley engineers—more than 28,000—were Indian, most with advanced degrees.

Between 1990 and 2000, the number of Indians living and working in the U.S. more than doubled. This trend reflected a combination of students; researchers in engineering, sciences, technical and management fields; professionals in medicine, law and business; IT engineers and programmers recruited on H1-B visas during the tech boom to meet Internet software development and Y2K needs; and their family members. Over time, South Indians and Gujaratis have come to outnumber Punjabi Sikhs in the U.S.

By 1998, at the height of the tech boom, 774 of the 11,443 Silicon Valley tech firms started after 1980 had Indian CEOs. These firms employed more than 16,000 people and generated annual sales of \$3.6 billion. More recent survey data developed by Saxenian and Duke University's Pratt School of Engineering suggests that more than half of Silicon Valley startups during 1995–2005 were founded by immigrants, with 15% of the total founded by Indians—more than for any other immigrant group, including Chinese.

California topped the list of states for Indian startups during that period, accounting for 26% of the U.S. total; 90% of Indian startups nationwide were in two business categories, software and innovation/manufacturing-related services. Indian immigrants based in the U.S. applied for more than 10,000 patents between 1998 and 2006, most in categories involving electrical engineering, chemistry and physics, agriculture, and medicine.

The Indian population in the U.S. today is estimated at 2.48 million, according to 2007 U.S. Census Bureau figures—more than a 35% increase over 2000, which in turn had doubled from 1990. Roughly a third of the community nationwide is 18-34 years old, mainly students. More than 68% have completed at least four years of college, and 36% have advanced degrees. Median annual household income tops \$87,000. One in nine Indian-Americans is a millionaire, and 10% of U.S. millionaires are Indian-American, according to a 2003 Merrill Lynch market study.

California is home to the largest Indian population among the 50 states, with 475,000 in 2007, up from 450,000 in 2005. Census figures indicate a Bay Area Indian immigrant community of at least 215,000, the second largest metro area Indian-American community in the U.S.—behind New York and ahead of Chicago, Los Angeles, and Washington D.C. (The 215,000 figure is for the *San Francisco-San Jose Metro Area*, which is not specifically defined but which covers a population of 7.2 million; separate 2007 data for the *San Francisco-Oakland Metro Area*, covering a population of 4.2 million, shows an Indian population of 102,000, presumably with significant overlap.)

To a unique extent, Bay Area Indian-Americans are deeply integrated and have assumed prominent roles in the region's entrepreneurial, technology and investment communities.

3

A Diverse, Vibrant Community

“It is this capitalist drive to succeed, rather than some nostalgic connection to India, that some theorists believe is the true connection among citizens of the global Indian diaspora. As the United States dominates the economy and popular culture of countries all over the globe and asserts a greater and greater role as the world’s sole superpower, perhaps we are all flashy bits of the American mirror, more starred and striped than we know. Or perhaps the American dream is only one manifestation of a kind of success that my relatives have been pursuing for more than a century: the Fijian dream, the South African dream, the Australian dream, the Hong Kong dream.”

Minal Hajratwala, “Leaving India”

Key Findings:

- The number of immigrants has grown since the 1960s and particularly since 1995.
- Many are IT and software professionals, a change from the traditional pattern of small business owners.
- Most Indian immigrants are affluent, professional homeowners with families.
- Cultural networks have been augmented by business networks.
- Philanthropy is directed mainly toward economic and social needs back in India.
- Indians in post-9/11 America are wielding new political influence.

Since the changes in immigration policy that began in 1965, a broad cross-section of India’s population—from different professions, but also from different regions, castes and religious sects within India—has been drawn to the U.S. in search of opportunity.

The Bay Area Indian community is far from monolithic: even recent arrivals gravitate to particular temples, civic organizations and neighborhoods where their native languages are spoken, their native cultures and religious celebrations are observed, and their native cuisine and newspapers are available. *India West*, a newspaper published in San Leandro, serves the larger Indian community with news from India, U.S. Indian news, and information on entertainment, events, sports, culture and religion.

A Broad Cultural Bridge



Bay Area Prabasi, a Bengali cultural organization, was established in 1974 in Alameda, beginning with 70 families. The Jain Center of Northern California began with 20 families in 1973 and today has 600, centered around the Jain Bhawan Temple in Milpitas.

The **Bay Area Gujarati Cultural Association**, located in Fremont, was formed in 1979 and currently has some 3,000 members. **Kannada Koota Northern California**, in Milpitas, was formed in 1973. These and other groups—the **Malayalee Association of Northern California**, **Bay Area Maharashtra Mandal**, the **Punjabi Cultural Association**, **San Francisco Bay Area Tamil Manram**, the **Konkani Association of California**, **Rajasthan Association of North America**, **Sindhi Community of Northern California** and the **Bay Area Telugu Association**, plus a number of non-sectarian community service groups—have functioned as benevolent associations that welcome new arrivals to the area but also seek to preserve native cultural heritage through language classes, youth and senior programs, community picnics and trips, cultural performances, and religious celebrations throughout the year.



As a global center for arts and culture with a large and diverse Indian community, the Bay Area has also attracted Indian artists of global stature. **The Ali Akbar College of Music**, founded by renowned sarodist Ali Akhbar Khan in 1967 to preserve and teach Indian classical music, operates from San Rafael in Marin County. Its origins date to the 1960s, when the American Society of Eastern Arts held an annual summer institute in Berkeley to teach Indian music. When Khan came there was so much interest that he decided to establish his own program, which became a full-time school in 1968 and moved to Marin County in 1969.

Khan, who played and with such greats as Ravi Shankar and George Harrison, subsequently produced more than 100 recordings and personally taught at the school until his passing in June 2009. Tabla (drum) master Swapan Chaudhuri continues to teach and play there. More than 10,000 students have taken classes since the college opened. With support from the Marin Community Foundation and the San Francisco Foundation, the College presents free concerts to K–12 schools, which have introduced more than 6,000 students to Indian music. Thousands of other Bay Area residents have attended the College’s annual concert series. Khan returned to India each year for the winter concert season and played throughout the country. His eldest son Ashish maintains a second school and teaches in Kolkata.

Zakir Hussain, an internationally recognized tabla master and resident of Marin County first came to the Bay Area in 1970 at the invitation of Grateful Dead drummer Mickey Hart, to collaborate on an album. An invitation to play with Ali Akbar Khan turned into a 12-year association with the College, where Hussain taught until 1981. He recalls that “the school was like a place of pilgrimage for many Indian musicians. Ali Akbar Khan was worshiped in India, and when he moved here, the Bay Area became known as the place to be.” Why did so much activity center on the Bay Area and Marin County? Hussain points to the influence of both Khan and the Beatles, who popularized and introduced many in the West to Indian music: “Students flocked here to study with him [Ali Akbar Khan]. In the 60s San Francisco was the center of the hippie universe. Artists who looked beyond their own musical traditions flocked here, and lived or hung out in Marin. It became the place to try different styles and to look at music with a global view.”

A Diverse, Vibrant Community

Through the 1980s most students at the College were non-Indian, but as the size of the Indian population the U.S. and the Bay Area has swelled, more Indians seeking to stay connected to their roots have come to study, accounting today for nearly 40% of the student body. Hussain notes that as the Indian population in the Bay Area has both grown and become economically successful, a rich Indian cultural scene has developed, with newspapers, visiting artists and 8–10 cultural events happening somewhere every week: “This is a unique place. America has given space that allows an institution of this magnitude [the College], from a totally alien culture, to exist. It’s fast becoming clear that America is becoming the place that may house the seeds of world culture. It allows people to express themselves and flower.”

Hussain himself is a good example. He presents approximately 140 concerts around the world every year, teaches at Princeton and Stanford and, like Ali Akbar Khan did, he travels to India every year for the winter concert season. His credits includes scores for feature films including Francis Ford Coppola’s *Apocalypse Now*, Merchant Ivory’s *Little Buddha*, and Bollywood productions. His 2008 disc with Mickey Hart, *Global Drum Project*, won the Grammy for Best World Music and, since 1991, his record label has exposed listeners to Indian music as it would be heard in a concert setting. In early 2009, Hussain played four concerts to sold-out audiences at Carnegie Hall, and students travel from around the world to study at his annual summer workshop in Fairfax.



The Bay Area’s cultural ties to India extend from music to film. The **Satyajit Ray Film and Study Collection** at the University of California Santa Cruz taps into another cultural vein—India’s vibrant history of film production. The Center, led by Director Dilip Basu, has restored endangered film prints by the globally acclaimed director and houses the world’s most comprehensive collection of materials on Satyajit Ray, including sketchbooks, stills, posters, books and journals.



The **Asian Art Museum of San Francisco** also firmly anchors Indian culture in the Bay Area. Much of the museum’s outstanding South Asian collection—the largest and strongest west of the Mississippi—was donated by Asian art collector and longtime

president of the International Olympic Committee Avery Brundage (1887–1975). Supplemented by later donations and acquisitions, it ranges from impressive stone sculpture to Mughal jades and miniature paintings, spanning India’s history and traditions from North, Central, East, West and Southern India. The opening of the museum’s new building at San Francisco’s Civic Center in 2003 provided a dramatic space to display the collection, enhance the viewing experience and set the stage for further expansion. Chief Curator Forrest McGill guides its development.

Community Associations Evolve

The Indian presence in the region has been continually refreshed by new waves of immigrants. In the past two decades, growing numbers of well-educated, highly-skilled younger professionals coming to the region as students, entrepreneurs and managers have more readily assimilated into the broader population and have had less need for many of the social services traditionally provided by the cultural organizations. While maintaining cultural ties, more recent immigrants have gravitated toward a new set of business-focused organizations.

A U.S. Census profile of the Bay Area Indian community reveals that 82% of the population of 215,000 live in family households and 75% are married couple families; half of all households are families with children. More than 27% of the population are enrolled in college or graduate school; 74% of those who have completed their education hold at least a bachelors’ degree, and 41% hold masters’ or doctoral degrees. Nearly half of the community—97,000 residents—are not U.S. citizens, while 61,000 have green cards. About 70% of those over 16 years old are in the workforce; 86% of those employed are in white-collar professional jobs; only 3% are unemployed. Median household income is \$107,000 annually, higher than the regional average of about \$70,000; the median household size is 3–4 people. Half own their homes, with a median price in 2007 of \$796,000, also higher than the regional average.

Bay Area Entrepreneurs Flex Their Muscle



In 1987, Intel engineer Prakash Chandhra and three roommates launched the **Silicon Valley Indian Professionals Association** (SIPA). Membership swelled by the late 1990s to some 1,000 members from across the Indian community, who found common ties through their work and their educational backgrounds—many core members were IIT and IIS graduates.

Many of these graduates had taken jobs with large computer, software, IT service, telecom and Internet companies only to encounter a glass ceiling in terms of promotions, choice work assignments and compensation. Building on the similar experiences of Chinese engineers, who had formed the Chinese Institute of Engineers and the Asian American Manufacturers Association, Indian tech professionals gravitated to a group of their own where they could feel comfortable socializing and sharing experiences.

SIPA's core activity is a series of monthly business-focused programs, plus a large annual event. Programs cover a combination of tech issues with an India emphasis, such as virtualization and enterprise computing; the geo-spatial web; challenges for Indian software companies going global; and entrepreneurial topics such as business ethics, financial strategies and personal branding.



Indian Business & Professional Women (IBPW), based in Fremont, was established in 1988 as a support network and discussion forum for South Asian women professionals. Originally an informal group called Indian Women in Business, it incorporated as a non-profit in 1997 and held its first annual “Inspire...Aspire...Achieve” conference, attracting 200 attendees.

IBPW hosts career development, personal finance, health and other seminars, as well as networking mixers. A resident mentor program, run by former HP Labs research director Neerja Raman, offers coaching on career strategy, interpersonal communications, leadership and other issues. IBPW advisors include: former SupportSoft chief executive officer Radha Basu, who developed Hewlett-Packard's Bangalore software center in the mid-1980s; Lata Krishnan, president of the American India Foundation and chief financial officer of the \$300 million Shah Capital Partners mid-cap technology private equity fund; and Talat Hasan, founder of two Valley semiconductor instrument startups, Prometrix and Sensys Instruments, and a guiding force behind the Indian Community Center in Milpitas.



The **South Asian Bar Association of Northern California (SABA)** began in 1993 as the Indo-American Bar Association, when attorney Mukesh Advani cold-called lawyers with Indian surnames from a legal directory and invited them to a meeting. The name change in 1999 was intended to broaden the membership by reaching out to all South Asian attorneys. Today SABA has some 450 members, and welcomes all lawyers and law students. Membership in SABA is diverse, from immigration and employment attorneys to in-house and outside corporate intellectual property (IP) counsel. Events are a combination of social mixers and continuing legal education seminars. SABA also offers a mentorship program and pro bono legal services, and maintains a hate crimes hotline. It established a foundation in 1999 to award a \$1,500 annual fellowship to a deserving law student.



The San Francisco-based **Network of Indian Professionals (NetIP)**, launched in 1995, caters to a younger membership and balances professional and cultural development and community service. NetIP holds monthly business card exchange mixers, guest career events with speakers from various industries, sector-specific events, social outings, an annual banquet, and a charitable foundation that, over 2004–05, donated more than \$68,000 for tsunami and Pakistan earthquake relief, hate crime victims in Northern California and Hurricane Katrina relief.



The **Global India Venture Capital Association (GIVCA)**—formerly the U.S.-India Venture Capital Association—promotes global cross-border investments with India by providing a forum for venture capitalists and entrepreneurs to network and collaborate. Directed by Bakul Joshi, GIVCA has a membership that includes leading venture firms and affiliates such as banks, law firms, and accounting firms, with a focus on India investment.



Reflecting the Bay Area's dominant life sciences sector and the rapid growth of biotech and pharmaceutical activity in India, **EPPIC** (Enterprising Pharmaceutical Professionals from the Indian Sub-Continent) was founded in 1999 to create a Bay Area network of life science professionals. The group, now numbering 300 members, initially focused on Indian expatriates, but globalization of the industry has led EPPIC to expand its mandate to include all life sciences professionals. Still, it functions as a bridge between life sciences communities in the U.S. and India through networking, entrepreneurship and professional development, and by holding quarterly events and an annual conference.

In the early 1990s, as SIPA's influence had begun to wane, a new wave of Indian students and tech professionals arriving in Silicon Valley were looking beyond social networking. They saw communities of Chinese engineers, scientists and programmers joining professional organizations to share ideas for new tech applications and new startup business opportunities, and to use professional and alumni networks to team with mentors and investors.



The Indus Entrepreneurs (TiE) was formed in 1992 by a group of Indian tech professionals—among them Odyssey Enterprises CEO A.J. Patel and IBM executive Kailash Joshi, who met at San Francisco International Airport while waiting to meet India's Secretary of Electronics N. Vittal, who was on a scheduled visit to the area. Most had encountered glass ceilings at established companies, and difficulties starting their own companies in the absence of mentors and a strong professional network. They talked of the need to begin building such an infrastructure in the Indian community to encourage new business and wealth formation.

Soon after the fortuitous airport meeting, a core group of 20 Indian entrepreneurs began TiE with monthly dinner meetings initiated by Patel at the San Jose Hilton. Cirrus Logic founder Suhas Patil was instrumental in organizing the first TiE Annual Conference in 1994, which drew a surprising 500 attendees; by 1999 it was regularly drawing nearly 1,000. Besides Patil, who served as TiE's first president, other senior members included Sun Microsystems founder and venture investor Vinod Khosla; Kailash Joshi, who set up IBM India and the IBM-Tata joint venture in the late 1980s; former McKinsey senior partner Rajat Gupta; and Hotmail founder Sabeer Bhatia.

Today TiE is a global organization, with 53 chapters in 12 countries, 11,000 general members and 1,800 charter members (experienced entrepreneurs and senior, established executives recruited by invitation only). It is first and foremost a mentoring organization, providing new entrepreneurs access to the intellectual capital of its charter member network. Charter members make themselves available as a way of giving back to the community; they are approached for guidance or contacts and not as prospective investors, although that is not prohibited.

The Bay Area organization has reached out since its inception to all South Asians, and more recently has fully opened its membership, but the majority of its general and charter members are still of Indian origin. TiE now has 49 chapters in 11 countries, and has extended beyond tech to involve entrepreneurs in a wide range of industry sectors. TiE Silicon Valley remains the mother ship of TiE's global network, with the annual TiECon conference (drawing over 3000 participants) as its centerpiece.

TiE has forums for experienced and young CEOs to meet and exchange ideas, and for members to discuss specific cross-border business challenges as well as broad economic and policy trends as they relate to entrepreneurship. An annual job fair connects members with startup companies that have job openings. Through a mentoring clinic, charter members advise young entrepreneurs with early stage companies or startup business plans. The TiE Institute acts as an “entrepreneurial university,” offering global business strategy and management education taught by charter members. A women’s forum enables women members to form distinct professional networks of trusted relationships. A TiE Salon organizes charter member events centered on arts, music and science.

Special interest groups (SIGs) link up experienced entrepreneurs, executives and venture investors with interest in specific industries such as the Internet, networking, consumer technologies, software, semiconductors and wireless communications. A relatively new initiative, TiE Life Sciences, focuses on the convergence of life sciences and other technologies by enabling networking across disciplines.

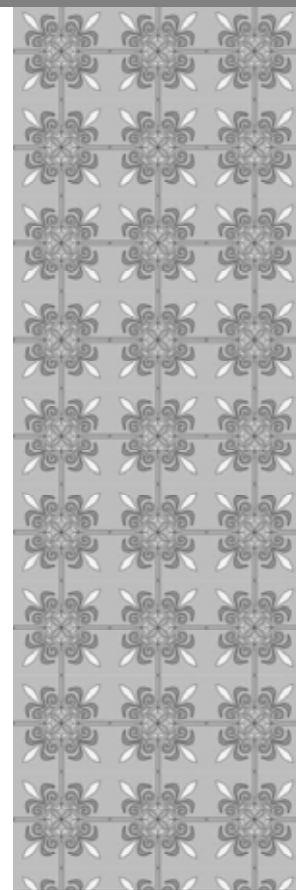
TiE has emerged over the years as the preeminent Indian business organization in the Bay Area, but its dramatic worldwide success and expansion have not come without growing pains.

TiE Re-Examines its Mission

Can there be such a thing as too much success? At age 16, TiE faces an identity crisis.

During the 1990s, the organization played a key role in building a robust professional network of Indian engineers, entrepreneurs and investors in the Bay Area, beginning with Silicon Valley. Its concentration on business formation, wealth creation and mentorship nurtured a number of well-known Indian-owned and managed startups, such as Brocade Communications, Juniper Networks, Hotmail and Wind River Systems. It is estimated that the TiE network helped originate or enable as much as \$100 million in venture and angel investment in Silicon Valley tech enterprises during its first decade.

But in the early years of this decade, the organization drifted: Y2K work gradually tapered off, the Internet bubble burst, and cross-border business activity slowed in the post-1997, post-9/11, post-SARS landscape. In response, TiE expanded beyond tech and Silicon Valley to more broadly translate the best entrepreneurial practices of Silicon Valley—innovation, good corporate governance, increased productivity through technology, flexible financing alternatives—to the overseas South Asian diaspora.



Chapters multiplied worldwide, in sectors ranging from apparel and leather goods to gems and auto parts distribution. TiE wrote and published the definitive book on entrepreneurship in 2003—*The First Mile*, a how-to collaboration of 60 Valley experts covering all aspects of starting and growing a successful business. Through it all, Silicon Valley remained TiE's physical headquarters and intellectual center.

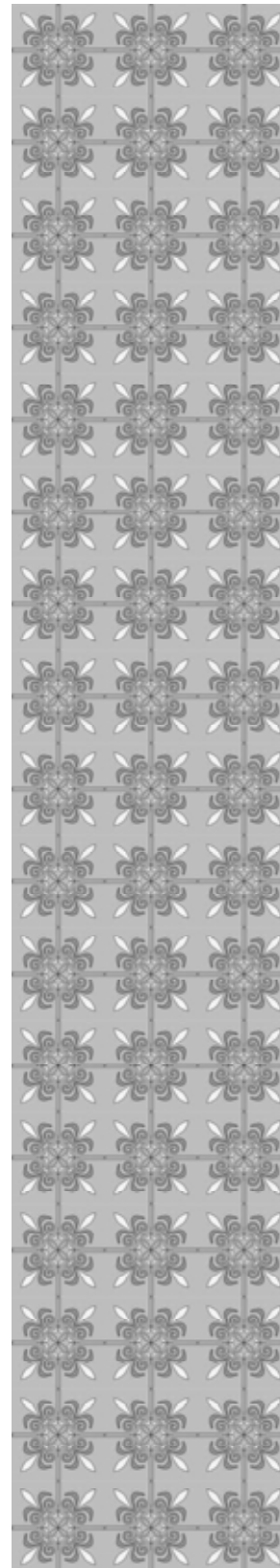
Recent years had brought major change, however: India now had its own networks, through its large established companies and major universities. Increasingly it was India, and not Silicon Valley, where the job growth and startup opportunities were. Successful Indian entrepreneurs felt a gravitational pull to return home, to reunite with existing families and start new ones, and to offer their money and talent to “give back” to a country with huge needs for reliable energy, clean water, urban planning and sustainable agriculture. By 2005, as part of the fallout from 9/11, student and work visas were harder to obtain. Fewer of India's best and brightest were coming to the U.S., and many of those who came earned their advance degrees or completed their work assignments and then went home.

Where does TiE fit in this new environment? “The challenge we now face is that, in a sense, we've accomplished our mission,” says former TiE executive director Seshan Rammohan. “Now what do we do for an encore?” At a 2007 charter member retreat in Hawaii, TiE's leadership decided that the group would:

- retain its business focus and not expand into social or charitable activities;
- promote scalable business, not “lifestyle” business such as a single store or franchise; and
- continue to apply its entrepreneurial model in more diverse, non-technology areas.

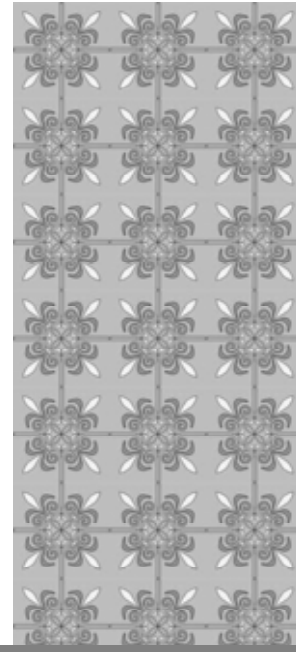
TiE still brings a number of strengths to the table as a global organization, Rammohan contends, including:

- a cross-border rolodex of more than 2,000 senior executives, academics, researchers and investors;
- a mentorship model under which charter members make themselves available to new entrepreneurs, regardless of how far along in their business plans they are, no strings attached, as a form of “giving back”; and



- access for non-tech entrepreneurs to top IT service, software and other technology experts who can help them gain a competitive edge and scale up their operations.

Rammohan acknowledges that younger Indian graduates and entrepreneurs with 5–10 years' experience will be tempted by new opportunities—and the success of their classmates back home—to move back to India. Older, established executives with families already here are likely to continue living primarily in California, even if they also maintain a residence in India. Those who see India as an emerging market for their businesses will likely be opening local sales offices there but are less likely to move back. And, as more Indian firms expand globally and enter the U.S. market through organic growth or M&A (mergers and acquisitions), opportunities for Indian entrepreneurs and managers here will increase.



Build Something New—Then Do It Again

The list of Indian contributors to the Bay Area economy is legion. Often there is a recurring pattern: an Indian-born entrepreneur creates a successful company, then moves on to lead a new generation of startups or support community development in the Bay Area or in India.



Adithya Padala, a TiE charter member, has done a lot of thinking about entrepreneurship. He came to the U.S. in 1983 as a computer sciences graduate student at the University of South Carolina at Columbia, after obtaining an undergraduate degree in electrical engineering from Hyderabad's Osmania University. He worked on artificial intelligence projects for Massachusetts startup Arity Corp. and later Texas Instruments, before ending up as a management consultant at Coopers & Lybrand.

Coopers sent him to California to evaluate a troubled company, UmeCorp, with an interesting technology and too many diverse business lines. The firm was started by a scientist living on a Sausalito houseboat, and it centered on voice recognition/noise reduction technology that enhances voice-over-Internet protocol (VOIP) signals for use in high-noise environments.

By 1995, Padala was the CEO of a renamed company, **UmeVoice**. Its core technology is voice recognition software tailored to the jargon of Wall Street traders, enabling them to voice-execute trades more quickly over the phone and at their terminals. In addition, UmeVoice has developed theBoom, a miniaturized, noise-canceling voice-over-Internet protocol (VOIP) headset that filters out background noise up to 100 db for clear voice recognition in high-noise environments such as a trading floor. The system is in use at the New York Stock Exchange, the Chicago Mercantile Exchange, and the Chicago Board of Trade, and by customers such as Goldman Sachs & Co., UBS Warburg, Credit Suisse First Boston, and Merrill Lynch & Co.

Padala has been active in TiE and the Bay Area Indian business community for more than a decade. In the last 2–3 years, he has seen a change in the community among Indians who have come to the U.S. to attend graduate school. Increasingly, they are opting to start businesses of their own rather than work for large companies. And where they used to talk of returning to India but usually became attached to the California lifestyle and stayed, now they are returning to India in greater numbers. U.S. visa policy plays a role—with its requirement that student visa holders go home and then come back before taking a job, and with the likelihood going forward that it will be more difficult to bring family members here—but new opportunities for cutting edge technology work in India is the main reason.

“It’s not a zero sum game,” Padala stresses, however. “Markets are going to grow worldwide, and there will always be a place for people with expertise to help them grow. I look at my daughter and the question in my mind is how to give her the best global education to prepare her for the future. She may spend part of her time here, part in Europe, part in Asia. There’s no need view it in competitive terms.”



Kanwal Rekhi, a graduate in electrical engineering from IIT-Bombay, founded his first company, Excelan, in San Jose in 1982. The company was the first to commercialize Ethernet technology and standardize computer networks, and after a successful IPO in 1987, it was sold to Novell for \$210 million. Rekhi stayed on as executive vice president and chief technology officer and helped grow Novell into a world-leading software company but, finding a glass ceiling, he left in 1995 to take stock of his future. Since then, he has taken on new roles as an investor in Silicon Valley through venture capital firm **Inventus**, a mentor to emerging companies, and a co-founder and past-president of TiE. His personal donations have helped support Michigan Tech University, where he earned his Masters Degree, and IIT-Bombay, which is now home to the Kanwal Rekhi School of Information Technology.



Kumar Malaveli came to Silicon Valley in 1995 from Canada, having developed a prototype technology for network server storage. Seeing an entrepreneurial opportunity and wanting to build on it, he had met at Gaylord’s Restaurant in Palo Alto with Seth Nyman, a venture capitalist with Crosspoint Ventures. The conversation led to a seed investment of \$1.3 million—with the condition that he move to Silicon Valley. It was a move that led in to the founding of **Brocade**. Together with partner Paul Bonderson, who worked for Sun, and four engineers from Sun and HP, the company quickly raised two more rounds of venture funding, leading to an IPO in 1999—the largest of the year. Three subsequent stock splits by 2000 produced a market capitalization of \$27 billion. Brocade developed switches to make storage area networks happen. Today Brocade produces switches that are the infrastructure of storage networks—with an 80% market share. In 2002, Mallavali left Brocade to start another company, **Inmage**, that focuses on disaster recovery and continuous data protection, with Brocade as an investor.



A physicist and specialist in optics, Narinder Kapany came to the Bay Area in 1960 by way of Imperial College in London, the University of Rochester in New York, and the Illinois Institute of Technology in Chicago. Though lacking in business experience, he found the Bay Area an inviting place to start a laser and fiber optics company, Optics Technology

Inc., funded by Draper, Gaither and Anderson, the region's first venture capital firm, which was soon joined by other funders including Bill Hewlett, David Packard, and other HP executives. (See Chapter 7, *M&A, Venture Capital, and Private Equity: A Thriving Investment Climate*.) Kapany ran Optics Technology for ten years before selling it to start a new enterprise, **Kaptron**, which he later sold, repurchased, and sold again. Today he serves as chairman of a new company, **Photonera Inc.**, started by his son.

Named by *Life* magazine as “the father of fiber optics,” Narinder Kapany currently devotes his time to several business ventures, serves on the boards of the University of California, Santa Cruz, California State University, East Bay, and Imperial College, London, and is chairman of the **Sikh Foundation**, which he founded 42 years ago. Based in Palo Alto, downstairs from Kapany's office, the Foundation has funded chairs in Sikh Studies at the University of California, Riverside, California State University, East Bay, and the University of California, Santa Barbara, and a chair in Optoelectronics at the University of California, Santa Cruz, where for seven years he also ran the Center for Innovation and Entrepreneurial Development. San Francisco's Asian Art Museum is also home to the Satinder Kapany Gallery, containing a collection of Sikh art donated by the Kapany.



Since Vinod Khosla first heard about Intel at age 16, he dreamed of starting his own technology company. With a bachelor's degree in electrical engineering in hand from IIT-Delhi, he earned a master's in biomedical engineering at Carnegie-Mellon and later an MBA at Stanford in 1980. Upon graduation, he joined with two other colleagues to found Daisy Systems, the first computer-aided design system for electrical engineers and, after a successful IPO, went on to found Sun Microsystems in 1982 with funding from venture firm Kleiner Perkins Caufield & Byers. In 1986, he moved to Kleiner Perkins, where one of his investments was Cerent (see discussion of Ajaib Bhadare immediately below). In 2004, feeling again the entrepreneurial pull and his scientific roots, he founded Khosla Ventures, which has subsequently become a leading investor in renewable energy technology. Khosla serves as a charter member of TiE and is a founding board member of the Indian School of Business (see discussion of the school in this section below).



Ajaib Singh Bhadare also came to the Bay Area from India, by way of England, with a degree in electronics. Attracted by the opportunities for career growth and development, he settled in Santa Rosa (Sonoma County) and joined telecommunications startup Optilink in 1987. When Optilink was acquired several years later by Alcatel, Bhadare reverted to startup mode. Venture capitalist Vinod Khosla funded Bhadare's new telecommunications company, Fiberlane, which later split to become three companies, including Petaluma-based **Cerent**. In 1999, Cerent was acquired by Cisco for \$6.9 billion, which represented the highest price paid to date for a startup. After overseeing the transition, Bhadare moved on to invest in a number of smaller companies and in 2004 founded First Community Bank in Petaluma, which became the fastest growing *de novo* bank in California. Together with other Cerent alumni, Bhadare is an investor in Basin Street Properties, a development group which has built a new downtown in Petaluma, revitalizing the city center.



An IIT Graduate, Raj Jaswa came to work at Intel in 1981 following stints in Toronto for graduate study and with GE in New York. Founded in 1989 with angel funding, his first entrepreneurial venture, **Opti**, grew within four years to become the world's largest chipset company. When Opti went public in 1993 with a capital value of \$400 million, Jaswa and a team of entrepreneurs from Xerox Parc started **Selectica**, a company offering an online sales configuration platform, that today handles Cisco's \$30 billion in annual orders. After five years, the company went public in 2000 with a market capitalization of \$5 billion. In 2002, Jaswa left Selectica to become president of TiE, but unable to resist the entrepreneurial urge, he now heads a new start-up called **Dynno** that enables gamers, businesses, and just about anyone else to share videos online through a distinctive software-as-a-service video distribution platform.



Even at a young age, Dr. Suhas Patil had a natural curiosity about how things work. His father, Shrikrishna, worked first as an engineer and later in finance, for Tata Steel, eventually retiring as CFO of the company. Suhas shared his father's fascination with cameras and photography, as well as with repairing radios. He played with the UK equivalent of an Erector Set, and studied English in order to read *Popular Science* magazine in the early 1950s. As a boy, he dreamed of being an inventor.

Dr. Patil would carry on the family tradition, first earning an engineering degree from IIT-Kharagpur in 1965, earning master's and doctoral degrees in electrical engineering at MIT by 1970, and then staying on to teach until 1975, when he was recruited by the University of Utah to set up a new laboratory and program for very large scale integration (VLSI) semiconductor design.

Out of this early work, Dr. Patil formed Patil Systems in Salt Lake City in 1981, with funding from General Instruments Corp., to develop automated chip design software. With new tools, Patil Systems introduced a way for system designers to design complex semiconductor chips that could be targeted for production in more than one fabrication facility without re-engineering each time. This marked the beginning of the "fabless foundry" model, buying generic wafers from outside sources and focusing on value-added custom design.

But by 1983, the company was burning money twice as fast as it was coming in. The integrated chip companies like Intel, AMD and Motorola had no interest in the fabless model, and there was no venture capital money in Utah. Patil Systems relocated to Silicon Valley in 1984, with a team made up largely of students from Utah and Silicon Valley, and became **Cirrus Logic**.

The first wafer orders came from General Instruments, then from Atari, Sharp, and Sanyo. Over time, Cirrus would account for 20% of Taiwan Semiconductor Manufacturing Corp.'s total wafer output. The firm went public in 1989.

"I was among the first Indo-Americans to found a company that went public in the U.S., and that created a lot of visibility," Dr. Patil says. "When I was building Cirrus Logic, there was no access to any organization such as TiE for networking and learning from those who had succeeded earlier." Dr. Patil became a core founder and the first president of TiE in 1992.

"TiE is a unique organization where those who have succeeded and those who are aspiring are all members together," he suggests. "It came out of the fact that we were middle-aged and that

we'd succeeded at different things, and we felt there ought to be a way of helping the next generation to succeed. We came to the conclusion that there were many channels for giving back and that we could give money, but what we had to offer that was special was that we'd each gone through the school of hard knocks in terms of raising capital and starting businesses. Perhaps our biggest contribution might be to increase the success of entrepreneurs coming after us by passing on our knowledge, extending to them our network, setting out techniques for people to work with each other."

After a series of monthly dinners usually involving 10 to 15 people, Dr. Patil remembers both the nervousness among the core group in planning the first TiECon in 1994, especially once the deposits were taken for the hotel and food, and the group's surprise at the unexpectedly large turnout: "The venture capitalists came, the investment bankers came. That single event lifted the spirit of the community, and it also elevated the community in the public awareness."

Dr. Patil believes Indians in the U.S. had certain advantages, as they had received great engineering educations in India, came to the U.S. to attend graduate schools, spoke English well and grew up in a democratic country. The success of Indian entrepreneurs, he says, in turn boosted confidence in India. "It said to those who had not yet quite succeeded—companies like Wipro and Satyam—yes, things can be done."

On several visits to India in the mid-1990s, Dr. Patil, Excelan founder Kanwal Rekhi, and others from TiE gave seminars on how to financially structure a startup company; explained to Reserve Bank of India officials the need to reform limited partnership laws to make startups easier; and advised Indian ministries on opening the telecom sector. Since 1992, he has been an angel investor in and/or served on the boards of a number of Valley tech firms: **Cybermedia Inc.**, a Santa Monica developer of computer automatic diagnosis and repair software; Mountain View process and portfolio management software developer **Digité Inc.**, and San Jose e-procurement software firm **RightWorks**. He is currently chairman of **Cradle Technologies**, a maker of networked video surveillance systems for the Indian and U.S. markets.

Looking at the market and human ties now in place, he maintains that "Silicon Valley will continue to benefit from India's growth. I don't think you can separate India from Silicon Valley; they're joined at the hip."



Silicon Valley helped put Dr. Romesh Wadhvani on the Forbes 400 list of billionaires and his **Wadhvani Foundation**, established in 2000, aims to create similar entrepreneurship opportunities in India, with special assistance for the disabled.

Dr. Wadhvani is a 1968 software engineering graduate of IIT in Bombay, with a doctoral degree from the Carnegie-Melon Institute in Pittsburg. After first building an energy management IT systems firm, and then computer-integrated manufacturing software company Cimflex Technology Corp., he relocated to the Bay Area in 1991 and with VC funding from Sequoia Capital founded Aspect Development, a maker of business-to-business software to track internal spending, procurement and inventory.

At the height of the tech bubble in 2000, Dr. Wadhvani sold Aspect to Dallas-based i2 Technologies—headed by another non-resident Indian (NRI) tech entrepreneur, Sanjiv Sidhu—for \$9.3 billion, then the largest software firm acquisition on record. He currently heads the Palo Alto-based **Symphony Technology Group**, which invests in first-to-market technologies and partners with companies to provide consulting services and enterprise technology solutions to a global client list that has included Autodesk, Bank of America, Siebel, Viacom, General Motors, Morgan Stanley, Citigroup, BMW, Pepsico and Johnson & Johnson.

A portion of Dr. Wadhvani's \$1.3 billion net worth after the Aspect sale (he stayed on as vice chairman of i2 for a time) was used to start the Wadhvani Foundation, which is dedicated to promoting research, grant and fellowship programs, faculty education, and peer-reviewed curricula at Indian educational institutions, with a focus on entrepreneurship. The Foundation has directly funded the Wadhvani Electronics Laboratory at IIT-Mumbai and the Wadhvani Center for Entrepreneurship Development (WCED) at the Indian School of Business (ISB)-Hyderabad. Its National Entrepreneurship Network (NEN) was launched in 2003 with six initial partner institutions: ISB-Hyderabad; Birla Institute of Technology & Science, Pilani; IIM-Ahmedabad; IIT-Mumbai; the Institute of Bioinformatics & Applied Biotechnology (IBAB), Bangalore; and the S.P. Jain Institute of Management and Research, Mumbai.

Dr. Wadhvani's goal in founding the National Entrepreneurship Network was to help Indians start companies, not just work for multinationals. Today NEN has been extended to 233 institutions supporting 350 active Indian faculty members reaching an estimated 250,000 students. Overseas faculty is flown in from Stanford and elsewhere to teach local Indian faculty at IIM-Bangalore, and Indian faculty is brought to the U.S. under fellowships. The Foundation hosts an Entrepreneurship Week India event, has developed an online portal (www.nenonline.org) and India-specific teaching materials, and has a speakers program with representatives from TiE and the Stanford Technology Ventures Program among its participants. NEN director Laura Parkin observes that entrepreneurship in India is still embryonic. Among other hurdles, it's still difficult and expensive to start a company, and family members tend to favor more traditional occupations. This is starting to change, however; these days more people are prepared to take risk and aspiring students have a growing number of role models.

The Wadhvani Foundation has also funded a range of programs to assist the disabled in India, including a job placement center for the blind, vocational training in horticulture for the physically disabled, and job training for people with neuromuscular disorders, all in Bangalore, and free cataract surgeries at a Chennai eye clinic.



Anil Kumar has also applied his Bay Area experience to help build the new India. Kumar was based in San Francisco with McKinsey & Company in 1992 when the business consulting firm asked him to relocate to Delhi to open its first India office. By 1995, Kumar had made a name for himself with a research project on how the digital economy would impact the services sector. McKinsey envisioned low-cost telecommunications leading to “remote services” being provided globally to U.S. firms. This was around the time that American Express, Citigroup and General Electric began looking at offshoring various customer service

and data processing functions (see the *Software/IT Services/Business Process Outsourcing* section in Chapter 6). McKinsey's own Knowledge Center in Delhi and Visual Graphics Center in Chennai provided centralized companywide research, document management and presentations.

While in India, Kumar noticed the absence of international business schools at a time when the economy was growing and becoming increasingly globalized. He saw interest on the part of owners and chief executives at a number of Indian companies—in particular at family-owned companies concerned with management succession and taking their enterprises global—in starting Western-style, private business schools outside the rigid operating and curricular government constraints in place.

Beginning in 1997, Kumar, along with McKinsey worldwide managing partner Rajat Gupta, set about establishing the **Indian School of Business (ISB)**, an effort that illustrates the two-way flow of knowledge, talent and capital between the U.S. and India. Other founders include Romesh Wahdhwani and venture capitalist Vinod Khosla, forming a strong Bay Area leadership cohort and the largest from the U.S.

After forming an executive board of Indian corporate leaders, Kumar and Gupta secured partnerships with the University of Pennsylvania's Wharton School of Business, Northwestern University's Kellogg School of Business and, a short time later, the London School of Business (LSB).

To locate a site for the new campus, Kumar led a group that included Harvard graduate Rahul Bajaj, head of the Bajaj Group of industrial companies; MIT graduate and Godrej Group chairman Adi Godrej; and Wharton graduate Anil Ambani of the Reliance Group. At Mumbai, the Maharashtra chief minister offered them 25 acres but wanted them to set aside a portion of places in the new school for students of Maratha origin. At Bangalore, the chief minister there kept the group waiting before offering a parcel of vacant land with no access road. At Chennai, the chief minister offered a piece of industrial land adjacent to a Honda factory. At Hyderabad, CM Chandrababu Naidu was more entrepreneurial; he sent his chief secretary and education minister to meet the group at the airport, brought them to a 250-acre site where 20 local officials showed development plans for roads and utilities, and had a draft agreement waiting for them to amend and sign at his home. A deal was done on the spot.

The one million square foot campus, designed by Portman & Associates, broke ground in 1999 and was completed in only 21 months. Wharton, Kellogg and LSB provided curriculum and visiting professors. Of the more than 50 visiting faculty coming to ISB in the past year, however, fewer than half came from the three sponsoring schools. Visiting professors account for a third of the total faculty teaching capacity; some local professors have jumped from the IIMs at Bangalore and Ahmedabad. On the ISB governing board, along with Kumar and Gupta, were Citigroup vice chairman Victor Menezes; Kleiner, Perkins partner Vinod Khosla; Anil Ambani of the Reliance Group; Rahul Bajaj, head of the Bajaj Group; Godrej Group chairman Adi Godrej; and the chairmen of Chatterjee Group, Hindustan Lever and ICICI Bank. Current members also include Arcelor Mittal CEO Lakshmi Mittal; HCL Technologies founder Shiv Nadar; and Infosys founder N.R. Narayana Murthy.

Currently, ISB's one-year program accepts over 400 students annually, with women making up 25% of the 2008 class. Like the IIMs, ISB is not government certified and therefore offers graduates diplomas rather than formal degrees, but Kumar says that has not been an issue.

In January 2009, the *Financial Times* rated ISB-Hyderabad among the world's top 15 business schools. It ranked among the top 18 in terms of opportunity for career advancement, with an average graduate salary of \$145,727. Students from Berkeley participate in 6–12 week exchanges at ISB, and Indian students visit Berkeley for periods of up to three months.

In 2005, ISB-Hyderabad's Wadhvani Center for Entrepreneurship Development launched the annual three-day TiE-ISB Connect conference, in cooperation with The Indus Entrepreneurs. The program offers speakers and panel discussions on entrepreneurship, as well as networking opportunities introducing students with business plans to more than 60 venture investors.



The **U.S.-India Business Council (USIBC)**, an arm of the U.S. Chamber of Commerce, was established in 1975 to represent the trade and investment interests of major U.S. corporations doing business in India. More recently, it has been joined by Indian businesses—primarily in software, IT and business consulting—interested in promoting trade, investment, legal and financial reforms in India, and in heading off U.S. protectionism on issues such as the offshoring of jobs.

USIBC has been active at the highest policy levels, representing the business community in U.S. government-backed initiatives such as the U.S.-India Economic Dialogue (CEO Forum), the U.S.-India High Technology Cooperation Group, the U.S.-India Energy Dialogue, the Defense Procurement & Production Group, and the U.S.-India Trade Policy Forum. Twelve sector-specific committees have launched initiatives in civilian space cooperation, trade, intellectual property protection, corporate social responsibility, civilian nuclear power, Hollywood-Bollywood anti-piracy, and health care.

For most of its history, USIBC's focus was in Washington D.C. and New York, representing established global firms such as Boeing, Dow Chemical, Pratt & Whitney, Raytheon and AIG. In 2005, it established a West Coast presence in San Francisco. Key issues of concern for USIBC members in California have involved tariffs (mainly for agricultural products and downloadable software); earnings repatriation (for retailers returning merchandise with quality problems); and intellectual property (regarding biotech and pharmaceutical companies withholding R&D investment, and cross-border film and music production being slowed by piracy).

A Guiding Principle: Community Service

Some of the best-known success stories in the Bay Area Indian community have chosen to direct their time, business acumen and fundraising energies toward charitable works, in addition to or instead of new business opportunities. This philanthropy not only extends to India's estimated 500 million people suffering from poverty and lack of education and jobs, but also to the Bay Area's South Asian children and seniors and to the broader local community.



The **American India Foundation** (AIF), was founded in 2001 in Silicon Valley to raise funds for relief efforts in Gujarat state following a major earthquake. More recently, AIF has supported relief and rehabilitation in Tamil Nadu and the Andaman and Nicobar islands after the 2004 tsunami, and in Kashmir after the 2005 earthquake there. It has effectively tapped into Indian professional networks nationwide and, in the past six years, has raised more than \$45 million for education, economic livelihood and public health projects.

AIF's board includes, among others, retired Citigroup senior vice chairman Victor Menezes; McKinsey & Company senior partner worldwide Rajat Gupta; Chugh law firm founder Navneet Chugh; New Path Ventures managing director and developer of the Intel Pentium processor, Vinod Dham. Former U.S. President Bill Clinton is AIF's honorary chair.

AIF employs experienced local staff on the ground in New Delhi and Bangalore, and works with some 30 non-governmental organization (NGO) partners throughout India. It leverages the benefits of its funding through matching fund partnerships with 25 organizations in the U.S. and India.

The Foundation acts much like a venture firm in its grantmaking, with formalized processes in place for measuring results, sharing best practices and transferring ownership of programs and projects directly to local communities or to government. Among its activities, AIF has funded:

- English and computer classes, plus job training for 25,000 young people in Gujarat;
- AIDS prevention education and treatment in Uttar Pradesh and Bihar;
- organizing “rag pickers” in Patna under income-generating recycling programs;
- a book, *Locked Homes, Empty Schools*, on rural migration and its effects on children; and
- a public-private partnership to provide universal education for 15,000 children in Jaipur City, Rajasthan.

The Service Corps is an AIF-administered leadership program that has placed more than 140 young Americans with some 70 Indian NGOs since 2001. The League of Artisans helps tribal, rural and women artisans translate their crafts skills into sustainable businesses through micro-credit, business training and an online store. AIF's Digital Equalizer (DE) program provides computers, Internet service and training to 634 underserved schools in 13 Indian states, with a goal of 1,000 schools by the end of this year.

Silicon Valley firms have played a key role in Digital Equalizer. Applied Materials has opened six high school computer centers in Bangalore, with Applied employees teaching classes and offering mentoring for male and female students—part of an AIF network of 470 such centers nationwide. Silicon Valley Bank (SVB) has made a similar commitment for an additional Bangalore school, through its SVB Global unit. Intel Corp. and Advanced Micro Devices also participate. Adobe Systems held two Youth Voices Workshops for students and teachers at four Bangalore high schools, providing camcorders, video editing software and materials to produce video documentaries on DVDs for sharing at their schools and with local government leaders.



Back in the Bay Area, two brothers, tech entrepreneurs Anil and Gautam Godhwani, have built the nation's largest **Indian Community Center (ICC)** in Milpitas. Gautam, a UC Berkeley engineering graduate, and Anil, who holds a B.A. in economics from UC Santa Barbara, held positions at AT&T, Hewlett-Packard and IBM during the 1990s before starting their own website maintenance company, AtWeb. After Netscape acquired AtWeb for \$95 million in 1998, Gautam served as a director of Netscape and AOL for two years, and then the brothers took a year off to travel in Asia, Europe and India. It had been their first time back since emigrating with their parents to the U.S. in 1981.

Returning to the Bay Area in 2001, the Godhwanis found the tech industry in a downturn and a community in need. An older generation of Indian émigrés—those who came in the 1960s and 1970s, and parents or extended family members brought over by working professionals—found themselves isolated from both children working long hours and from their cultural traditions. Young people often had little or no connection to their community and needed a safe place to go with friends after school or in the evenings. New arrivals needed help getting driver's licenses, opening bank accounts, renting apartments and getting legal or medical referrals.

Typically, Indian immigrants had relied in the past on their temples to provide language and dance classes, lunches, weekend outings and help getting settled in the U.S., but the temples were reliant on limited funding and volunteers. The Godhwanis realized that as long as services were fragmented among Hindus, Jains, Telugu and other sects, the overall wealth of the Indian community was not being properly leveraged. One early decision in designing the Indian Community Center was to avoid divisive religious, partisan political or sectarian issues.

The brothers began with \$200,000 of their own money and first teamed with the existing Indo-American Community Service Center (ICSC), which had been connected with the Hindu Temple in Sunnyvale and was housed in a 1,200-square foot space belonging to TIE. They looked to the Jewish Community Center (JCC), YMCA and United Way as models, rented a 20,000-square foot facility in 2003, hired full-time professional staff, and recruited from the corporate and outside non-profit worlds for their board (Board members have included JCC executive director Nate Levin, former Brocade Communications chief technology officer Kumar Malavalli, Intel enterprise processing division senior director Bala Joshi, and Google senior research scientist Vibhu Mittal.)

With a \$3.85 million loan from Wells Fargo Bank and a number of \$1 million donations from wealthy individuals in the community, ICC opened a new, 40,000-square foot center in Milpitas in 2007. The Center today has more than 1,500 paying members, 200 volunteers and a small paid staff. It offers a fitness and wellness center and classes in yoga, Bollywood dancing, music, martial arts, art, and college test preparation, that are open to the broad local community. ICC also hosts a table tennis league, children's story time, karaoke night, career counseling, pro bono legal assistance, a free medical clinic, and a lecture series featuring a wide range of authors, academics and civic leaders. A seniors program offers a platform for socialization, lunches, outings, mah-jongg, and yoga and wellness classes. A new satellite center for seniors has opened in rented space in Cupertino, and ICC has expanded to serve the greater Bay Area Indo-American population by partnering with community centers in Fremont, Saratoga and other cities. By networking with some 70 community and professional organizations, ICC has provided a focal

point for the Indo-American community, with traditional music, dance, arts and other programs that cross regional, sect and caste boundaries.

A growing number of Bay Area non-Indians are also taking the Center's yoga and Indian music and dance classes as well. "If you look at our table tennis league, hardly five percent of the players are of Indian origin," Sharma says. "That gladdens my heart, because that's what it's all about, people coming together."



The **Federation of Indian Associations** (FIA), based in Fremont, is an umbrella group of some 40 community organizations originally established in the 1980s. It is part of a national FIA network of similar organizations throughout the U.S., that is dedicated to representing the interests and increasing the visibility of the Indo-American community and to expanding business opportunities. FIA is best known as organizer of the annual Festival of India & Parade since 1992, which recently featured Bollywood actress and model Amrita Rao as 2007 grand marshal. The organization has also raised money for disaster relief in South Asia and supports the Aasra Shelter for victims of domestic violence. It offers free medical care at its annual health fair during the festival, as well as programs for youth and seniors.

Political Networks: The Next Logical Step

TiE, AIF and ICC demonstrated to the Indian community what can be achieved by coordinating and leveraging its combined wealth and talent. Although Indian donors have raised and contributed millions of dollars for local, state and national political campaigns, their ability to field candidates and exert influence on issues of importance—education, health care, U.S. economic competitiveness, H-1B visa restrictions, the Patriot Act, outsourcing, and U.S.-India relations—has been limited to date.

Nationwide, Indo-Americans hold a relatively small number of seats in state legislatures (Minnesota, Ohio, Iowa, Kansas and Maryland) or local offices, so the recent election of Republican Governor Bobby Jindal in Louisiana made headlines. But Dilip Singh Saund remains the only Indo-American to have served in Congress, from 1956–62. Locally, San Francisco District Attorney Kamala Harris and Fremont City Council member Anu Natarjan are the only elected officials of Indian descent.



In October 2007, the Indian community launched an initiative of its own, beginning with an inaugural conference of the **Indo-American Council** (IAC) at the India Community Center in Milpitas. IAC was created by a group of prominent community leaders—among them Vinod Dham, Navneet Chugh, Dr. Kamil and Talat Hasan, Kumar Malavalli, California Medical Association president Anmol Mahal, Cirrus Logic founder Suhas Patil, former Excelan CEO and TiE president Kanwal Rekhi, and Storm Ventures managing partner Sanjay Subhedar—with the goals to:

- increase the visibility and influence of the Indo-American community through public service and political activism;
- inspire, mentor and provide material support for young Indo-Americans to get involved in public service and run for public office;

- identify, prioritize and develop positions and strategies to address issues of importance to the Indo-American community; and
- create a forum for exchanges of ideas between the community and policymakers.

San Francisco Mayor Gavin Newsom, former state controller Steve Westly, and Representatives Mike Honda and Zoe Lofgren attended the conference, and Barack Obama made a video appearance. Despite the heavy Democratic participation and the historic allegiance of Indo-Americans to the Democratic party, IAC insists that it will be bi-partisan in its activities and that the key objective is civic involvement. McKinsey senior partner Rajat Gupta, who donated to both Khanna's race and Jindal's first 2004 run in Louisiana, observes: "I think we should make contributions in all fields. While the first-generation immigrants did not participate in politics, the second and third generations are becoming fairly active, and this is overdue."

Non-Stick Networks

Indian professional networks are structured differently from Chinese networking models and reflect a distinct set of interests within the Indian immigrant community. Specifically:

- Chinese organizations formed more along occupational and business networking lines, while Indian professional organizations were initially cultural.
- Chinese professionals faced a more challenging glass ceiling due to language and cultural differences, and they channeled entrepreneurial energy earlier in the direction of creating new startups; Indians experienced greater mobility and opportunity within their professions due to English language proficiency and world-class educations from India's elite schools.
- Indian networks have tended not to link mentoring to investment, but rather have viewed it as a way to give back by passing on knowledge to the next generation.
- Chinese networks have been shaped in part by government policies in Taiwan and the People's Republic of China that were geared to reverse a potential "brain drain" and lure graduates back home in the interest of technology and skills transfer; no comparable Indian government strategy has existed.
- India's sizable domestic pool of legal and financial services talent has reduced the need for cross-border collaboration in M&A and business startup activity.

Forrester research vice president Ravi Nadjou also points out that while entrepreneurs in India have been highly effective in developing new tech products, programs and applications, they have until recently been relatively risk averse in starting their own companies to take those advances to market.

Education and job experience in Silicon Valley may impress, but heading a startup with no sales and no revenue other than early-stage VC funding is still socially suspect (compared, for example, to government service).

Sequoia Capital managing director Sumir Chadha, speaking at a recent M&A panel discussion in Menlo Park, adds that he has seen similar caution on the part of businesses in scaling up or attempting vertical integration through M&A. The relatively small number of acquisitions have been in cash, as buyers are skeptical of valuation in accepting stock, and sellers don't want to dilute their majority shareholdings; and even with relative corporate transparency in India, there is fear of attracting attention from government regulators or inadvertently reaching the scale of a large business and triggering restrictive employment rules. More recently, exchange rates and stock market uncertainty in the U.S. and India have added to the hesitancy.

All of the above factors alter the cross-border investment dynamics within the Indian immigrant community. This is not to say that there is less entrepreneurship, but only that it has manifested itself differently due to cultural and market factors. This may change as new industries emerge—biomedicine, clean technology, the Internet, or entertainment—where joint research and investment produce true hybrid industries over time, and also as business culture and regulation become more flexible.

Institutions also Network

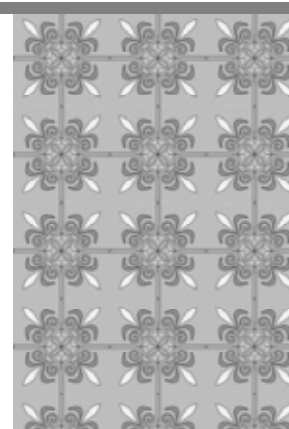


Other networks reach beyond the Indian community to connect the Bay Area and India. **The Asia Foundation**, based in San Francisco, recently returned to India after a thirty year absence. Its liaison office in New Delhi, headed by Rajendra Abhyankar, a former Indian Consul General in San Francisco, has begun making grants and organizing study tours and exchanges in 2009. The Foundation's main focus is on U.S.-India relations, but it is being extended to include government reform (with three projects running with non-governmental organizations in Pune, Bihar and Madhya Pradesh), economic reform, and women's rights. The Foundation is working with India's election commission to help neighboring Afghanistan acquire election management skills, and for five years it has run a research fellowship with India's foreign ministry, under which ministry nominees are placed at American think tanks and universities. Groups of junior diplomats are also sponsored to attend summer programs on U.S. foreign policy at George Washington University in Washington, D.C., followed by studies tours of the U.S., including the Bay Area.

Bay Area Cities Have “Sisters” in India

Sister city relationships typically offer an opportunity for student, cultural and business exchanges through the Sister Cities International program, begun in 1956 by then-President Dwight D. Eisenhower as a goodwill initiative to broaden Americans' understanding of the world and other cultures, and vice versa.

Five Bay Area cities—San Jose, Modesto, Union City, Fremont, and San Francisco—have sister city relationships with counterparts in India—Pune, Vijayawada, Jalandhar, Jaipur, and Bangalore, re-



spectively. As with most sister city links, these primarily involve a combination of charitable fundraising, visits by municipal delegations in both directions, student exchanges, and community cultural events.

The San Jose-Pune sister city program has been the most active since it was established in 1992 through the efforts of finance executive Vijay Pendse, a native of Pune, a city of some 4.5 million people in the state of Maharashtra near India's central west coast. Pune is home to 107 universities and scientific research institutes, graduating 87,000 students each year, mainly in engineering, medicine and science. It is also an automotive manufacturing center.

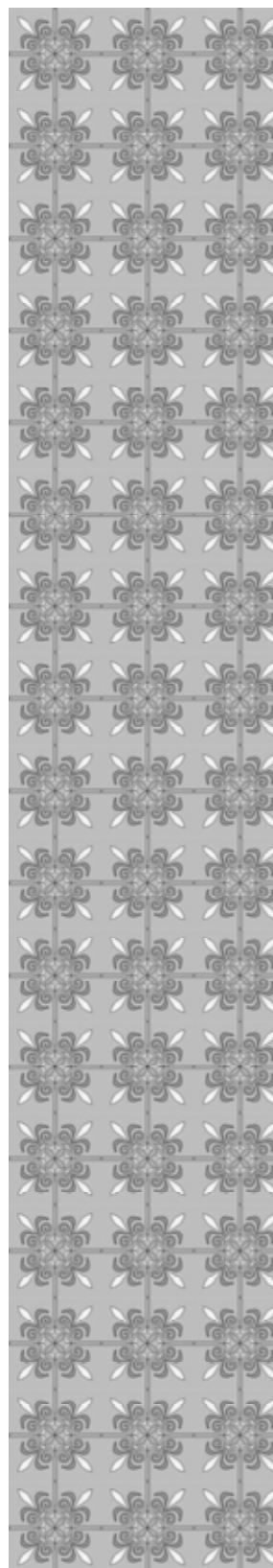
San Jose has hosted four technology symposia since 1996, inviting engineers and managers from Pune to hear presentations by Silicon Valley firms such as Intel, Hewlett-Packard and Siemens. It has arranged student and teacher exchanges with Pune University and other schools; raised funds and worked with the Rotary Club in Pune to provide vaccinations for low-income children and build the five-acre Mutha River Park; donated prosthetic limbs for children with polio; and organized book drives and a music program.

San Jose's latest sister city project with Pune has created a communication link between students at St. Francis High School in San Jose and the Mahatma Rajguru High School (HRHS), an all-girls school in Pune. The project is intended to help the economically disadvantaged HRHS girls to stay in school, through student-to-student contact and financial help for their families.

Vijayawada, a city of approximately 1 million in Andhra Pradesh near India's eastern coast, is one of five Modesto sister cities. In April 2007, Modesto held an Indian dinner/concert program to raise funds for the SKCV (Sri Krishna Chaitanya Vidyavihara) Children's Trust, which provides outreach, education, training, and night rescue centers for homeless youth in Vijayawada.

Union City's relationship with Jalandhar—a Punjabi manufacturing city of some 700,000 near India's border with Pakistan, known for making leather goods and surgical tools—is relatively inactive at this time. An annual festival initially raised money to host a visiting delegation from each of Union City's four sister cities (Santa Rosalia, Mexico; Pasay City, Philippines; Chiang Rai, Thailand and Jalandhar), but priority has more recently been shifted to providing each one in turn with aid.

Fremont, with its large Indian population, is linked to Jaipur, a historic city in the state of Rajasthan with a growing technology presence. Together with the Rajasthan Association of North America



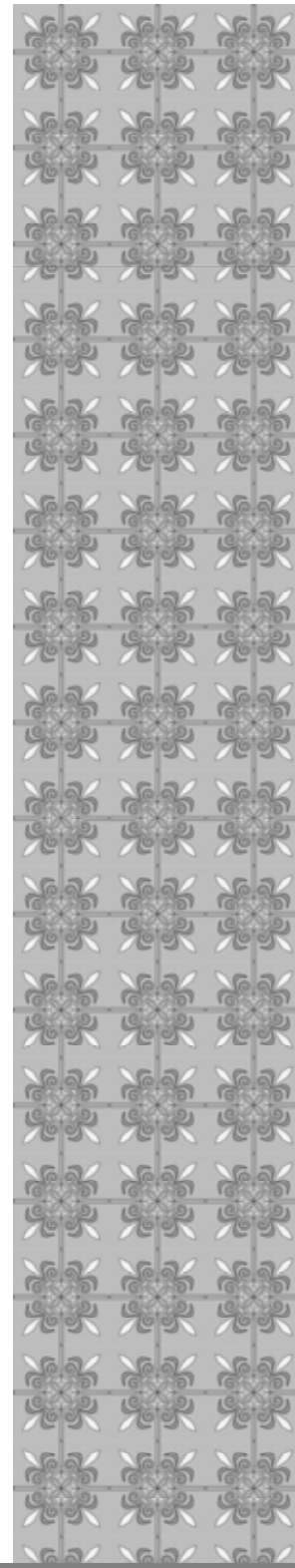
(RANA), the city recently hosted a well-attended forum honoring Rajasthan Home Minister Shanti Dhariwal.

Sister city exchanges are meant to be largely cultural in nature but larger cities, especially those that are key industrial or research centers often expand their charters to include economic exchanges of some kind. Several of India's largest cities are already involved in sister city programs (Chicago/New Delhi, Los Angeles/Mumbai, Long Beach/Kolkata, Riverside/Hyderabad). In 2008, San Francisco sealed the region's latest sister city agreement with Bangalore, the capital of Karnataka state in southwestern India.

The San Francisco-Bangalore relationship is built on a network of connections. Like the Bay Area and known as the "Silicon Valley of India," Bangalore is a center for aerospace, software and information technology. Bangalore hosts the R&D centers of many Bay Area technology companies, and it also hosts a major concentration of universities and research institutes.

San Francisco Mayor Gavin Newsom decided to pursue the Bangalore connection during a 2006 trip to China with Senator Dianne Feinstein. Citigroup private banker James Herlihy—who had been active in two of the city's other sister city committees (Cork, Ireland and Haifa, Israel) and had accompanied Newsom to China—eventually became the Mayor's point person for launching a Bangalore relationship, in partnership with sister city committee co-chair Madhav Misra.

Herlihy, now with Deutsche Bank, notes the compatibilities between the Bay Area and greater Bangalore, including opportunities for exchanges in biotechnology, clean energy, wastewater and sewage treatment, and public transit. The initial focus of the committee is on education, health care and the arts. In May of 2009, a memorandum of understanding (MoU) for the exchange of students and teachers was signed between Indus Schools (a private system in India founded by board member and founder of Brocade Technology Kumar Malavalli) and the French-American International School in San Francisco, both of which offer the international baccalaureate. Future items for the agenda may include water purification, waste management, and exchanges between Bangalore's airport and San Francisco International Airport. (Updated information on the committee's programs can be found at www.SFBangalore.org.)



Global Reach



4

Indian Students: Innovation and Quality of Life Are Still a Draw

Key Findings:

- India sends the most foreign students to California, and their numbers are growing.
- Nearly half of the 8,300 Indian students in California in 2008 were in the Bay Area.
- The UC campuses and Stanford enjoy deep connections with world-class Indian schools.
- Universities and tech firms are teaming to address India's pressing societal needs.
- Overseas alumni networks of Bay Area universities are weak; Indian graduate students identify with schools back home.
- Philanthropy focuses on preserving Indian culture here or on "giving back" in India.

Despite long waits and difficulties getting visas, Indian students, teachers and researchers continue coming to the U.S.—and to California especially.

Clearly, employment opportunities are on the rise in India. Fewer graduates remain in the Bay Area than before, but many are still drawn by the region's global leadership in technology, the prestige of an advanced degree or research position at a Bay Area university, entrepreneurial opportunities, the depth and breadth of the Indian community here, and the quality of life for those working and raising or relocating their families here.

More Students Coming, More Graduates Returning Home

According to the Institute of International Education (IIE), India is the leading country of origin for international students, with 94,600 in the U.S. in the 2007–08 academic year (AY)—surpassing even China's 81,100—and up 13% from the previous year. AY 2007–08 is the seventh consecutive year that India has sent the most international students to the U.S.

Some 8,300 Indian students enrolled in California universities and colleges in 2007–08, up from nearly 6,800 in the previous year and 5,600 in 2005–06, and they account for 11.5% of California's international students. Of the estimated \$2.45 billion spent in the past year by international students

in California on tuition and fees plus living expenses, the Indian students' proportionate share amounts to some \$240 million, up from \$232 million in 2006–07 and \$155 million in 2005–06.

Statistics are collected and reported differently by different university systems and individual campuses, making precise numbers elusive. A survey of the UC and California State University systems, Stanford University, University of San Francisco and Santa Clara University suggests that more than 3,500 visiting undergraduate and graduate Indian students are enrolled at major Bay Area institutions.

Most visiting scholars enter the U.S. on J-1 exchange visitor visas. The U.S. Department of Homeland Security (DHS) reported just under 6,000 Indian nationals entering the U.S. on those visas in 2006. DHS does not provide a breakdown of these arrivals by destination state or institution, but the survey of Bay Area campuses indicates a number in the 300–400 range.



UC Berkeley, as discussed earlier, has a history of Indian students dating back to the turn of the 20th century. For that reason, says Ananya Roy, an associate professor of city and regional planning who is also associate dean of academic affairs in the division of international and area studies and co-chair of the Berkeley India Initiative, Berkeley's traditional strength Indian studies has been in the humanities. The university last year celebrated its 100th year of teaching Sanskrit, for example, and has dedicated itself to preserving key regional Indian languages that are giving way to English instruction in many Indian schools.

Berkeley has 45 faculty that specialize in India, in fields ranging from engineering to comparative literature, and it boasts 88 visiting scholars from India, most of them in medicine, plant sciences, chemistry, physics and mathematics. It has 127 students from India with F-1 student visas, and many more who are first-generation children of immigrants.

The university's **Center for South Asia Studies (CSAS)** serves as a focal point for India-related research and programs across multiple departments. Housed within CSAS, the **Berkeley India Initiative (BII)**, launched in 2007, has been specifically set up to coordinate multi-disciplinary research and exchanges taking place with respect to India, including:

- research on key sectors of the Indian economy and global links, particularly in high-technology;
- identification of key policy interventions for expanding economic opportunity and mitigating poverty and inequality; and
- examination of issues of governance in the world's largest democracy.

BII is also looking to fund through CSAS an annual Berkeley-India Forum, an India Chair in Sustainable Development, graduate student fellowships, and undergraduate study abroad programs. On the cultural front, BII wants to continue to expand Berkeley's work in documenting and preserving Indian languages and culture with intensive language instruction and student exchanges.

In May 2007, Berkeley hosted the first in a series of conferences as part of the Project on Indian Democracy, a partnership with the U.S.-based nonprofit Foundation for Democratic reforms in India. The conference on governance and citizen empowerment featured, among others, Union

Indian Students: Innovation and Quality of Life Are Still a Draw

Minister of Urban Affairs Jaipal Reddy and Union Minister of Panchayats (district councils) Mani Shankar Aiyar. A second program in September 2009, will focused on India's legal and judicial system and featured leading Indian jurists.

At present, Berkeley funds three academic chairs directly related to India:

- The Chair in Tamil Studies was established in November 1997, with support from the Tamil-American community, to help preserve Tamil language and literature in the U.S.
- The Indo-American Community Chair in India Studies grew out of a community initiative in 1990–91 and was inaugurated with guest lecturers Nobel laureate physicist S. Chandrasekhar and former U.S. Ambassador to India John Kenneth Galbraith. Past holders of the chair have included economist Mrinal Datta Chaudhuri, political scientist Subrata Mitra, environmentalist Ramachandhra Guha, and literary critic Meenakshi Mukherjee. The permanent chair since 2001 has been political science professor Pradeep Chhibber, who has written extensively on political party structure, property rights, foreign investment and political participation by women in India.
- The Sarah Kailath Chair in India Studies was established in 1996 by Thomas Kailash with Vinita and Narendra Gupta. Dr. Kailash is Hitachi America Professor of Engineering at Stanford, and he and Dr. Narendra Gupta founded Santa Clara-based Integrated Systems, Inc., a design tool and operating system software developer. Vinita Gupta runs her own telecommunications company, Digital Link, Inc., in Sunnyvale. Sociology professor Raka Ray, who also heads Berkeley's Center for South Asia Studies (CSAS), currently holds the chair.

Berkeley also has multiple privately funded programs related to India:

- The Amrit Kaur Ahluwalia Memorial Grant Program was founded in 2000, with support from Dr. Joginder Singh Ahluwalia and family, to provide graduate summer research grants in Sikh studies.
- The Berkeley Bengali Initiative began in 2003 to promote Bengali language and cultural studies, as well as training for scholars, development experts, and NGO activists to conduct research in and about West Bengal.
- The Rajendranath Das Lecture in Bengali, an annual lecture by a Bengali scholar, has been created by retired physicist Dr. Satyendranath Das.
- The Bhandari Program on Indian Entrepreneurship in Silicon Valley was launched in late 2007, with funding from the Bhandari Foundation, to document the achievements of the Indian diaspora in Silicon Valley. It was initiated in 1994 by Aspen Semiconductor founder and venture capitalist Narpat Bhandari, and his wife, Chandra, an educator.
- The Berkeley Telugu Initiative, begun in late 2007 with gifts from the community, launched with a beginner level Telugu language course.

- The Gobhind Behari Lal Scholarship in Science Journalism was launched in 1982 with \$5,000 from the estate of John Herron in honor of his friend, 1937 Pulitzer Prize-winning science writer Gobhind Behari Lal. Indian community members added to the fund, which is administered by the graduate journalism school.
- A two-week Indo-American Community Lectureship, initially started to bring prominent scholars from India to Berkeley to lecture and interact with the campus community every other year, was upgraded to an annual event in 2007. The Indian Council for Cultural Relations contributes visitors' airfare.
- The Qayum Family Foundation Grants for Travel and Conferences program results from a funding pledge for a series of lectures and graduate fellowships through CSAS and represents the first U.S. initiative by the Foundation, which funds scholarships for worthy students, particularly women, at the Aligarh Muslim University and Shibli National College in Azamgarh.

Also underway and involving Berkeley faculty are a variety of other India-related projects which deal with technology, the Indian economy, poverty eradication and inequality, and democratic reforms.

Berkeley's **CITRIS** (Center for Information Technology in the Interest of Society), through the Intel Research Berkeley Lab and its director, computer science professor Eric Brewer, launched a wireless communications network in 2005 linking Aravind Eye Hospital in Tamil Nadu with five rural health clinics so that eye specialists could interview and diagnose patients by video conference. The project has since been expanded to five hospitals and some 50 clinics.

CITRIS director and Dean of Engineering Shankar Sastry leads the Team for Research in Ubiquitous Secure Technology (TRUST) project with IIT-Bombay, IIS, Tata Institute of Fundamental Research and Amrita University of Science and Technology, to improve the privacy and security of India's computer infrastructure (an important issue given the leading role of India's IT service sector). A second project with Amrita establishes a distance learning program, with top U.S. engineering faculty teaching courses by satellite at Indian colleges and universities. And a group led by mechanical engineering professor Arun Majumdar is working with IIT-Mumbai on improving efficiency and performance of devices that convert heat to energy using nanotechnology.

All of the above activities fall under a broader 2005 memorandum of understanding CITRIS signed with the Indian Space Research Organization, India's Department of Science and Technology, Amrita University and others. The MoU also includes participation from CITRIS corporate sponsors Microsoft, Qualcomm and Cadence Design Systems.

Berkeley-India Joint Leadership on Energy and the Environment (BIJLEE) formalizes and expands ongoing R&D relevant to India, with U.S. support from the Department of Energy, the Department of State, the Environmental Protection Agency, and the Agency for International Development, as well as support from the California Energy Commission and the California Public Utilities Commission, and the support of numerous other private and governmental organizations in both the U.S. and India.

The Berkeley Group for Architecture & Planning, a nonprofit alliance of architects, planners and UC Berkeley professors and students, has been formed to design the Nanocity project—a sustainable, economically viable, technologically advanced new town in India outside the city of Chandigarh. The project’s initial design phase is underwritten by Hotmail founder Sabeer Bhatia, working in cooperation with a developer group and the Haryana State Industrial and Infrastructure Development Corp.

Berkeley College of Environmental Design associate dean Nazer AlSayyad and professor Susan Ubbelohde head the NanoCity design team, and Ananya Roy, professor of comparative urban studies and international development within Berkeley’s Department of City and Regional Planning, is a planning consultant to the project. (More information on Nanocity and Sabeer Bhatia can be found in the *Architecture/Urban Planning/Infrastructure* section later of Chapter 6.)

Ashok Gadgil, a scientist at Lawrence Berkeley National Laboratory, developed technology in the 1990s to quickly and cheaply disinfect drinking water using ultraviolet (UV) light. In a collaboration with ICICI Bank, Naandi Foundation and local village councils, Gadgil’s UV Waterworks technology has been licensed to WaterHealth International, which has set up over 200 WaterHealth Centres, mostly in Andhra Pradesh, to dispense treated water to rural residents.

Energy and Resources Group associate professor Isha Ray has researched and written on water access, sanitation and pricing in rural India and is involved in ongoing community-level water treatment and delivery projects in India, Mexico, Sri Lanka, and China.

Economist Ashok Deo Bardhan, with the Haas Business School’s Fisher Center for Real Estate & Urban Economics, has written a 2004 book on globalization in California’s tech sector, as well as numerous research papers on offshoring, innovation, international real estate, and globalization of capital flows.

Economics professor Pranab Bardhan (no relation) has co-written textbooks on development economics and has conducted field research and presented lectures on rural economics, models for decentralized governance, and the economic impacts of trade and globalization. Bardhan and Boston University scholar Dilip Mookherjee have studied the impacts of land reforms and the panchayats (India’s 436 district councils within its states that function similarly to county or other regional governments) on farm productivity and targeting of development assistance in 90 West Bengal villages—a collaboration with the Indian Statistical Institute and Kolkata’s Center for the Study of Social Sciences.

The Richard C. Blum Center for Developing Economies, founded in April 2006 with a \$15 million gift (including a \$5 million challenge grant) from San Francisco financier Richard Blum, is pursuing a number of projects in developing countries. One involving Berkeley faculty is Haath Mein Sehat (HMS), or “Health in Your Hands,” a water purification and sanitation research program in the Mumbai slums.

Shailendra Kumar, senior director for special projects and research funding at the College of Arts and Letters, is currently pursuing alliances with the Indian Institutes of Technology, as well as other prospective academic, government and corporate partners, relating to several multi-disciplinary

initiatives, among them the Center for Computational Biology, the Berkeley Institute of the Environment, and the Berkeley Nanosciences and Nanoengineering Initiative.

Berkeley has collaborative arrangements with the IIT, IIS, Delhi University and other institutions. A pilot collaboration among UC Berkeley, Lawrence Lab and IIT-Kharagpur, initiated by Kumar and the IIT Foundation, was launched in 2008, focusing on biofuels and on emerging and neglected diseases (See *UC Berkeley and IIT-Kharagpur: In Search of Synergy* later in this chapter.)



Stanford University has 426 students from India, of which 362 are graduate-level, with electrical and mechanical engineering, computer science, management science and engineering, civil and environmental engineering, materials science, and business as their primary fields of study. Stanford's 70 visiting scholars in 2006–07 taught, lectured and conducted research in biology, biochemistry, biomedicine, business administration, chemistry, physics, psychology, and structural biology among other fields.

Stanford launched its own South Asia Initiative (SAI) in 1999, with support from the School of Humanities and Sciences and the Bechtel Initiative on Global Growth and Change, part of the Freeman-Spogli Institute for International Studies (FSI). SAI activities are largely oriented toward economics and business, although some of its work touches on security and political reform issues. Its activity is closely linked with the Shorenstein Asia-Pacific Research Center (APARC), FSI, and the Stanford Program on Regions of Innovation and Entrepreneurship (SPRIE).

SAI executive director Rafiq Dossani holds an MBA from the Indian Institute of Management and a PhD in finance from Northwestern University, and was formerly an investment banker and deputy editor of *India Business Weekly*. During his tenure with APARC, Dossani was instrumental in securing a 5-year protocol with the Prime Minister's Office and the Ministry of Communications in India, to assist with telecom industry reform. SAI advised the government on licensing, pricing of bandwidth, opening the telephony market to local franchisees, and other practices to increase services.

A subsequent 2006 joint field research project with India's National Informatics Center focused on rural access to Internet and telecom services, particularly in the areas of health care, education, and enabling landless laborers to arrange work and negotiate payment.

In 2006, Dossani was invited by the Indian government's Planning Commission to participate in the Committee on Technology Innovation and Venture Capital. The Committee's July 2006 report examined how innovation, research, entrepreneurship, capital markets and public policy interact to foster economic growth in India, and it recommended policy adjustments. Dossani has also collaborated with Asawari Desai of TiE on an analysis of access to early-stage risk capital in India, and with UC Davis professor Martin Kenney on a 2005 report, *Offshoring and the Future of U.S. Engineering: An Overview*.

Stanford has numerous other activities relating to India:

- In 2006, Stanford launched the Center for South Asia to strengthen and coordinate the university's faculty, curriculum and research in the School of Humanities and Sciences.

Indian Students: Innovation and Quality of Life Are Still a Draw

- Dr. Philip Pizzo, dean of the Stanford School of Medicine, signed an agreement on May 9, 2007 with the nonprofit Emergency Management Research Institute (EMRI) in Hyderabad to train 150 paramedics and 30 paramedic instructors over a two-year period, first in the southern India state of Andhra Pradesh and, ultimately, nationwide, under an EMRI government contract. EMRI operates 500 ambulances and a state-of-the-art call center in Andhra Pradesh.
- A School of Medicine training program, Stanford-India Biodesign, offers Indian engineering, business and medical students immersion at Indian community clinics and hospitals in a two-year joint fellowship project to identify unmet medical needs and develop cost-effective technologies, devices and treatments. Stanford will partner with the All India Institute of Medical Sciences and the Indian Institute of Technology in New Delhi, with \$4.8 million from the Indian government.
- The Center for International Security and Cooperation (CISAC) has collaborated with the Indian government, diplomats, military officers and scholars on matters involving nuclear safety and security.
- Stanford's Graduate School of Business has developed the IIMB Exchange Program in partnership with the Indian Institute of Management in Bangalore, an exchange of 16 students from each school in a cross-cultural study of business and management in the U.S. and India. Ramping up its India focus in 2007, 70 Stanford first-year MBA students participated in two study tours to India. The school's Global Management Immersion Project has placed students in four-week summer internships at Infosys, Genpact and Nike India. A Haas Center for Public Service summer fellowship program has placed engineering and international relations students in projects with local NGOs and with the Federal Reserve Bank of India. Two Stanford Business School alumni overseeing this engagement—Infosys founder Narayana Murthy and Mukesh Ambani, head of Reliance Industries—participate on the Dean's strategy council.
- A two-year Rule of Law Program, involving workshops and research in India led by professors Tom Heller and Erik Jensen, is currently studying the relationship between legal quality and economic growth in India. A second project led by professor Paul Goldstein and Dr. Joseph Straus of the Max Planck Institute examines "Intellectual Property Infrastructures in Asia's Emerging Markets," including comparative case studies for India and China.
- Stanford's Asia Technology Initiative (ATI) held two global entrepreneurial forums in 2005 and 2006 in Mumbai, bringing together Indian corporate and government leaders with participating Stanford alumni, faculty, and students.
- Stanford students are working on rural energy projects with The Energy Research Institute (TERI), one of India's leading energy research centers.



UC Davis reported 60 international students and 78 visiting scholars from India in 2007–08, engaged in plant biotechnology, microbiology and immunology; transportation; environmental science; materials science; and chemical engineering, among other fields.

Davis faculty and scholars have been deeply involved in work relating to India's society and its economy. Some examples:

- Davis has had, over the years, research collaborations with the Indian Institute of Science, National Center for Biological Science, University of Hyderabad, Center for Cellular and Molecular Biology, Osmania University, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Plant pathology professor Douglas Cook's lab has worked with Indian researchers on agricultural biotechnology research in support of rural development.
- Dr. Satya Dandekar teaches microbiology and is conducting research into gastrointestinal tissue as an early target of the HIV virus. She has established an international collaborative research consortium in India with the Indian Institute of Medical Sciences at New Delhi and two Indian NGOs in the coastal region of Andhra Pradesh, where there is a large rural population and high incidences of HIV infection. As director of developmental core activities with the Northern California Center for AIDS research, she has trained Indian researchers.
- Davis faculty members Ranjan Bose and Daniel Sperling prepared a 2001 report for Davis' Institute of Transportation Studies, published by the Pew Center on Global Climate Change, on strategies to reduce greenhouse gas emissions in New Delhi through introduction of new technologies, increased mass transit, and a mix of alternative vehicles.
- Delhi University graduate Smriti Srinivas, now an associate professor of anthropology at Davis, has written extensively on the transformation of spiritual memory and tradition, cultural identity, and physical movement in the city of Bangalore as it evolves into India's high-tech city of the future.
- Within the Davis School of Law, professor Anupam Chander has focused his published work on the trade impacts on India of intellectual property protection under the World Trade Organization structure. Law professor Madhavi Sunder has examined the issue of countries protecting their cultural industries as a form of intellectual property, as well as the topic of women's rights within Muslim communities.



UC San Francisco, with 19 graduate students from India and 106 visiting scholars, is involved in a wide range of medical research relating to India—in HIV/AIDS treatment, eye care, women's health, and trauma care linked to earthquake and tsunami relief.

The CARE-India program developed at UCSF, for example, is a set of interactive computer tools and self-testing programs that enable low-literacy international populations to determine whether they may have HIV/AIDS or other sexually-transmitted or drug-related illnesses and to obtain limited counseling through a network of interactive kiosks. This approach offers services at more locations closer to patients, while offering privacy, uniform levels of service, lower training costs and automated statistical reporting.

In 1997, the Francis I. Proctor Foundation, which funds eye disease research laboratories and clinical facilities on the UCSF campus, expanded its programs for developing countries to include

India. Specific activities have included public education, antibiotics, and development of a low-cost vaccine to treat trachoma, an infection spread by hand-to-eye contact; partnering with the Aravind Eye Hospital Uveitis Clinic in Madurai, South India (founded in 1992 by Proctor researcher Robert Nozik) to study the formation of cataracts and prevention with antioxidants; and research into AIDS-related eye infections such as CMV retinitis and their reaction to antiretroviral drugs.

In 2006, UCSF launched a five-year research program with three Indian NGOs to study the correlation between alcohol abuse and AIDS. The university is also collaborating with UC Davis, the National Institute of Mental Health and Neurosciences, and the Tata Institute of Social Sciences in a study of stigma and discrimination by gender in the treatment of AIDS. A further study now underway involves 40 patients and physicians in Bangalore and examines factors affecting whether patients adhere to antiretroviral AIDS treatment.



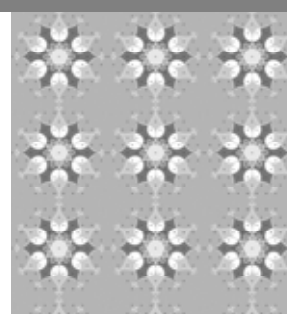
The California Institute for Quantitative Biosciences, also known as **QB3**, one of the four California Institutes for Science and Innovation, is a research center housed on the UCSF campus, that focuses on applications emanating from the fusion of information technology and biotechnology. In 2007, through the signing a memorandum of understanding with the Indian government's Department of Science and Technology, Department of Biotechnology, and Science and Engineering Research Council, as well as the autonomous nonprofit Indo-U.S. Science and Technology Forum, and various research and educational institutions, the University of California launched the UC-India Initiative to encourage cross-border research collaborations.

QB3 associate executive director Dr. Douglas Crawford accompanied UC president Robert Dynes on a visit to India in February 2007. His goal was to establish a program of cross-disciplinary research for developing drugs to treat neglected diseases such as tuberculosis and malaria. Specifically, he was offering Indian researchers use of QB3's small molecule discovery center and seeking partners to develop new compounds and then perform the necessary medicinal chemistry and pre-clinical development work to begin taking them to market.

Crawford says the QB3 effort has been slow to materialize for several reasons: the university graduate research infrastructure and linkages with national research laboratories in India are not fully developed; intellectual property issues within UC and funding concerns on both sides have delayed agreements; and, at least in the case of a planned collaboration on tuberculosis drug development, industry partners have emerged as competitors—Indian researchers formed a partnership with Merck, Serrano instead.

UC Berkeley and IIT-Kharagpur: In Search of Synergy

While a deeper, comprehensive research partnership between the 10-campus University of California network and India's elite schools has proven elusive in the short term, an important collaboration between two schools may hold the key to a future model.



Discussions between UC Berkeley and IIT-Kharagpur were initiated largely by IIT-Kharagpur alumnus Shailendra Kumar, senior director of external relations for the UC Berkeley College of Letters and Science. Kumar had earlier served as president of the IIT Foundation, an alumni fundraising entity for IIT-Kharagpur, and his efforts were a follow-up to the February 2007 India visit by UC president Robert Dynes and a systemwide UC faculty delegation.

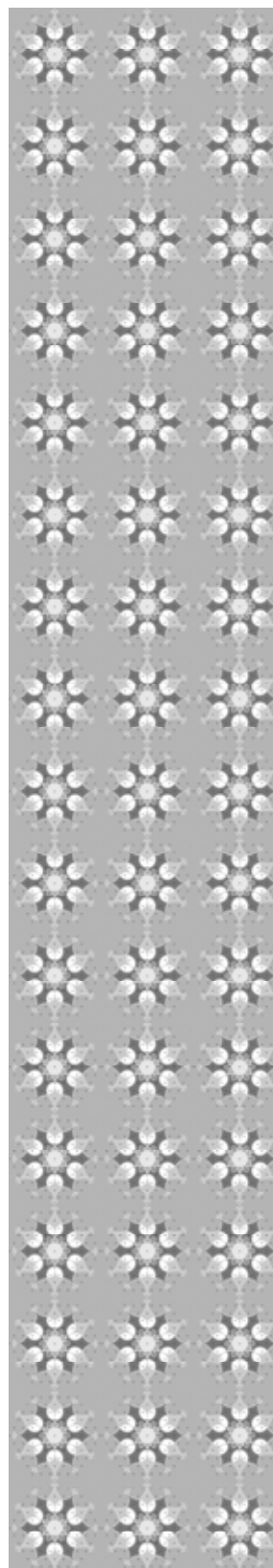
The collaboration was formalized in November 2007 with a return visit by three Berkeley deans—from Letters and Science, Physical and Mathematical Sciences, and Biological Sciences. Letters and Science dean Mark Richards and IIT-Kharagpur biotechnology department head Professor Satyahari Dey led the initiative at their respective schools.

The model has been to focus on complementary research strengths and begin with small steps. The schools identified two areas of study—biofuels and health care biotech related to emerging or neglected diseases—and in 2008, hosted 11 IIT-Kharagpur students for an eight-week summer research session at Berkeley. The 2009 summer session hosted 18 students.

“It’s an experiment we’re conducting,” says current IIT Foundation president Roy DaSilva. “Our ultimate goal is to get a true collaboration going by bringing students over, having the professors here look at the quality of students available, and come up with projects that students and faculty at both schools can focus on.”

Biofuels and health care biotech offer clear examples of Bay Area-India synergies, DaSilva explains. UC Berkeley, along with the Lawrence Berkeley National Laboratory and the University of Illinois, have formed the Energy Biosciences Institute (EBI) under a 10-year, \$500 million research grant from energy firm BP to develop next-generation fuels; IIT-Kharagpur has established a Biofuels Center of Excellence on its campus, and it is the only IIT with an agricultural engineering department. The study of next-generation fuels merges the developed world’s interest in energy independence and climate change with immediate, real world applications for India’s off-grid rural poor.

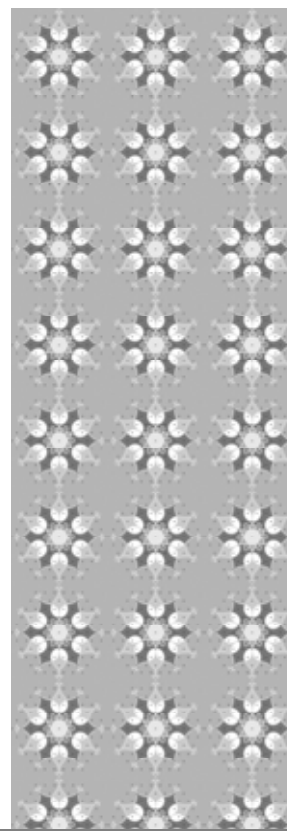
Similarly, DaSilva points to the potential good that research into neglected diseases can do—and the potential market it represents in India and other developing countries. Some of that research can be difficult to undertake in the U.S., where the diseases in question may never have existed or have, in a different form, been eradicated.



A \$2.8 million, three-year first phase of the joint program has been sponsored by EBI, the IIT Foundation and Berkeley/LBNL faculty to host the summer sessions, continued research at IIT-Kharagpur, joint student/faculty research at both schools, and reciprocal faculty visits toward completion of final-year projects. IIT Foundation seeded the first phase of the collaboration, and has agreed to facilitate fund raising activities so that alums can make “targeted donations” to fund the UCB IIT KGP collaboration. The second phase will focus on extended joint research and bringing scientific discoveries to market.

Sharing of intellectual property (IP) patents in this kind of cross-border exchange has frequently been a challenge. IIT-Kharagpur benefits from its work studying IP regimes worldwide through its Rajiv Gandhi School of Intellectual Property.

The IIT Foundation was created in 1992, specifically as an alumni fundraising association, by Vinod Gupta, an IIT-Kharagpur graduate and founder of market database developer InfoUSA. The Foundation has 11 U.S. chapters and 15 others worldwide. Its global membership numbers 11,700, with 4,300 in the U.S. and nearly 1,200 in California, of which about 800 are in the Bay Area.



The proximity of the **UC Santa Cruz** (UCSC) campus to Silicon Valley and the South Bay Indo-American community has produced a number of significant Bay Area-India collaborations, among them:

- the Kamil and Talat Hasan Chair in Indian Classical Music, begun in 2000 with an endowment from the Saratoga couple, respectively a general partner with Hi Tek Venture Partners and CEO of Sensys Instruments, and their Hasan Family Foundation; the chair is the first of its kind in the United States;
- the Ali Akbar Khan Endowment for Indian Classical Music, a 1999 Hasan Family Fund endowment that helped bring Indian star musician Ali Akbar Khan to the UCSC campus as Distinguished Adjunct Professor of Music;
- the Sarabjit Singh Aurora Chair in Sikh and Punjabi Studies;
- the Kumar Malavalli Chair in Storage Systems, funded through a \$1 million 2004 donation made to UCSC's Baskin School of Engineering by Malavalli, the founder of Brocade Communications;
- the Narinder Singh Kapany Chair in Optoelectronics, launched with a 1999 endowment from Dr. Kapany, founder of K2 Optronics and Kaptron, former director of UCSC's Center for Innovation and Entrepreneurial Development (CIED), and a Stanford visiting scholar;

- the Satyajit Ray Film and Study Collection, containing a comprehensive collection of the director's works;
- the annual Siddhartha Maitra Memorial Lecture, which has featured prominent Indian intellectuals such as Nobel Laureate Amartya Sen and authors Vikram Seth and Pico Iyer.

UCSC economics professor Nirvikar Singh also serves as director of UCSC's South Asian Initiative, which until now has focused on the social sciences. Singh was central in coordinating and launching a 2008–09 colloquium series, "Mapping the Future of India," in cooperation with the Indian Community Center. The series began with a May 2008 lecture by Shubhashis Gangopadhyay, adviser to India's finance minister. Professor Singh works to enable UCSC faculty with expertise in South Asia to meet with counterparts in India.

A longer-term goal is to establish an interdisciplinary South Asian Studies Center (SASC) in 2010 that—in contrast to most South Asian studies centers that focus on language and culture—will primarily emphasize business and economic development (international finance, water management, agroecology, health care), and science and technological innovation (environmental science, climate change, engineering).

In a separate Silicon Valley Initiative, UCSC is working to establish networks and collaborative arrangements with South Asian entrepreneurs in Silicon Valley, including TiE and other groups, and with business leaders in India.

Professor Singh points to a range of programs and events on the UCSC campus that can be leveraged through better coordination under the auspices of a new SASC. For example, the Santa Cruz Center for International Economics and the Center for Global, International and Regional Studies have held three successful conferences on the economies of India and China. The Center for Agroecology and Sustainable Food Systems, the Program in Community and Agroecology, and the Center for Integrated Water Research are positioned to study crop development, food production, and water policy. Faculty members in the Division of Physical and Biological Sciences are conducting research in areas critical to South Asia's future, including arsenic pollution in groundwater, environmental pathogens such as cholera, and the effect of global climate change on environments and populations in low-lying coastal areas. And members of the Baskin School of Engineering faculty, particularly in Technology & Information Management (TIM), have been invited by California government agencies, Indian business and government leaders, the Indian Institute of Science (IISc), and the Indian Institutes of Technology (IIT) to participate in research and education initiatives.

UCSC's goals for the South Asian Studies Center are establishing faculty and professional networks in Santa Cruz, Silicon Valley and India; convening an advisory board; hiring an executive director; endowing six new faculty positions—two each in business and economic development, science and technological innovation, and arts, music, and culture (including language)—and, by 2020, endowing \$3 million in scholarships to attract foreign students.



Within the California State University (CSU) system, only **San Francisco State University** (SFSU) reports data separately. SFSU had 73 Indian students on campus in 2007.

The Munger Chair of Computer Engineering and Munger United States-India Student Program in Computer Engineering at **Fresno State University** were established in 2002 with a \$1.95 million endowment from Lajpat Rai Munger and family. Munger came to California in 1966 from Hoshiarpur, Punjab. He and his sons grow pistachios on 7,000 acres in Delano. The endowments strengthen distance learning links between students at Fresno State and in Hoshiarpur, where the Munger family has also established a medical dispensary and an 11-acre information technology campus.

CSU East Bay (Hayward) has a significant number of Indian students and ties to India, in part due to the large local Indian community in the East Bay and the South Bay. CSU trustee and Providian Financial Corp. CEO Shailesh Mehta donated \$100,000 in 2003 toward a \$23.5 million business technology center completed in 2006. More than \$7 million in private donations were raised for the project (largely from the Indo-American community), which is the first major new academic building on the Hayward campus in 30 years. Hayward has established an Asian Quarter abroad program in Manipal for marketing students, as well as student/faculty exchanges and business consulting programs with Indian companies.

San Jose State University (SJSU) boasted a sizable number of Indian students in 2004, although it is not clear whether SJSU's 1,068 graduate and 311 undergraduate Indian students were Indian nationals in the U.S. on visas with SJSU as their sponsoring university (the reporting criteria used by the Institute for International Education) or whether the figures also reflect students of Indian origin or nationality.

SJSU's College of Engineering has a \$1 million Global Technology Initiative, sponsored largely by Silicon Valley tech industry donors, that hosts a two-week trip abroad for engineering students, including tours, meetings and lectures. The 2008 trip was to India, led by graduate business advisor and mechanical engineering professor Dr. Raghu Agarwhal. The Lucas Graduate School of Business at SJSU signed a memorandum of understanding with IIM-Bangalore for faculty and student exchanges beginning in the fall of 2008. In May 2007, the school hosted a visit and talk by Indian School of Business dean Rammohan Rao.

San Jose State's College of Business links to Silicon Valley through its Silicon Valley Center for Entrepreneurship, headed by Dr. Anuradha Basu, a specialist on entrepreneurship in the College's organization and management department.



The **University of San Francisco (USF)**, a Jesuit Catholic institution, had 784 international students (about 9% of the total student body) enrolled as of September 2007. Of those international students, 51 were from India.

USF has an active Indian Student Association, with approximately 20 members. Every year, the association sponsors events that highlight Indian culture. The USF alumni office reports 58 USF alumni living in India for whom current mailing addresses are available, although the total number of alumni is significantly higher. Among USF's 367 full-time faculty members, at least four are from India.

Exchanges with India have included a visit in the summer of 2004 by a group of 24 USF students from the Erasmus project (a USF living-learning community) and USF president Stephen

A. Privett, S.J, and a January 2007 tour of 18 USF MBA students visiting businesses and non-profit organizations. During the past three years, 13 USF students have spent a year or a semester studying abroad in India.

USF's Center for the Pacific Rim held a "mini-festival" on India in 2007, featuring five public programs on India, and honored Indian born entrepreneur and Hotmail founder Sabeer Bhatia at its 20th Anniversary Gala in April 2008.



The Global Social Benefit Incubator (GSBI) in the Center for Science, Technology, and Society at **Santa Clara University** has worked with more than forty "social enterprises" in India to develop innovative business models that enable a new breed of "social entrepreneurs" to achieve significant scale. One example, a reverse osmosis system that was serving one million customers two years ago, will be serving more than fifteen million people in three years. Innovative businesses nurtured at GSBI illustrate how challenging problems like access to safe water, the productivity of small holder farms, and access to financial services for the unbanked can be addressed through low-cost solutions. Insights from GSBI's work in India are attracting growing interest in the possibility of serving the poorest of the poor through user-centered product, service, and process innovation that radically reduces costs.

The Alumni Conundrum

Global alumni networks can play a vital role in a university's ability to:

- raise funds and attract endowments;
- provide employment and entrepreneurial networking contacts for graduating students; and
- link with universities, research laboratories, companies and government bodies worldwide on joint research and collaborative exchanges.

Through its overseas alumni, a university is additionally able to stay current with market and social trends, leverage complementary work and funding support, and enhance the university's overall stature abroad. Alumni organizations often serve as parallel professional networking organizations, both in the home country and overseas.

UC Berkeley's estimated 800 alumni living in India, and Stanford's 400, represent an impressive resource of talent and connections. Yet the connections between these alumni and their schools remain relatively weak, especially when compared to the role played by their Chinese counterparts in cross-border business development and exchanges.

Both universities maintain contact with their India alumni in the context of arranging visits, hosting industry or public policy conferences, facilitating individual contacts and so on. Neither school, however, has a distinct Indian alumni group on the order of the Berkeley Chinese International Alumni Association or the Forum for American/Chinese Exchange at Stanford (FACES), or a distinct development entity such as the Berkeley China International Association (although the Stanford Office of Asian Relations does broadly perform such a function for Asia as a whole, including India).

Indian Students: Innovation and Quality of Life Are Still a Draw

Rafiq Dossani of the South Asian Initiative at Stanford admits frustration that while some of India's wealthiest business and thought leaders are Stanford graduates, that has not translated—as might be expected—into major endowments or opportunities for newly graduating students. Ananya Roy, of the Berkeley India Initiative, similarly acknowledges that “some of our strongest supporters are not necessarily alumni.”

Endowments are often philanthropic, favoring fellowships or scholarships that commemorate an individual and/or address particular research needs in India (preservation of language and culture, sustainable development, women's health, water quality). Relatively few are intended to advance business-related study through new laboratories or research chairs that help meet future R&D and workforce requirements in the donor's field.

Alumni chapters in India are fewer in number and tend to be less active than those in China; they participate in conferences organized by the schools, for example, but do not typically host high-visibility programs or formally maintain business and government contacts in support of the university and its pool of graduates.

Bay Area thought leaders in the Indian community interviewed for this report offer several explanations:

- An older generation of Indian immigrants, who made their wealth and either relocated or raised families in Silicon Valley, direct their philanthropic efforts toward solving India's huge social problems, as a way of giving back.
- Next-generation arrivals, who come to the U.S. for graduate study or are recruited by Silicon Valley companies, hope to gain skills and experience, earn more money than would be possible in India, and eventually return home to start families and pursue business opportunities there.
- Most successful Indian immigrants came to the U.S. for graduate or doctoral studies after a four-year program at one of India's elite schools, to which they feel a closer identification.
- The needs of Indian universities to provide students with modern facilities, equipment and course materials are seen as much greater and more immediate, with nowhere near the same access to endowments and other funding as U.S. universities.

“I think, more than anything, there is a sentiment among alumni that the schools in India need money and resources so much more than the schools where they got their graduate degrees,” says Roy DaSilva, executive committee president of the IIT Foundation, which raises money worldwide, including in the U.S., for IIT-Kharagpur. “When you look at the foundations and the size of endowments that U.S. schools have, they're huge compared to what you find in India.”

Not surprisingly, several IIT campuses have Bay Area alumni chapters, as do the IIMs, IIS, National Institutes of Technology and other schools. Creation of the IITs' extensive global alumni network was spearheaded by graduates in the Bay Area, starting with IIT Mumbai, whose initiative to create a Bay Area chapter was subsequently replicated throughout the world.

PanIIT, an umbrella organization of IIT alumni organizations, has hosted two of its three biennial global conferences in the Bay Area. The first, in 2003, drew 2,200 people and featured Microsoft founder Bill Gates as keynote speaker. The CBS News program “60 Minutes” covered the conference, referring to IIT as “the most important university you’ve never heard of.” A July 2007 Santa Clara conference entitled “Transforming the World through Technology” attracted an attendance of 4,000 over three days. PanIIT’s annual Diwali celebration in Los Altos Hills draws some 1,400 attendees.

IIS alumni hosted their own three-day global conference in Santa Clara in June 2007, featuring Government of India principal scientific advisor Dr. R. Chidambaram, Applied Materials chairman Jim Morgan, Boeing chief technology officer Dr. Robert Krieger and UC Berkeley chancellor Robert Birgeneau.

A Frontier Market for Education

The challenges faced by the founders of the Indian School of Business (as recounted in Chapter 3) point to the difficulties encountered by foreign educational institutions in entering the Indian market. Despite its considerable pool of human resources, India faces a shortage of educated workers. India therefore presents an emerging market for California and U.S. educational institutions seeking to deliver programs abroad. While almost 100 foreign institutions offer programs in India, at present they can only offer courses as extensions of programs based abroad and may not be located in India as distinct degree-granting institutions. Institutions with a presence in India must offer limited courses in partnership with recognized Indian institutions—a requirement that subjects them to inflexible restrictions on curricula, salaries and fees.

Those same restrictions have arguably limited educational innovation, impacted teacher quality, and unnecessarily inhibited economic growth. To meet growing demand and the government’s target of 15% enrollment, the scale of university education in India needs to grow faster. Recognizing the urgency of this gap, educational reforms that would open the educational market to foreign degree-granting institutions have been proposed, but at this writing the outcome remains uncertain.



5

Two-Way Trade: Slow but Steady

Key Findings:

- U.S.-India merchandise trade is small, but growing.
- Bay Area merchandise trade with India is mainly in low-end manufactured imports, technology, and agriculture exports.
- Indian IT and software exports dominate, tied to financial, health care, tech sectors.
- California agricultural exporters face tariff, phytosanitary and fumigation barriers.
- Outside of hotels and airport duty-free shops, high duties protect Indian wineries.
- Dockers are the IT uniform in India; Cost Plus profits from Indian fashions.
- Direct flights and budget hotels are a key to unlock India tourist growth.

Trade relationships are inherently difficult to measure. Merchandise is tracked as it passes through harbor or airport gateways, typically using a combination of vessel or cargo jet manifest data, shipper's export declarations, automated inbound customs filings, and so on.

Ultimately, merchandise trade data is viewed as a measure of overall economic and employment activity. But it is often impossible to tell from that data whether the point of origin or the destination was actually local to the gateway area, or whether goods were simply passing through the gateway en route to or from another part of the U.S., or whether a local origin or destination point was simply a distribution center or other storage facility where little or no value added work was done.

Services trade is far more nebulous. Clients worldwide may access customer relations management software on a company's servers on a subscription basis. An advertising agency may send artwork to a magazine across the globe by email and receive payment from the client in a third country by wire transfer. Banks process thousands of foreign exchange and letter of credit transactions daily, and collect both monthly and per transaction client fees in addition. Engineering and architecture teams in multiple countries may similarly exchange design drawings relating to a high-rise office building and a developer located in completely different parts of the world. Teenagers in India may pay a monthly fee to access multiplayer online games over lines provided

by a state-owned phone company that, in turn, leases the game from an offshore Mauritius content provider that licenses it from a California game developer.

Even in cases where such transactions might be captured in trade data, for the purpose of measuring actual economic impact, the precise point where value is generated in the transaction remains elusive.

That having been said, it is possible to use data to identify trade trends as long as the limitations of the data are understood.

The Flow of Goods Increases

Two-way U.S.-India trade has grown steadily during this decade, reaching \$44.3 billion in 2008, up from \$41.6 billion in 2007 and \$31.9 billion in 2006. The U.S. has historically been India's largest trading partner, until 2008, when China-India trade posted 34% growth to \$51.8 billion. The U.S. has run a consistent trade deficit with India, peaking in 2006 but declining over the past two years.

Two-way merchandise trade with India moving through the San Francisco Bay Area Customs District in 2008 topped \$966 million in value, according to U.S. Census Bureau figures. It included \$336.9 million in imports and \$629.1 million in exports moving via conventional air and sea cargo transport, plus a small percentage of goods carried in other ways, such as by tourists, or moving inbound through another gateway such as Southern California and then trucked to the Bay Area before clearing customs.

Two-way commerce in goods has risen steadily in recent years, imports dipped slightly in 2005, and overall, the San Francisco Bay region has consistently maintained a healthy trade surplus with India.

San Francisco Bay Area Merchandise Trade with India (\$ millions)

	2004	2005	2006	2007	2008
Air imports	\$65.5	\$73.0	\$65.7	\$66.2	\$82.0
Sea imports	\$208.4	\$198.9	\$262.0	\$263.0	\$254.4
Air exports	\$238.1	\$227.6	\$241.9	\$321.9	\$314.4
Sea exports	\$155.2	\$173.0	\$203.8	\$295.3	\$313.8
Total imports	\$275.1	\$272.8	\$328.1	\$329.4	\$336.9
Total exports	\$393.5	\$404.4	\$447.1	\$617.8	\$629.1
Total trade	\$668.6	\$677.2	\$775.2	\$947.2	\$966.0

Numbers may not add up due to rounding and due to small amounts of exports and imports carried via methods of transport (e.g., by tourists or through different routes) not recorded in the air and sea transport data collection process.

Source: U.S. Census

Two-Way Trade: Slow but Steady

While volumes and aggregate value may be small relative to trade with other partners, India is a buyer and seller of a wide range of products important to the Bay Area economy.

Air freight to and from India is typically a combination of lower-value or less-time-sensitive goods moving by indirect, traditional air cargo service through San Francisco International Airport (in the absence of extensive direct passenger-cargo flights) and high-value, very-time-sensitive shipments moving via air integrators, such as Federal Express and United Parcel Service, through either SFO or Oakland International Airport. Ocean freight is primarily container traffic moving through the Port of Oakland.

The top import cargoes from India include:

Cashew nuts	Rolled/coiled steel
Coffee and tea	Metal screws, bolts and castings
Rice	Engine parts
Vegetable extracts	Computer power packs
Carpets	Integrated circuits
Blankets	Telecommunications equipment
Apparel	Wooden furniture
Kitchen/bath linens	Bedding
Granite and slate	Lighting fixtures
Jewelry	Christmas decorations

The numbers reflect, in part, contract manufacturing and imports by leading Bay Area retailers, including Gap and Levi Strauss (apparel), Williams-Sonoma (home furnishings, tableware, glassware, lamps, rugs and linens for Williams-Sonoma, Pottery Barn, and West Elm retail stores), Restoration Hardware (bath and kitchen fixtures), and Cost Plus and Pier One Imports (clothing, furniture, cushions, linens, decorative items, window blinds, etc.).

Oakland-based **Cost Plus World Market** (CPWM), for example, sources a substantial percentage of its total product from India, and the volume of goods sourced in India has risen gradually but steadily during this decade.

Cost Plus had its start with a single store on San Francisco's Fisherman's Wharf in 1958 and capitalized on a West Coast fascination with Indian culture and Eastern religion in the 1960s and 1970s. That aesthetic remains part of its branding today: senior director for supply chain Bob Tway says the decision to manufacture in India has at least as much to do with the look and feel of the goods as it does with cost. "People are attracted to that style and the trendiness of the products," he says, "and our agent and the vendors we work with understand our brand and what we want." The company imports linens, pillows, window blinds, hardwood furniture, figurines and metal products such as candleholders, among other products. Tway adds that if there is a weakness, it is in the lack of assembly line quality control and manufacturing scale. "If you go to factories in China, Vietnam or Thailand, it's like night and day," he explains.

Top export cargoes moving to India via the Bay Area include:

Almonds	Oilfield equipment
Cotton	Metal fabrication equipment
Petroleum coke	Electrical machinery
Chemical catalysts	Computers/parts
Lab reagents	Telecommunications equipment
Animal hides	Recorded media
Wastepaper	Integrated circuits
Polyester fabric	X-ray/medical equipment
Metal scrap	Scientific testing instruments
Filtration equipment	Leather goods

California-grown almonds are the largest agricultural export commodity to India, with a 2006 value of more than \$157 million, of which \$118 million worth was shipped via the Bay Area. India buys approximately 7–8% of California’s almond exports each year and 5% of cotton exports.

Fresh and frozen produce exports are hampered by high air freight costs or, alternatively, long sailing times and poor inland infrastructure and distribution networks to get perishables to market. U.S. agricultural exports also face average tariffs of 30% imposed by the Indian government. India’s reference pricing system and a 45% tariff has constrained U.S. soybean oil exports, and sanitary and phytosanitary certification and inspection rules limit shipments of peas, beans and lentils, wheat, apples, poultry, and dairy products. Almond exports occur under a waiver of rules banning the use of phosphine as a fumigant.

Major California Agricultural Exports to India (\$ millions)

	2004	2005	2006	2007
Almonds	\$94	\$130	\$157	\$175
Cotton	\$10	\$34	\$30	\$9
Table Grapes	\$8	\$11	\$12	\$7
Other	\$3	\$1	\$3	\$10
Total	\$115	\$176	\$202	\$201

Source: University of California, Agricultural Issues Center.

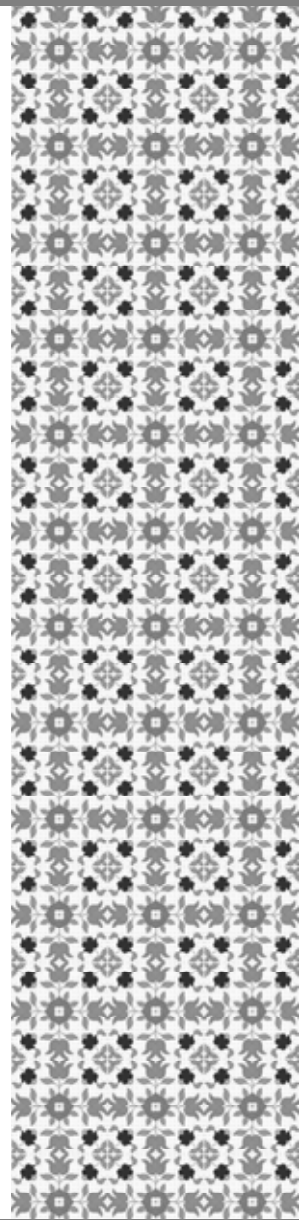
California’s high-tech sales to India totaled \$606 million in 2008, according to TechAmerica (formerly the American Electronics Association). While this was a small fraction of the state’s \$49.3 billion in worldwide tech exports (with India as California’s 19th largest market), it represents a 58% increase since 2002.

Find a Need and Fill It

Jamal Qureshi's story illustrates the opportunities in India for small and mid-sized exporters. Qureshi founded a small trading company, **JQ America Corp.**, with his wife in 1998, operating out of their Fremont apartment. JQ America initially shipped valves, pumps, bearings and other industrial equipment to oil companies in the Middle East and Africa.

In 2005, while at a college reunion in India, Qureshi heard about a medical school, 750-bed hospital and network of clinics to open in his home town of Bhopal, part of a settlement growing out of the 1984 Union Carbide pesticide plant disaster when some 4,000 residents were killed. Qureshi learned from local contacts that the procurement process for private and state hospitals was limited. Most purchased equipment and supplies through a tender/bid process, from a small number of suppliers. "Only hospitals in major cities buy directly from overseas," Qureshi says. "In outlying areas they buy through local suppliers, very few of which import products." The trade environment had become more relaxed in terms of central bank approval of transactions, the distribution infrastructure and so on, he adds, but the procurement mindset had not changed.

Buyers proved receptive to high-quality medical supplies from the U.S. once they became available. JQ America landed a three-year, \$22.3 million contract with the Bhopal Medical Trust to supply clothing, radiology and endoscopy equipment, surgical instruments and other items for the Trust's new 750-bed hospital and network of clinics. Qureshi says he has since entered discussions with hospitals in Andhra Pradesh and Hyderabad.



Services trade, as indicated earlier, is difficult to quantify. The Office of the U.S. Trade Representative's 2009 National Trade Estimate for India places U.S. exports of private commercial services of all kinds at \$9.4 billion in 2007, steadily rising from \$6.6 billion and \$5.2 billion in 2005. Imports of Indian services also rose from \$5.0 billion in 2005 to \$6.7 billion in 2006 and \$9.6 billion in 2007. Sales of services in India by U.S.-owned affiliates reached \$4.2 billion in 2006, nearly double the \$2.2 billion seen in 2004. Likewise, sales of services in the U.S. by Indian firms in 2006 totaled an estimated \$3.1 billion, up sharply from \$1.8 billion two years earlier.

At the same time, India's National Association of Software and Service Companies (NASSCOM) forecasts sales of Indian IT services, business process outsourcing (BPO), and software—India's leading value-added export category—at \$47 billion in 2008–09, up 16–17% from the previous year and nearly double the \$24 billion in sales seen in FY2006. Current estimates represent a downward revision from earlier forecasts, due to the economic downturn. The U.S. has typically accounted for about two-thirds of India's IT, BPO and software exports.



A November 2006 working paper by UC Berkeley's Fisher Center for Real Estate & Urban Economics, points out significant opportunities for California services exports—notably by small and mid-sized businesses—to China and India. The Fisher Center estimates that California accounts for as much as 20% of total U.S. services exports (\$551.6 billion in 2008). Leading services exports include travel and tourism, royalty and licensing fees, education, film and tape rentals, and R&D testing.

While both China and India are well down the list of top U.S. trading partners with respect to services (behind the UK, Canada, Japan and Germany, among others), data on unaffiliated trade—excluding investment-related intercompany transfers—indicate that the U.S. enjoys a sizable services trade surplus with both of those countries. In 2004, for example, services accounted for 47% of U.S. exports to India and 15% of imports. Similarly, services made up 18% of exports to China versus 3% of imports.

The Center identified export opportunities in a number of specific sectors where California has strength:

- | | |
|--|--------------------------------|
| Education and professional training | Logistics |
| Energy and environmental services | Software and IT services |
| Technical, engineering and scientific services | Finance, banking and insurance |
| Real estate services | Legal services |
| Architecture and design | Travel and tourism |

Small and mid-sized companies face a range of obstacles—pricing issues, capitalization, the need to modify products for foreign markets, and legal and regulatory challenges—but the Fisher Center working paper sees potential for growth by leveraging U.S. and foreign government support;

family, cultural and private consultant networks; joint ventures with foreign firms; use of franchising and process licensing in unfamiliar markets; and piggybacking on the activities of a large multinational as a supplier or vendor.

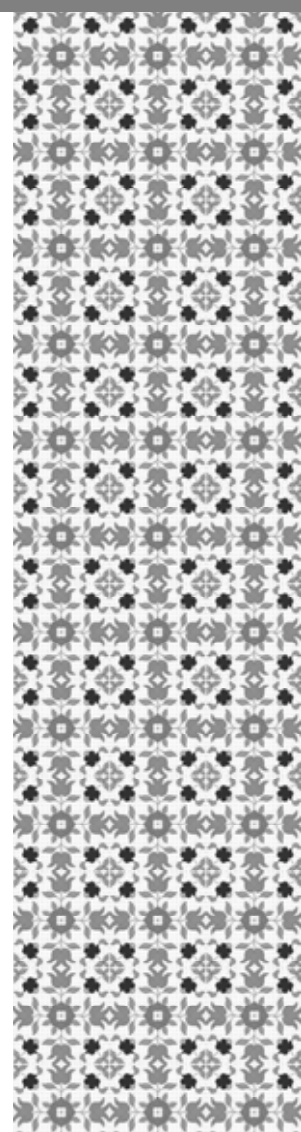
As indicated in the earlier discussions on India's economy and education, India's needs at all levels may present a large export opportunity for educational services. As each Indian state has its own rules and regulations, good local partners are required, and customization of content and delivery to India's environment is essential. But innovative delivery of content and curricula, and particularly on-line and technical or professional education, offers a promising field for partnerships. As will be discussed later in this report in the sections on semiconductors and computing, Bay Area technology companies are already in the forefront of this process, addressing Indian community needs through a range of innovative corporate social responsibility initiatives.

Today Almonds, Tomorrow Pistachios

Agriculture may well be the last segment of global trade to open, long after services, investment, and even intellectual property. Farm tariffs, subsidies and other barriers have been the third rail of multilateral trade negotiations for a variety of reasons: to preserve rural economies, ensure food security, protect political constituencies, preserve cultural traditions, or simply raise revenue.

Accessing India's huge consumer market is a top priority for Mark Masten, as head of sales for California's largest pistachio nut producer, Paramount Farms, and as chair of the U.S.-India Business Council's agricultural committee, which includes some of the largest U.S. agribusiness producers. Paramount, based in Lost Hills in the San Joaquin Valley, owns nearly 100,000 acres on which it grows 100 million pounds of pistachios and 80 million pounds of almonds each year.

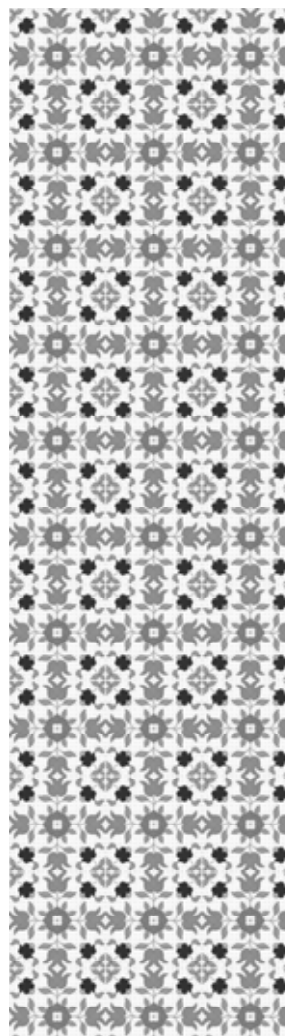
The 17-year old, privately-held company is looking to increase its pistachio yield by half and double almond production in the next few years—part of a global strategy to scale up output and reduce per unit costs to compete worldwide. India is a logical target market: dried fruits and nuts are a popular part of the Indian diet; pistachios, called *pistas* in India, are especially popular as gifts during the Diwali holiday in November, which coincides with an August–October California harvesting season; and pistachios are not widely grown in India. Of a total domestic market of 8,000 to 10,000 tons, some 6,000 are imported, mainly from Iran and Afghanistan and about 30 tons come from California. Paramount estimates that the market could grow to 25,000 tons by 2012.



California almond exports have grown sharply since 2003, a function of effective marketing by the California Almond Board, a reduction in the tariff to a flat rate rather than a percentage of the transaction price, and a widespread perception of health benefits. Paramount, testing the water for pistachio exporting, sold \$2 million worth of pistachios in India during 2007 under the Sunkist brand, mainly through a tie-in with Reliance Retail; Masten would like to grow that number to \$100 million.

Agricultural trade, including tariffs, has been left largely untouched in the Uruguay and Doha rounds of multilateral trade negotiations, so there is no global mechanism through which to address India's 30.9% pistachio tariff. Instead, Paramount has been in direct talks with the Indian government as well as with U.S. trade officials. "We've made the case that if India reduces its duties by 5% as a start, it will make consumer prices more attractive, they'll see greater sales, and overall tax revenues will go up," Masten explains. "In addition, they'll see added employment and revenues from value-added activities like sorting, roasting and packaging."

Paramount does not plan to wait for the duties to come down. It is currently finalizing a location near Vadodara, Gujarat for a planned, \$5 million pistachio processing facility that will sort, roast and package up to 4,500 tons of nuts per year, selling raw pistachios to importers and processed nuts to wholesalers and retail chains. Masten expects the Paramount facility to be in place and operating in time for Diwali in 2009.



The U.S.-India trade relationship has not been without its rough patches over the years, and several key points of contention remain, with implications for California business:

- continued high tariffs, averaging 27% when excise taxes are included;
- a 2% education fund assessment (expanded under the 2007–08 budget) and a 1% customs handling fee, assessed against shipment value plus tariff;
- a proposed increase in the current downloadable software tariff, from 10% to 12%;
- customs revaluation of import merchandise believed to have been unfairly discounted, thereby inflating both transaction values and related duties; and
- currency controls limiting returns and chargebacks for damaged or defective merchandise sourced in India.

More recently, as the Doha Round of global trade talks has foundered, the U.S. has rejected Indian proposals for differentiated tariff cuts for developing and industrialized countries and has called for repeal of export bans, announced in June 2008 in the name of food security, on certain rice and edible oils exports.

All of these difficulties notwithstanding, there are also positive developments regarding U.S.-India trade:

- In May 2007, the U.S. reversed a 1989 ban on Indian mangoes after India agreed to use irradiation in place of chemical pesticides and to open its market to U.S. motorcycle exports.
- In December 2006, a bilateral working group of U.S. and Indian legal experts was established, including representatives of the American Bar Association and the Bar Council of India, with a goal of facilitating trade in legal services between the two countries.
- Since 2002, a U.S.-India High-Technology Cooperation Group has collaborated to upgrade information security in government and commercial operations and, subsequently, to ease restrictions on U.S. dual-use technology exports to India.
- An Agricultural Knowledge Initiative formed in July 2005 has funded collaborative exchanges and training programs in areas such as cold chain technology; sanitary and phytosanitary techniques; agricultural marketing; biotech standards and regulations; and water resources management.

Wine Trade with India: Not the Best Pairing...Yet

Despite the Indian government's easing of some duties on imported wines in July 2007, California shipments have not markedly improved and trade issues with India involving wine and distilled spirits remain contentious for both the U.S and the European Union.

The wine market in India remains relatively small—an estimated 700,000 Indian consumers drank about 7.8 million bottles in 2006—but it has been growing at a rate of 30% annually since 1999. Consumption is forecast to reach 9.76 million bottles by 2010. India also has a domestic wine industry, consisting of some 65 wineries and 170,000 vineyard acres, mostly table grapes, under cultivation throughout the country. Over 2004–2008, India's vineyard acreage has increased by 5.8%; grape production has risen by 36.1% to 1.8 million tons in 2008; and domestic wine production and consumption have each grown by 98%. In the same period, exports rose 492% and imports rose 267%, both from small baseline levels, according to figures provided by the Wine Institute, a San Francisco-based trade group.

U.S. wine export sales to India dropped off dramatically in 2008—to \$525,000 from \$1.6 million in 2007—due in large part to impacts from the global economic downturn on luxury goods sales and on business travel and tourism. A major share of U.S. wine sales in India (90% made up of wines from California) are to luxury hotels and airport duty-free shops, which both enjoy a duty-free exemption.

The 2007 high in export sales was double the \$792,000 in 2006, which in turn had more than doubled from \$376,000 in 2005. This is the result of ongoing trade pressure from the EU—and later the U.S.—for India to live up to its WTO commitment to reduce total wine and spirits tariffs to no more than 150%. In July 2007, India set the national tariff at 150%—up from 100%—maintaining that it would displace all other taxes and special duties, including to special surcharges that had effectively raised national tariffs to 300%, as well as various restrictions imposed by states. But it is still not clear whether, and over what time period, the national government will be able to preempt state barriers. Tamil Nadu, for example, has banned sales of imported wines altogether, as have 12 other states, and Maharashtra imposes a special excise duty to offset the federal duty exemption of airports and luxury hotels.

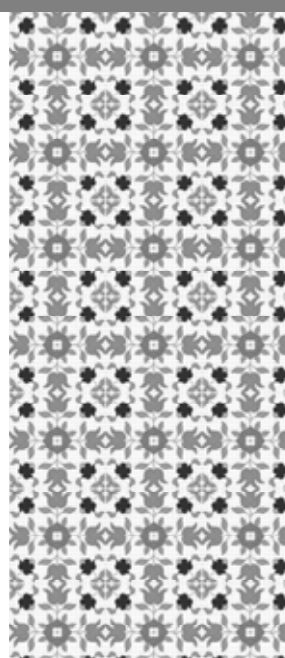
India's two largest wineries, Chateau Indage and Sula Wines (the latter started by a Stanford alumnus, Rajeev Samant), have led the lobbying effort for higher federal and state duties, supported by Agriculture Minister Sharad Pawar, whose family owns the Bosca winery. Recently, however, high import costs have had unintended consequences for some Indian producers, who have been forced to import, blend and repackage bulk wine to meet rising consumer demand.

Another practice creates a further limitation: alcohol consumption is prohibited on 21 “dry” holidays each year throughout India. And there are infrastructure problems, according to Joe Rollo, international director of the Wine Institute. “They don't have the trucks or the refrigerated distribution warehouses,” he says, “and I'm told that in many local stores, when the proprietor goes home for the day and turns off the lights, that means he also turns off the refrigerator cases, so the wine eventually goes bad.” California wineries such as Ernest & Julio Gallo and Joseph Wente have made sales in India but, overall, the industry sees India as a long-term opportunity, with perhaps as much as a 10-year time horizon or longer.

Levi Strauss: Evolution of an Indian Brand

Of the 30 countries ranked in A.T. Kearney's 2009 Global Retail Development Index, India is ranked as the world's most attractive market for international retailers. While sales growth slowed from nearly 40% in 2007–08 to low double digits in 2008–09, Indian consumer markets have held up well by global standards.

There are some restrictions on foreign operations, however. Under Indian law, multi-brand foreign retailers are barred from selling directly to consumers. Opposition from the country's large numbers of small, family retailers has so far kept large chains at bay, but Wal-Mart Stores recently formed an innovative partnership with Bharti Enterprises to apply Wal-Mart's volume management expertise by wholesale marketing to smaller businesses. The cash-and-carry business will sell to licensed store owners and institutions. Meanwhile, the field is open for single-brand retailers like Levi Strauss.



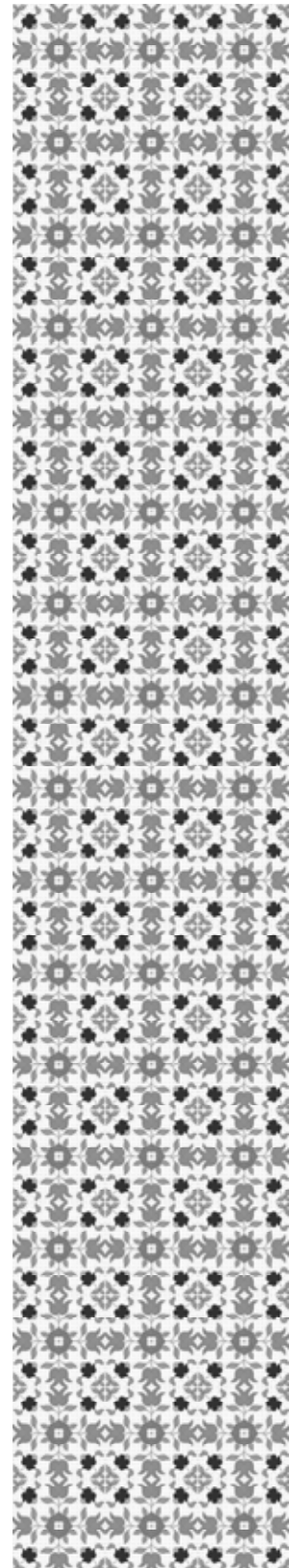
Apparel maker Levi Strauss & Co. began sourcing product from India in 1983. It set up a commercial business, Levi Strauss, India, in Bangalore in 1995, to open Levi's retail outlets under a franchise model. At the time, the company was still primarily a maker and seller of denim clothing.

By the late 1990s, denim sales were slowing, and Levi Strauss was finding it difficult to attract and train the right franchisees in the right locations. Managing director C.S. Suryanarayanan changed the model, convincing management in San Francisco to launch the Dockers brand in India in 1999. The line was a hit, in part due to the emergence of casual workwear in the tech sector, emulating the Silicon Valley dot-com fashion at the time. Denim rebounded in 2002, after the company had broadened its lines to include tops, shirts, t-shirts and sweatshirts, all under four sub-brands: 501, Red Tab, Red Loop and Sykes (a line of non-denim streetwear, aimed at teens, that includes popular reversible clothing and detachable cargo pants). Levi Strauss & Co. launched the Levi Strauss Signature brand targeted at the non-premium jeanswear college consumer in 2006.

Aggressive branding and marketing, plus a proliferation of new retail malls across India during the current economic boom, has raised the Levi Strauss footprint from 100 exclusive outlets in 1999 to 450 today in 80 cities, including 215 stores for the Levi's brand (including Levi's Sykes), 100 stores for the Levi Strauss Signature brand and 35 stores for the Dockers brand. The various brands also have a footprint in some 2,000 multi-brand stores in more than 500 cities.

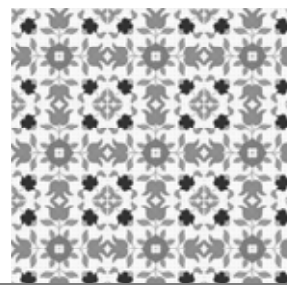
Levi Strauss, India marketing director Shumone Chatterjee took over as managing director in 2004 and has guided Levi's into new areas, such as the fast-growing women's wear segment and licensing deals for shoes, innerwear, eyewear, watches, and children's wear. Levi's has also been successfully using Bollywood celebrities in its advertising, including Sushmita Sen (Miss Universe), Bipasha Basu, Shah Rukh Khan, Deepika Padukone and Akshay Kumar.

The company's India business is reportedly growing by 30–40% annually. In May 2006, a three-story, 9,000-square foot Levi's megastore, second only in size to the company's San Francisco flagship store, opened on Brigade Road in Bangalore. A new 1,100-square foot store, designed by UK firm Checkland Kindleysides, opened in Chennai in December 2007—the second



for Chennai, which is the company's sourcing center. Other megastores have opened in Delhi, Chandigarh, Ahmedabad, Hyderabad, Jaipur, Pune and Mumbai.

Contract manufacturers in India produce the Levi's, Dockers and Slates lines for the U.S., Canada, Mexico and Asian markets.



A Tourist Market in the Making

A profile of Indian visitors shows that California is a popular travel destination in the U.S., but primarily for work and family visits, with a small amount of actual tourism thrown in for good measure. A February 2007 report prepared by San Diego-based CIC Research, Inc. for the California Travel and Tourism Commission presents a revealing snapshot:

- Some 98,000 Indian nationals visited California in 2005, about 35,000 of them coming to the Bay Area.
- Of the total coming to California, 62% were on business trips, 44% were visiting family, 26% were on holiday, and 17% were attending a convention. (Percentages add up to more than 100% because many trips had dual purposes.)
- 31% booked their trips through a corporate travel department, up from 20% a year earlier; 17% used a travel agent; and only 56% pre-booked any lodging at all.
- 53% of total visitors stayed in a hotel or motel; 84% of leisure travelers stayed in a family home.
- Average length of stay in California was 36 nights, up from 23 a year earlier.
- 91% of visitors from India were men with an average income of \$48,400; the average income of worldwide tourist visitors to the U.S. in 2005 was \$78,800.

At present there are no direct flights to and from India to any of the Bay Area's international airports. Indirect service runs through Asia (Singapore, Bangkok, Taiwan), Europe (London, Frankfurt, Munich), and the Middle East (Dubai). The shortest flights—on Lufthansa via Frankfurt—are more than 21 hours long. Lufthansa's "Bangalore Express" service from San Francisco International Airport (SFO) was introduced in 2001 with three flights a week, increasing to five flights in 2005, and daily flights since 2006. Flights run 90% full or better, and the route has become famous for its tech networking opportunities, at the gate and on the plane. Other Lufthansa flights from San Francisco connect daily through Frankfurt to Chennai, Mumbai, and New Delhi, six times weekly to Pune, five times weekly to Hyderabad, and three times weekly to Kolkata. Other flights fly daily to New Delhi via Munich, and five times weekly through Munich to Mumbai.

Two-Way Trade: Slow but Steady

For leisure travelers to and from India, a long flight and an expensive plane ticket limits the number and mix of passengers. It also encourages a longer visit, which favors staying in a family home, a common practice given the large Indian population in the state. Complicating matters further are language and religious dietary requirements, both on the flight and upon arrival.

The San Francisco Visitors and Convention Bureau believes that, as India's middle class grows, and as two-way business and investment ties increase, the Bay Area is a natural destination for both leisure travelers and new convention business. It is so convinced, in fact, that it set up a representative presence in New Delhi in August 2007 to begin laying the groundwork with airlines and tour operators.

Bureau vice president for tourism Deborah Reinow says the key to jumpstarting visitor traffic from India is expanded, direct air service. "All major markets start as a VFR (visiting friends and relatives) market," she says. "The first people that travel as flights are added are in the discount seats at the back of the plane plus the high-end business travelers. The whole picture is going to change when we have non-stop service from SFO."

The recent deregulation of India's civil aviation sector has spawned several new and highly competitive airlines, including Jet and Kingfisher.

Jet Airways launched a SFO-Mumbai service via Shanghai in June 2008, for a total travel time of 26 hours. But by October, difficulties with Chinese civil aviation authorities in Shanghai and financial issues at home led Jet to suspend the San Francisco service. Kingfisher Airlines also planned to begin direct SFO-Bangalore service in 2008, using its recent acquisition of low-cost Indian carrier Deccan Aviation to meet a government requirement that a carrier fly for at least five years before it can offer international flights. Kingfisher had moved New York staff to San Francisco in preparation for the new service, but has faced financial issues similar to Jet's and as of late 2009 had not launched service.


India's national carrier, Air India, has had plans to introduce service to SFO since 2004—first a New Delhi/Mumbai service via Frankfurt and, more recently, direct Bangalore flights three times a week. It opened a sales office in downtown San Francisco in 2006, but it has yet to initiate service and its plans remain unclear.

Direct service and more service choices should improve the travel experience, help reduce the price points for travel in both directions, and expand the volume of non-business and family travel. A second hurdle, Reinow says, is lining up airline and independent tour organizers in India, and matching them with tour operators and ground handlers (itinerary planners, guides, bus drivers, baggage handlers, etc.) in the Bay Area. The Bureau has hosted events for travel professionals in New York and Los Angeles. It is also working with the Receptive Services Association, a tour operators' trade group, to address payment and other past concerns, and to persuade them that the Indian travel landscape is changing.

Indians and Indian-Americans play a particularly large role in the U.S. hospitality industry. The Asian-American Hotel Owners Association (AAHOA) estimates that Indian-Americans (primarily from the state of Gujarat) own 43% of the nation's 47,000 hotels and motels, typically

through franchising agreements, but increasingly through regional and nationwide Indian-owned chains like Diplomat Hospitality, Tarsadia and JHM Hotels. Traditionally, Indian owners have focused on budget hotels with limited or no food service (easier to run, lower costs and no dietary conflicts for vegetarian owners). But Indian-American owners and franchisees are now moving up from Best Western and Days Inn motels to larger, full-service Sheraton, Hilton, Wyndham and InterContinental properties.

 In April 2007, San Francisco's high-end **Campton Place Hotel** was acquired for \$58 million by the Indian Hotels Company (part of the Tata Group) through its **Taj Hotels** unit. The purchase is part of a U.S. acquisition strategy that has also included a 2006 agreement to buy the Ritz-Carlton Hotel in Boston for \$170 million and a 2005 arrangement to operate the Pierre Hotel in New York under a 30-year lease at \$5 million per year. More recently, Delhi-based **Khanna Enterprises** bought San Jose's historic **Montgomery Hotel** in November 2008 for an undisclosed amount. In September 2008, Khanna also purchased the Holiday Inn Northeast in Sacramento for \$19 million.

 Tourism investment is moving in the other direction as well. In December 2005, VC firm **Bessemer Venture Partners** invested \$8.5 million in India's largest mid-market hotel chain, Sarovar Hotels, to start a chain of budget hotels under the Homotel brand, in part to address India's chronic shortage of hotel rooms in major cities (beginning with Bangalore, Pune, Mumbai, Jaipur and Hyderabad).

Hotel development has not kept pace with the rapid expansion of India's economy, leading to high room costs and restricted availability, particularly in major business centers like New Delhi and Mumbai. With only 100,000 hotel rooms across the entire country, room rates can be as high as \$600 per night in large cities. Given the trajectory of India's economy, India's hospitality sector presents major investment opportunities.



6

Cross-Border Exchanges Flourish

“There is a new American who could come from anywhere, have an American idea of risk-taking and self-reliance, and live anywhere he or she wants to. And if you can live where you want to, the Bay Area is one of the best places in the world. It’s London, New York, or here. Because this place is so focused on results and people have the opportunity to be creative, it draws people with different backgrounds. The Indian diaspora here is one aspect of that. Because Indians were so successful in the Bay Area, others followed. Every generation of Indians here builds on a reservoir of goodwill and understanding.”

Madhav Misra, Chairman, Misra Capital Management
Co-Chairman, San Francisco-Bangalore Sister City Committee

Since the 1990s, and in some cases much earlier, Northern California companies have established significant footholds in India—initially for cost arbitrage but later as part of a broader, global value proposition. And increasingly, Indian firms are arriving in the Bay Area to establish corporate and representative offices, access Silicon Valley technology, serve a huge local Indian market, collaborate with university research facilities, and connect with regional legal and financial expertise.

Tracking these exchanges typically involves mainly anecdotal and secondary research, rather than statistics which, when available, are often unreliable. As with its past country reports, the Bay Area Council Economic Institute does not attempt here to provide a comprehensive picture of the two-way commercial flow between the Bay Area and India, but instead uses selected examples of company activities in key regional industry sectors to illustrate the types of ongoing trends and exchanges taking place.

The industries we have chosen to highlight in this section include:

- A. Banking/Financial Services
- B. Legal Services
- C. Semiconductors
- D. Software/IT Services/Business Process Outsourcing
- E. Architecture/Planning
- F. Energy/Environment/Clean Technology
- G. Computing/Networking/Internet
- H. Biotech/Biopharma

Global Reach

In those eight sectors, we examine a range of “tangible” exchanges that may involve contract manufacturing, delivery of services, government procurement, or direct investment in plant or research facilities. In each case, we first present a snapshot of the cross-border market and its opportunities, followed by a representative picture of how leading Bay Area and Indian companies are developing these markets, evolving partnerships, and creating new business models.

Two-way venture capital, merger and acquisition, private equity, and other “intangible” portfolio investment activities are treated separately in Chapter 7 of this report.



A: Banking/Financial Services

Key Findings:

- India is in no hurry to ease market entry for foreign banks, directly or as investors.
- Public sector banks hold 74% of bank assets but are shrinking relative to private banks.
- Indian consumers prefer debit cards to credit; 65% of farm credit is informal, rather than with banks.
- Visa and Mastercard settle all India point-of-sale transactions, and issue most credit and debit cards.
- Bay Area banks focus on remittances, trade and venture financing.

Market Overview

India's banking and financial sectors were partially liberalized in 1991, but the process is far from complete.

Prior to 1991, the 20 large public sector banks (PSBs) nationalized in 1969 during Indira Gandhi's administration, plus the State Bank of India and its seven affiliate banks, together held 91% of total bank deposits in India. They were required to maintain high reserves; deposit and lending rates were government-controlled; and 40% of their total credit was earmarked for agriculture, small-scale business and other "priority sectors." PSB mergers and acquisitions required approvals both from India's central bank (the Reserve Bank of India) and from Parliament.

In 1991, the Indian government deregulated interest rates; imposed standards for credit evaluation, asset classification, risk management, loan loss reserves and capital adequacy; reduced its equity holding in the PSBs and encouraged them to raise up to 49% of their funds in the capital markets; and relaxed entry restrictions for foreign banks. A mix of new private domestic and foreign banks entered the market in the mid-1990s, offering low interest rates, new technology, and a wide range of products, including credit and debit cards, electronic remittance and bill payment, mortgages, auto loans, insurance and asset management.

Securities and Derivatives

Secondary markets for debt instruments and government securities were set up in the mid-1990s under the newly-created Discount and Finance House of India (DFHI), Securities Trading Corporation of India (STCI) and Securities and Exchange Board of India (SEBI). The 1993 Financial Institutions Act provided a structure—including special recovery tribunals—for banks and other institutions to accelerate debt collection.

In 1993, as an alternative to the Bombay Stock Exchange, leading financial institutions in India promoted the launch of the National Stock Exchange (NSE) to introduce electronic trading, clearing, and settlement nationwide. NSE launched exchange-traded derivatives in 1996, followed by exchange-traded funds (ETFs) and online trading in 2000. Mutual funds trading began in India in 1996.

Over time, SEBI has established a regulatory framework for corporate governance and transparency, including reporting, share buyback, and employee stock option provisions. It has also established rules for options and futures trading, a system of rolling settlements, and a code of conduct for credit-rating agencies. Borrowing, lending and short-selling of shares by foreign portfolio investors was approved in January 2008, with similar approval for local institutional investors to follow.

Restructuring India's Banking System

India has a multi-tiered banking industry comprised of:

- the 20 PSBs, plus the government-owned State Bank of India (SBI) and its 7 associate regional banks;
- 20 private banks, including 11 “old private banks” dating back as far as 1916, with most of the rest formed in 1994 following liberalization;
- a network of 96 regional rural banks (RRBs) that mainly take local and regional deposits and make small loans to farmers, cottage industries, and entrepreneurs;
- a system of nearly 2,100 urban cooperative banks (UCBs) with 80% in 5 states, plus nearly 400 district and state cooperative banks, and more than 92,000 agricultural credit societies; and
- 30 foreign banks with 279 branch offices—including four U.S. banks with a total of 52 branches—which operate under a two-phase “road map” toward India’s compliance with rules for World Trade Organization membership. (India has now delayed an industry review process, originally scheduled for completion in 2009, during which it would consider extending national treatment to foreign banks, removing all foreign ownership limits, and permitting foreign mergers and acquisitions involving private banks.)

According to a 2007 Reserve Bank of India (RBI) report, the nationalized public sector banks (PSBs) hold a 49% market share of the banking sector, with SBI and its associates holding another 24%. New private banks which offer better technology, services, and capital reserves have seen their share increase from 9% to 16% since 2002, while the old private banks have seen their combined share fall from 7% to 5% during that time.

Soaring Demand, Mismatched Supply

India's banking industry grew by 20% annually over 2002–07, with new private banks seeing their business grow by 35% annually while SBI and the old private banks have lost substantial market share. RBI attributes the setbacks to personnel policies, decision-making pace, and delays in scaling up financial technology. But these and other problems, according to an October 2005 McKinsey study of India's banking sector, stem in large part from remnants of the old regulatory system still in place:

- concentration of market share (33%) among India's top 5 banks, that has accrued through the absorption of smaller, failing banks;
- regulations limiting redeployment or layoffs of idle staff during downturns;
- branch location rules and directed lending that result in higher rates of non-performing loans;
- ineffective supervision and regulation of the approximately 4,200 RRBs and cooperatives throughout India that manage the equivalent of \$80 billion in deposits;
- low foreign participation in Indian banking due to ownership and branch restrictions;
- absence of professional, independent, nationwide credit-reporting bureaus;
- lack of independence or accountability among PSB boards; and
- at incumbent banks, lack of adequate skills in management or in structuring and marketing innovative services.

The current system has not helped rural populations to the degree hoped. According to India B2B marketplace IndiaMART, nearly 60% of rural households and 70% of marginal farmers do not have bank accounts; 87% of households have no formal credit, and only 21% have access to formal credit; only 1% of rural households carry any type of loan from a financial intermediary, with approval taking 24–33 weeks; and consumers commonly bribe lenders to approve loans, adding a 10–20% premium to their costs. McKinsey estimates that 65% of agricultural credit is obtained through more costly informal means.

Gradually this situation is changing, as banks have introduced online account access and payments via mobile phones, remote wireless Internet kiosks and ATMs; voice-guided access in local languages; biometric and fingerprint identification in place of signatures and passwords to overcome literacy barriers; and rural banking through post offices, rural NGOs, or trusted village leaders.

Credit Where It's Due...Or Not

As far back as the 1980s, foreign firms—among them Citigroup, American Express and Visa—helped launch credit cards in India, partly because, unlike traditional banking, market entry into the credit card sector has never been regulated. However, Indian consumers have been slow to embrace credit cards (which incur actual debt) versus debit cards (which access bank funds as a

convenience); as of early 2007, 22 million credit cards had been issued in India, compared to 70 million debit cards.

Credit card penetration is highest among affluent households (28%); among middle-class households, penetration for both is still in the single digits; and in many rural areas it is still nonexistent. Nationwide, personal consumption by credit card averages around 1%, versus 3% for China, 6% for the Asia-Pacific region and 8.6% worldwide.

Consumers spent only an average \$37 per month each on their credit cards in 2006–07, yet total credit card transactions in 2006–07 (\$7.4 billion) were five times that of debit card purchases. Consumers primarily used debit cards to access ATM machines, which grew in number to nearly 21,000 in 2006, a six-fold increase over 2001. Merchant point-of-sale (POS) terminals for processing credit and debit cards grew ten-fold during 2001–06, to more than 335,000, suggesting strong growth to come in debit and credit transactions.

Grappling with Consolidation

Freeing PSBs to scale up and compete, streamlining industrywide regulation, and fully opening the banking market to foreign competition would address most existing market distortions. Consolidation and vertical integration among Indian banks is key to their future competitiveness, yet of 71 banking mergers that have taken place in India between 1961 and 2004, 55 took place prior to 1991, largely in response to government pressure on large, profitable banks to absorb smaller, ailing ones. With a few exceptions—the HDFC Bank takeover of Times Bank in 2000, or the rollup of SCICI, Anagram Finance, ITC Classic and Bank of Madura into ICICI Bank, concluding in 2001—most post-liberalization mergers have also been horizontal, RBI-initiated rescues.

Banks have so far been unwilling to take on mergers aimed at scale or vertical integration in the absence of a streamlined approval process (deals are still subject to RBI and Parliament review and modification); an end to directed lending; relaxation of labor rules on hiring, layoffs and redeployment; and a consistent nationwide regulatory framework.

Cross-Border Banking

It is in this context that foreign banks are looking to expand their participation in a fast-growing and underserved mega-market, while meeting the needs of a relatively affluent non-resident Indian (NRI) customer base in their home countries. At the same time, major Indian banks are testing the waters in the U.S., looking to serve the 2.5 million NRIs here.

Citigroup has had an India presence since 1902, and American Express has offered travel-related financial services there since 1921. Both have established brands and service networks in spite of Indian government policies that place significant restrictions on foreign bank operations: \$25 million capitalization for a foreign bank's first branch; a restrictive RBI foreign branch licensing scheme with non-transparent quotas (19 foreign branches approved in 2007–08, many in less profitable rural locations, compared to 913 for SBI alone); directed lending and asset allocation

requirements; and required divestiture to bring ownership stakes in existing wholly-owned subsidiaries down to no more than 74% by 2009. According to Reserve Bank of India requirements, foreign banks may not own more than 5% of an Indian private bank without RBI approval.

The result: foreign banks have not opened any wholly-owned subsidiaries, and only 4 U.S. banks had a combined total of 52 branches across India as of June 2008, primarily in major cities, according to the U.S. Trade Representative's 2009 National Trade Estimate. But those figures are deceptive, given the rise of Internet banking. In 2005, for example, Citigroup—then India's second largest foreign bank—had a customer base of 900 large corporations, 22,000 small and mid-sized businesses, and 3.5 million retail customers, and was offering credit cards, mortgages and auto loans, consumer loans, cash management and trade services, fixed income and equities sales and trading, and corporate finance to businesses, government and other financial institutions.

Bank branch figures also don't reflect non-bank players, such as **Visa**, which has offices in Bangalore, Delhi and Mumbai, and which has issued some 30 million debit cards and 14 million credit cards through 32 banks and 13 non-bank partners in India. Mastercard also has a strong presence, through its MasterCard and Maestro card, as well as its popular MoneySend service that enables customers at 10 participating banks across India to transfer funds to friends and family via ATMs. All POS transactions are settled through either Visa or Mastercard at present, with interchange charges totaling some \$50 million in 2005-06 and forecast to triple over five years. The India Banks' Association (IBA), made up of major domestic and foreign banks nationwide, is considering establishing its own competing domestic payment settlement entity.

Another large non-bank player, GE-Capital Solutions India, has a \$1.2 billion asset base and 21 branches nationwide, and focuses on corporate, commercial, health care and construction finance, as well as asset management.

Foreign ownership within the Indian banking system is capped by law at 15%, and is currently only 8%. Ownership of a single bank by a single investor is limited to 10%; aggregate foreign voting rights in a local bank are limited to 10%. Aggregate foreign direct investment, foreign institutional investment or portfolio investment by non-resident Indians is 49%, but may be extended to 74% with approval from the bank's board.

Foreign banks see enormous potential in the India market and had hoped the RBI would finally keep its promise to publish in March 2009 a long-awaited "road map" for foreign bank entry into the Indian market. Instead, the RBI celebrated its 75th anniversary on April 1 with a six-volume report on India's financial sector, which it feels is adequately capitalized and provides adequate technology and services.

Bay Area Connections

At the center of Bay Area-India banking relationships is the NRI market segment, involving trade finance, remittance, foreign exchange, deposit services, and credit services for Indian nationals living and working in the region.



Only three Indian banks—State Bank of India, Bank of India and, more recently, Bank of Baroda—have established U.S. branches. A fourth, ICICI Bank, has opened a New York representative office. In the Bay Area, **Bank of India** has a single branch in San Francisco, and State Bank of India (SBI), through its **State Bank of India (California)** unit, has branches in San Jose and Fresno, as well as in Southern California.

According to the California Department of Finance, SBI (California), established in 1982, today has \$420.3 million in assets, \$107.2 million in deposits, and \$396.2 million in loans in California. Business in recent years has grown steadily. SBI (California) offers a variety of NRI deposit products, including:

- rupee-denominated, non-resident external (NRE) checking, savings or fixed deposit accounts in India, with repatriable deposits;
- foreign currency non-resident (FCNR) deposits denominated in dollars, pounds or euros;
- rupee-denominated, non-resident ordinary (NRO) accounts for income earned in India, for which deposits are not repatriable and taxes are paid in India; and
- for NRIs and people of Indian origin returning to India, resident foreign currency (RFC) accounts that are dollar-denominated and can be converted to FCNR or NRE accounts if the account holder moves overseas again.

A substantial amount of SBI's California loan business involves commercial real estate purchases, construction and renovation—particularly hotels and motels, multi-family apartments, and shopping malls. SBI also specializes in loans for medical professionals to set up practices, buy diagnostic and surgical equipment and buy or lease ambulances and other paratransit vehicles. In addition to accepting remittances, the bank offers loans against certificate of deposit and repatriable accounts in India; small business loans up to \$250,000; credit lines against inventory and receivables; and letters of credit for trade transactions.

Bank of India's first branch opened in San Francisco in December 1977. Today, its California activities total \$312.2 million in assets, \$4 million in deposits, and \$309.9 million in loans—up from \$116.3 million, \$3.5 million and \$113.7 million, respectively, in late 2004. Bank of India specializes in CD accounts, trade finance and advisory services for U.S. exporters and banks, as well as remittances through demand drafts and mail or wire transfers, denominated in rupees, dollars, sterling, euros or yen.



Wells Fargo Bank offers remittance services to India as part of its ExpressSend product, in partnership with ICICI. Up to \$3,000 per day, in cash or by electronic transfer from a Wells Fargo account, can be sent the next business day to a beneficiary's ICICI account.



As it had done earlier during the 1990s in China, Silicon Valley Bank (SVB) began establishing a foothold in India in 2000 by making contacts and connecting Indian and Silicon Valley entrepreneurs and venture capitalists. In August 2008, SVB subsidiary

SVB Financial Group established a wholly Indian venture lending arm, SVB India Finance, to offer debt financing for domestic, venture-backed, early stage, mid-stage, and high-growth companies in India. It has also established a \$54 million India venture fund. SVB is discussed in greater detail in Chapter 7 of this report.

A group of Indo-American business owners and investors raised \$21 million and, in October 2008, announced plans to launch **Global Trust Bank** in Mountain View. An eventual Fremont branch office is also part of the business plan. Once it wins Federal Deposit Insurance Corp. approval, Global Trust will be the only bank in California with Indo-American owners, but it won't be the first: Indo-American Bank, founded in 1987 in San Francisco, was merged with Millennium Bank which, in turn, was acquired by First Banks America in 2000.

Global Trust plans to market initially to some 700 prospective customers with a breakdown of 40% small and mid-sized businesses, 30% real estate investors and hotel operators, and 30% professionals. The business segment breaks down into physicians, hotel/motel owners, convenience stores and other small businesses, and technology companies. These are all underserved segments of the community, particularly as more established banks face ongoing liquidity problems. As a small, new bank with no exposure to subprime mortgages or other non-performing assets and a willingness to lend, the bank expects to build a loyal local customer base.



Mission National Bank was opened in 1982 as a community bank specializing in small business and commercial real estate lending. With two offices in San Francisco and one in Berkeley, the \$165 million bank counts Indian residential hotel owners and operators among its major customers.

“The type of residential hotel you find in the Bay Area is different from the type of property you might find in Los Angeles or Chicago,” explains Mission National president and CEO David Joves. “Typically you might think of it being part of Skid Row, but in San Francisco we see it as a low-income housing opportunity.” Where a one-bedroom apartment in the pricey San Francisco market might rent for \$1,500 or more, a downtown hotel room off Market Street might rent for \$700, attracting restaurant workers, mechanics, janitors or other workers who are low-income, may not own a car, and need to live in the city near their jobs.

The bank has identified in its service territory “a couple of hundred” hotels in the size range of 10–80 rooms. “They’re working on very thin margins, keeping their costs low by employing family members,” Joves says. “An average hotel has 65-70% occupancy; with these hotels it’s 90–95%. Their cash flow is stable, and we’ve never had a mortgage default or repossession.”

During the past four years, San Francisco’s city government has become a growing partner in the residential hotel business through its Care Not Cash program, which provides housing and on-site services for the homeless. The City enters into master leases with property owners—many of them Indian—and brings in nonprofit agencies to manage the buildings and provide counseling, alcohol and drug treatment, and other services to residents.

B: Legal Services

Key Findings:

- A shortage of judges, lengthy appeals and manual recordkeeping add to case backlogs.
- With 25 million cases pending in India, arbitration is the preferred course.
- Foreign lawyers are barred from practicing Indian law; market opening is not likely soon.
- Cross-border work focuses on incorporation, IP, real estate; M&A to follow.
- Legal process outsourcing (LPO) business is booming.

Market Overview

India's legal structure is, for the most part, rooted in English common law. Its system of the Supreme Court, 18 high courts, and thousands of subordinate courts, tribunals, and local dispute resolution bodies administer more than 2,500 federal laws and more than 25,000 state statutes, plus administrative and local ordinances.

Many of India's laws date back to the 19th century colonial period but have implications today: the local government in Delhi used an 1867 law penalizing innkeepers for refusing to offer water to passersby to take a five-star hotel to court in the 1990s, for example, and the 1885 Indian Telegraph Act has been used by a state-owned television network to monopolize broadcast rights for cricket matches. As of 2006, the 1948 Factories Act was still in place, mandating whitewashing of factories rather than painting; drinking water provided in earthen pots, not water coolers; and sand in red buckets rather than fire extinguishers.

Central and state laws often conflict. Business call centers are technically illegal under certain state statutes. In 2005, the Labour Ministry of the Haryana government invoked a 1958 law prohibiting women from working night shifts, applying it to call centers in Gurgaon. Women made up 40% of the call center workforce and the centers have to operate at night because of the time difference with Western countries.

Patience is a Virtue

Cases can be tied up in court for years: in 2005 the Law Ministry estimated that more than 25 million cases were pending in Indian courts. Civil suits constituted a third of the 22 million pending cases in subordinate courts and 80% of the 3.5 million in the high courts.

A famous labor case involved Uttam Nataka, a worker in a Bharat Forge factory in Pune. In August 1983 Nataka was found sleeping on the factory floor just before noon. He had already been cited three times previously, and the company began disciplinary proceedings, which took five months, after which he was fired. More than a decade of appeals by both sides followed, until 1995, when the court awarded Nataka a large back pay settlement because he was by then

too old to be hired somewhere else. Bharat Forge appealed all the way to the Supreme Court, where it was finally granted the right to fire Nataka—in 2005.

Conviction rates for criminal cases are notoriously low. At the same time, however, a majority of those accused spend more time in jail than their sentences might ordinarily be had they been convicted, because cases take so long to come to trial and they are unable to afford bail or a lawyer to obtain bail on their behalf.

The two principal reasons that cases take so long are that: (1) the courts are short of judges (13 per 1 million population, compared to 107 in the U.S., 73 in Canada and 51 in Britain); and (2) appeals are allowed for any case and most cases tend to be appealed by the losing party, often instigated by attorneys seeking additional fees.

Courts remain antiquated, with hand-kept records and poor filing systems that make documents difficult to locate. Judges often give oral summaries to court reporters in the absence of mechanized reporting. Evidence can only be given and collected in court, and no time restrictions are imposed. Parties frequently fail to appear in court, and when they do, extensions and adjournments are commonly requested and granted.

Business Grinds to a Halt

The length of time taken to adjudicate cases, particularly civil cases, has also inhibited the formation of precedent and a solid body of case law elaborating on the original statutes. Thus, most business activity remains covered under the 781 sections of the 1956 Companies Act, with little in the way of modernization through subsequent precedent and interpretation, although major amendments were adopted in 1988, 1998, 2000, and 2002. Comprehensive efforts to modernize the law in 1993, 1997, and 2003 failed. A new effort is underway.

A government initiative included in the 2002 Companies Act amendments—to establish a National Companies Law Tribunal (NCLT) and an accompanying appellate tribunal that would address complex commercial cases separately and more quickly—was successfully challenged in the Madras High Court by the Madras Bar Association and has been pending before the Supreme Court since 2004.

Cases such as M&A applications before the High Court—as well as reviews of public sector company restructuring or liquidation by the Company Law Board (CLB), the Board for Industrial and Financial Reconstruction (BIFR) and the Appellate Authority for Industrial and Financial Reconstruction (AAIFR) under the 1985 Sick Industrial Companies Act (SICA)—have become more numerous, with 480 M&A deals up for approval in 2006, and 339 in the first half of 2007.

Meanwhile, new post-1991 situations—insolvency and restructuring of public sector firms, anti-competitive practices, intellectual property protection, etc.—have been addressed through new laws, adding to the overall complexity of the system. Listed companies face dual reporting and compliance requirements, under the Companies Act and SEBI regulations.

Market Opening



Under the terms of its membership in the World Trade Organization, India has officially committed to opening its legal services market to foreign law firms in 2009. A four-year review of the current system is due to conclude, but U.S. attorneys familiar with Indian politics are skeptical. Raj Judge, an attorney with **Wilson Sonsini Goodrich & Rosati** who does extensive cross-border work, says “there’s a lot of talk about India opening, but I don’t see it happening in the foreseeable future because the Indian lawyers aren’t going to let it happen.”

The Indian legal community is divided on market opening. Young attorneys and law school graduates see greater opportunity and more challenging work in joining a global firm but would prefer not to relocate abroad. Long-established family-owned law firms and state bar associations are deeply opposed, fearing a sudden easing of rules and open competition. They have so far effectively persuaded India’s High Courts to constrain even the liaison office activities of foreign law firms.

Bay Area Connections

Opportunities for Bay Area law firms to develop India practices and generate business have been limited but are gradually expanding. Foreign lawyers (except graduates of Commonwealth law schools) and Indian nationals employed with foreign firms are barred from practicing or interpreting Indian law. Foreign firms may establish “liaison offices” in India and advise foreign or Indian clients engaged in cross-border business, but even that activity has been constrained by the Mumbai High Court. Bay Area firms maintain exclusive, preferred vendor, or ad hoc alliances with Indian law firms, similar to what is customarily done in China.

To date, key differences with China have been: (1) the relatively slow development of cross-border M&A and venture-funded entrepreneurial startups in India; and (2) the larger indigenous talent pool of bilingual accountants, attorneys and management consultancies in India to structure deals and undertake due diligence in commercial transactions without looking abroad for support.



Snehal Patil joined **Perkins Coie LLP** in Menlo Park in 2009, after coming to the U.S. in 2004 and working with The Chugh Firm in Santa Clara and then Thelen Reid Brown Raysman & Steiner in San Francisco. Patil’s work in India included litigation and transaction work involving corporate law, trademark and copyright protection, and real estate. His India work with Perkins and other firms has extended to include representing U.S. companies in their joint ventures and strategic partnerships with Indian entities; assisting an Indian firm with a \$20 million acquisition of a Silicon Valley startup; assisting U.S. and Indian companies in structuring M&A transactions and offshore entities; negotiating technology licensing and distribution rights; assisting India-based companies in establishing U.S. subsidiaries; and representing media and entertainment firms with copyright and trademark registrations in the U.S. and India.

Patil acknowledges that there is still a clear separation of cross-border work done by Indian and U.S. attorneys, although Indian-origin firms in the U.S. are able to hire naturalized NRIs and compete here for business, particularly in the startup and middle-market segment. As opposed to international arbitration, he says, litigation in court is the favored route of most Indian businesses for resolving commercial disputes, particularly if there is a possibility of obtaining a favorable


interim order, necessitating use of Indian counsel. The reason is that arbitration is expensive and time-consuming in many cases, as commercial arbitrators in India tend to be retired Supreme Court or High Court judges who may not be in a hurry to bring a case to conclusion since they are paid according to time spent.

Indian courts, meanwhile, tend to be conservative with monetary awards and have also been inconsistent in enforcing commercial arbitration awards. India does not view the U.S. as a reciprocating territory and so will not enforce a U.S. court judgment against a party in India without a separate subsequent lawsuit being filed in India, with the overseas judgment being submitted as evidence. At the same time, a U.S. arbitral award is directly enforceable in India in accordance with India's arbitral law.


Where international arbitration is a possibility, foreign law firms recommend to clients that contracts with Indian parties be written as enforceable in the laws of a neutral country, such as Singapore or the U.K.—or where Indian law is applied, that a venue outside India be used.

Following the Growth

Real estate work has been an important component of India practices, as Silicon Valley companies set up offices in major and “Tier 2” cities, and help locate R&D and design centers in government-sponsored tech parks or economic zones. Real estate documents are often in local languages, Patil says, and are not stored electronically, making title searches difficult. Indian laws restrict foreign ownership of land, favoring long-term leases of government-controlled or approved properties. Structuring entities offshore—Mauritius, Singapore and the British Virgin Islands are common locations—and negotiating leases in tech parks and economic zones can provide favorable tax treatment.

 Shirish Gupta, an associate in the Palo Alto office of Chicago-based **Mayer Brown LLP** and past president of the Bay Area chapter of the South Asian Bar Association (SABA), says SABA members tend to break down into two groups: younger immigration and employment lawyers, and more senior IP litigators.

Gupta and other attorneys interviewed for this report agree that IP licensing and distribution agreements, along with M&A, are the key areas of growth opportunity in terms of legal services, as basic technologies pioneered by Bay Area firms are finding new applications throughout India in the automotive, energy, environmental, transportation, health care, financial, wireless and other sectors.

 But an overall aversion to risk, along with regulatory hurdles, continues to hold back the kind of entrepreneurial startup and vertical integration activity seen elsewhere. Attorneys and venture investors at a November 2007 India M&A panel hosted by **Orrick Herrington & Sutcliffe LLP** in Menlo Park, for example, observed that Indian companies are prohibited from buying over their net worth and the large family shareholders that dominate many Indian firms often refuse to dilute their holdings in cash-stock deals. On the entrepreneurial side, startups are still relatively few and venture capitalists want to see a

management track record before committing funds, producing an early-stage gap. Orrick's own history in working with Indian firms includes the 1999 Infosys Nasdaq IPO.

Wilson Sonsini's Raj Judge says the cross-border deal-making and legal landscape is getting particularly interesting as India's economy and technology sectors advance. "At first, people accessed India for cost, but as time has gone on, the development of software and affiliated technologies has continued to improve and has relied on knowledge capacity," he says. "So the cost leverage became a talent leverage, and today India is going past talent to a management leverage and then a knowledge leverage. We're seeing companies in the U.S. turn to India for novel ways of managing their operations. That, in my mind, is the beginning of Indians managing their own companies."

Judge cites Tata Motors' acquisition of luxury car brands Jaguar and Land Rover from Ford Motor Company: "It's significant that as Tata is bidding for Jaguar and Land Rover it's also rolling out the world's cheapest car, the Nano, in India, and the only other bidder was another Indian company, Mahindra. These companies have the IT, the precision manufacturing capability and the global parts supply chains to help Jaguar and Land Rover become profitable, while still manufacturing in the UK with all of the union restrictions and legacy costs."



In India, Judge and his firm are helping two Silicon Valley entrepreneurs, Rajat Rakkhit and Jay Sethuram, with funding from Trident Capital, to build a nationwide digital advertising firm, **Elucido Media Networks**. Elucido is similar in structure to China's Focus Media Holding, a rollup of regional advertising companies plus flat-panel display and transmission technology. Rakkhit has held strategic positions with Cypress Semiconductor, Advanced Micro Devices, and NASA; Sethuram worked at Intel, National Semiconductor Corp., and AT&T Bell Labs, and later founded two companies, Cerent and Stratum One, that were acquired by Cisco.



In California's Searles Valley, 170 miles east of Los Angeles, Wilson Sonsini and Indian Counsel AZB Partners advised Gujarat-based Nirma Ltd. in the acquisition of **Searles Valley Minerals Inc.** (SVM) in December 2007. SVM is one of five U.S. producers of soda ash (accounting for 10% of the U.S. soda ash market), and the acquisition makes Nirma the seventh largest soda ash producer in the world. A sizable portion of SVM's output is shipped by rail to the ports of Long Beach and San Diego for export.

In IP licensing, joint ventures, and M&A, many Indian companies are still on a learning curve. Foreign partners often hesitate to enter into agreements, lacking the necessary level of assurance that they will not find themselves tied up in court for years trying to enforce otherwise routine contracts. As Orrick partner Neel Chatterjee, an IP specialist, told an August 2006 Delhi legal seminar:

In the medium term (1–3 years), the civil justice process will need to address complex cases in the technology transactions area. Indian companies have been signing very high dollar value outsourcing deals, technology transactions, and joint venture deals over the past several years. These deals are often framed without fully understanding the business complexity or multinational legal

experience. As a result, disputes will be forthcoming. While many of them will be addressed through private arbitration, the volume of litigation around these sorts of deals will expand considerably as ownership of IP from the technology transactions and joint ventures will need to be unpacked. In the longer term (4–5 years), there will be a greater need for “technical” IP mediation capability, such as with patents, technical trade secrets, and software litigation.



Chatterjee participated in the Alternative Dispute Resolution (ADR)/Intellectual Property Rights (IPR) seminar as part of a delegation brought to India by the San Francisco-based **Institute for the Study and Development of Legal Systems** (ISDLS). Since 1996, the Institute, founded and led by attorney and law professor Stephen Mayo, has collaborated with the Supreme Court of India, High Courts, and bar associations to modernize India’s legal system. Its specific mission, at the invitation of India’s judiciary, has been to design ADR and judicial case management processes that would reduce court backlogs overall and, in particular, help expedite IPR cases through the High Courts.

ISDLS, working with legal study groups of Supreme Court and High Court judges and attorneys created by then Chief Justice of India A.M. Ahmadi, helped develop reports and recommendations to the Indian Law Commission (ILC). Based on that information, the ILC prepared a draft law which was passed by Parliament in 1999 but was then tied up for three years in a constitutional appeal by an Indian bar association.



In 2002, ISDLS participated in the exchange when a Supreme Court of India delegation was hosted in Washington, D.C. by U.S. Supreme Court Justices Sandra Day O’Connor and Stephen Breyer. In 2003, ISDLS and the Law Commission co-hosted a national ADR conference in India, and in 2005, the Institute launched two pilot ADR projects in the Delhi district courts that produced settlement rates of 67% and resolved some 1,500 cases. In 2006, the Delhi pilot projects were made permanent. Bay Area attorneys Victor Schachter, a partner with **Fenwick & West LLP** in Mountain View, and Jeffrey Banchemo, a partner with **Kastner Banchemo LLP** in San Francisco, helped direct the second six-month pilot mediation project.

Bay Area Law Firms Active in India (Partial List)

The Chugh Firm	Orrick Herrington & Sutcliffe LLP
Cooley Godward	Perkins Coie LLP
Fenwick & West LLP	Pillsbury Winthrop LLP
Foley & Lardner LLP	Ropers Majinski Kohn and Bentley PC
Greenberg Traurig LLP	Shearman & Sterling LLP
Jones Day	Skadden, Arps, Slate, Meagher & Flom LLP
Latham & Watkins LLP	White & Case LLP
Mayer Brown LLP	Wilson Sonsini Goodrich & Rosati
Nishith Desai Associates	



Ropers Majeski Kohn & Bentley, in San Jose, represents twenty Indian companies doing business in the U.S. According to managing partner Michael Ioannou, at least half are looking to buy American companies.



The Chugh Firm, with an office in Santa Clara, is a rarity: a cross-border Indo-American law firm, founded by Navneet S. Chugh, a CPA and attorney who emigrated from Nagpur in the early 1980s, received an MBA from the University of Southern California in 1985, and earned a law degree from Western State University in 1992. Chugh was instrumental in founding the Southern California chapters of SABA and TiE in 1995 and 1997 respectively.

Today The Chugh firm has 135 employees, including 58 attorneys and CPAs at offices in Cerritos and Santa Clara in California and Iselin in New Jersey, as well as in Bangalore, Chennai, New Delhi, and Manila. The firm's cross-border business focuses on advising in the areas of immigration, banking and finance, insurance, real estate, and intellectual property. In 2004, it established Indian affiliate Universal Legal, which advises primarily on employment and workplace issues in India.



Nishith Desai Associates is a research-based corporate and tax counseling law firm, launched in 1984 in Mumbai by attorney Nishith Desai. Its Mumbai headquarters employs some 50 attorneys focusing on finance, investment, M&A, dispute resolution, intellectual property, and real estate. A smaller Bangalore office specializes in corporate/M&A. Desai and his firm have advised the Securities and Exchange Board of India on venture capital and employee stock option plan guidelines for India, including the structure for offshore incorporation in Mauritius.

An office opened in Palo Alto in 2003 specializes in IP. The practice has a fourth office in Singapore and a research center at Juhu outside Mumbai. Nishith Desai Associates is the first Indian firm licensed by the State of California to practice and interpret Indian law, and it acts as an advisor to Silicon Valley businesses and other U.S. law firms.

Desai told the legal trade publication *Metropolitan Corporate Counsel* that 70% of the firm's clients are in the U.S., so the Palo Alto office is a "service station," providing clients with a local link to counsel and researchers in India and an in-person point of contact 24 hours a day. At the same time the Palo Alto office was established, Desai launched IP Pro, a service made up of Indian engineers and lawyers doing patent research and drafting patent specifications and initial patent claims for U.S. attorneys and their clients. Nishith Desai Associates acted as underwriters or issuer counsel for share issues on NASDAQ and NYSE by Infosys, Satyam Infoway, Rediff Ltd., Wipro and Mumbai BPO/IT solutions provider Silverline.

Cooley Godward used Nishith Desai as Indian advisor on behalf of its client eBay in the \$50 million June 2004 acquisition of India's largest online auction site, Baazee.com. Desai also helped Amazon, Google and other firms set up their India operations.

Legal Process Outsourcing

A little-discussed segment of the business process outsourcing (BPO) market in India is legal process outsourcing (LPO). Crisil Research and Information Services, Ltd., a business intelligence firm, estimated this segment at \$60–80 million in 2006, with the potential to grow to \$4.7 billion by 2012. Most of the growth would be coming from mid-sized global law firms and from in-house legal departments of large corporations. The Indian market is currently estimated at about \$200–250 million annually. LPO firms in India currently employ about 12,000 lawyers and law school graduates; they are expected to employ 79,000 by 2015. A 2004 Forrester Research study forecast that U.S. legal jobs outsourced to India would grow from 6,000 at that time to 29,000 in 2010 and 79,000 by 2015.

General Electric, Cisco, Oracle, LSI Logic, DuPont, and Citigroup are among the firms that use Indian LPO services, which can include word processing, document management, specialized legal research, billing, preparation of boiler plate filings and contract language, electronic discovery, and so on. The LBO sector has actually grown during the economic downturn, due to increased demand for due diligence and e-discovery work relating to shareholder lawsuits, and assessment of mortgage-based and other potentially troubled assets

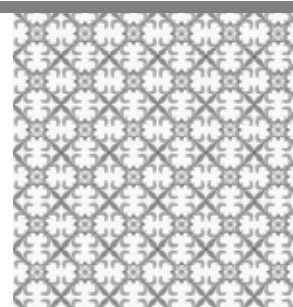
LPO shops, such as Pangea3, Integreon Managed Solutions, Legal Outsource, IP Pro, and QuisLex, typically do this work at anywhere from 25% of the cost of using junior associates or paralegals in the U.S., often paying as little as \$20 an hour. Work requiring a more specialized, experienced attorney may run in the \$75–100 an hour range. Not all of the firms are India-based: Legal Outsource is an Irvine, California firm run by a former Pillsbury business development director who had helped advise clients on outsourcing.

Junior attorneys in India hold mixed views on LPOs, seeing the work as tedious and exploitive, but also seeing an opportunity to broaden their exposure to global legal skills and issues. U.S. law firms, meanwhile, are under mounting pressure to outsource their back office work—first from Indian firms feeling the sticker shock of significantly higher legal fees in the U.S., but also from U.S. corporate clients pushing back against traditional law firm practices of high markups on billable back office services.

LPOs also offer small and mid-sized law firms an affordable way to free up lawyers to take on more or larger cases. Maharashtra-based research firm ValueNotes Database estimates that law firms represent 45% of India LPO revenues, while corporate legal departments account for 36%.

Dabhol: The Mother of All Cases

At the time of its first phase completion and startup in 1999, the \$2.9 billion Dabhol power project—built on the Maharashtra coast, about 100 miles south of Mumbai—was both the world's largest independent power project and the largest foreign investment in India. By late 2001, Dabhol had transformed into India's largest-



ever commercial dispute, involving 40 separate litigations across five countries that would not be finally settled until 2005.

Robert Nelson, then a partner with Thelen Reid Brown Raysman & Steiner LLP in San Francisco, served as lead counsel for two operating equity investors in the power project, General Electric Co. (GE) and Bechtel Corp. He took part in a complex workout that involved a gradual transfer from private to public ownership within India's complex investment rules; finding compromise among the competing claims of Indian banks, foreign banks, foreign credit agencies, and equity investors including Bechtel and GE; negotiating with multiple levels of government in political transition; and the first commercial arbitration ever brought on behalf of the Overseas Private Investment Corporation (OPIC) against a foreign host government by the U.S. government.

"On its own commercial terms, this was the single most complex project workout in history," Nelson maintains, "and when you add in the political dimension, it became even more complex." Nelson says that over a period of years, he participated in a 90-minute call five days a week, usually anywhere between 2:30 and 8:00 in the morning, eventually prompting him to move to Hawaii to manage the time differences between Europe, Asia, and the U.S. East and West Coasts.

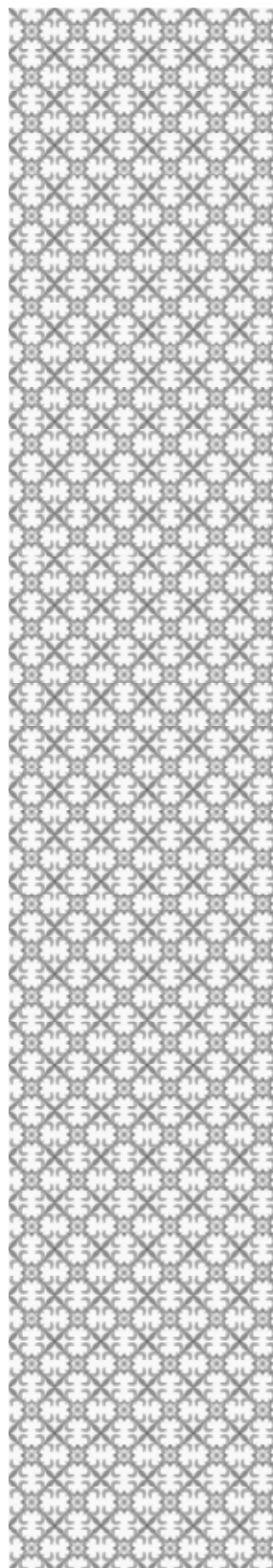
A Promising Start

In 1992 the Indian government unveiled a "fast-track" program to spur private sector investment—including foreign investment—in India's power generation infrastructure. To promote the program, a senior Indian government investment mission visited the U.S. in late May 1992 and met with officials of Enron Corp. By June 20, a memorandum of understanding (MoU) had been signed with the Maharashtra State Electricity Board (MESB) for a project at Dabhol.

The Dabhol Power Corp. (DPC) was established as an Indian limited liability company held by Enron (80%), Bechtel and GE (10% each) through offshore holding companies based in Mauritius. The initial 740-megawatt combined-cycle naphtha plant was to be completed in 1997. For Maharashtra, it was a mega-project bringing power to a state plagued by shortages; for Enron it was an early foothold in the Indian power generation market.

Project Cost Versus Electricity Prices

Critics who reviewed the MoU, among them the World Bank and India's Central Electricity Authority (CEA), were skeptical: the project had been awarded without a bid process or an environmental



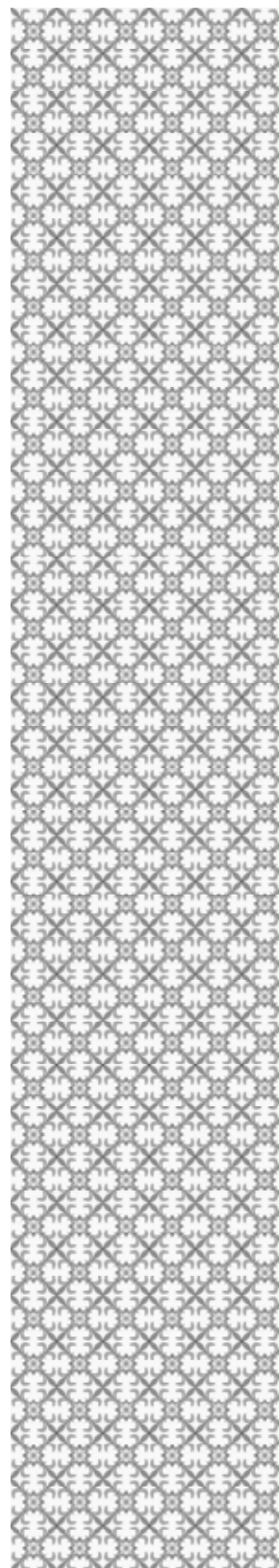
impact assessment; a “take-or-pay” provision required MSEB to pay a fixed annual rate in U.S. dollars for 20 years—irrespective of electricity consumed, fuel prices or exchange rates—with no corresponding audit or minimum supply requirements for Dabhol Power; and MSEB would have to charge customers rates much higher than elsewhere in India—which could have the effect of driving up electricity prices nationwide.

The World Bank turned down financing for the Dabhol project in April 1993, claiming that it was “not economically viable.” In December 1993, however, CEA gave its provisional approval and MSEB signed a power purchase agreement (PPA). Dabhol Power, in turn, used the PPA to raise \$1.9 billion from Indian public sector banks; Japanese and Belgian export credit agencies; a syndicate of foreign banks; and the Overseas Private Investment Corp. (OPIC), which lent \$160 million directly and provided an additional \$232 in political risk insurance for Enron, Bechtel, GE, and one of the commercial banks involved. Both the Government of Maharashtra and the Government of India provided guarantees.

Protests by local governments, environmental activists, and opposition political parties built steadily as the project broke ground in 1995. The Congress party was ousted in Maharashtra state elections, in favor of the Bharatiya Janata Party (BJP), which had campaigned against Dabhol. MSEB sent Dabhol Power a letter calling for a halt to construction.

Dabhol Power renegotiated the original PPA, adding a second phase that would expand the plant over time to generate 2,184 megawatts and would include a liquefied natural gas (LNG) tanker terminal and an inland pipeline for LNG that Enron would import from Qatar, under reduced tariffs approved by the Indian government. In return, electricity rates were lowered and MSEB was given a 15% stake in the project. Phase I was completed and began operating in 1999. But by 2000, electricity demand was still far below initial projections due to the 1997 Asian economic crisis, and MSEB was behind in its payments. Under the PPA’s take-or-pay provisions, once Phase II came online in 2001, MSEB’s payments would triple, and passing that cost on would mean a 50% hike in utility rates.

The state government decided to cut its losses: the Maharashtra Energy Regulatory Commission asserted jurisdiction over the project and, through a technicality, refused to permit testing of Phase II turbines, voided the existing Phase I and II payment terms, and blocked both arbitration and further MSEB investment in Dabhol be-



yond the 15% it held. The operating Phase I plant and the Phase II construction were shut down, triggering a wave of litigation in 2002.

Unwinding the Deal

Robert Nelson, who had earlier spent time in India and had written his senior college thesis on Indian history, says the keys to resolving the case were: (1) patience and an understanding of India's civil service ("In India a lot of things are won by stalling," he says. "People are penalized for failures more than they're rewarded for successes."); (2) pressing his clients' overall case firmly, while seeking specific solutions that served all parties' economic interests; and (3) showing respect throughout for India's governmental processes and business customs.

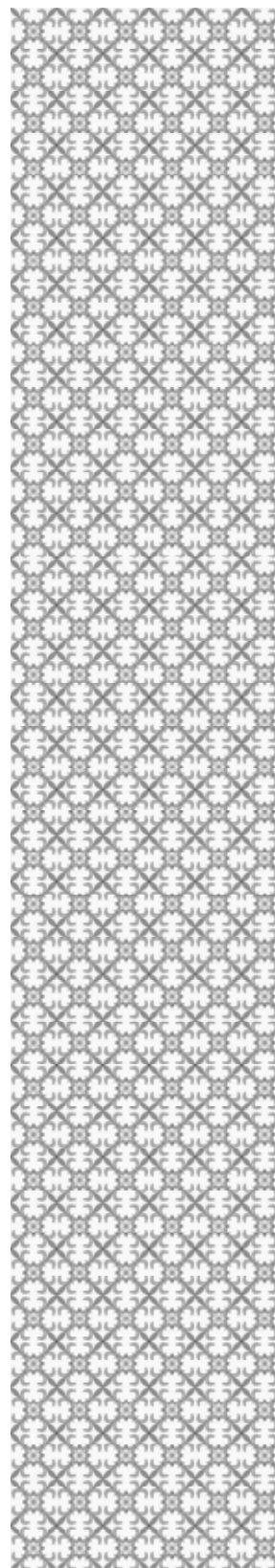
Bechtel and GE also needed to deploy a consistent, dual strategy seeking compensation from the Indian government under the bilateral treaty with Mauritius, and from OPIC in the form of risk insurance compensation. All of this took place in the context of a post-9/11 geopolitical environment that saw not only the U.S. forming closer ties to Pakistan, but also the collapse of Enron.

By 2005, time had worked in Bechtel's and GE's favor: Maharashtra was experiencing ongoing power outages; the Indian government faced difficult arbitrations that incurred mounting legal and administrative costs; India's economy was growing more rapidly—as was electricity demand—making the Dabhol project more feasible; and resolution had become an ancillary issue in the U.S.-India civilian nuclear deal by then under negotiation. Ending the arbitrations and getting the plant up and running had become a top priority.

Three years of litigation and negotiation eventually led to: a steeply discounted buyout of Enron's interest (\$16 million, a refund of its OPIC premium payments); phased transfer of ownership to state government entities through the Indian banks, who would in turn buy out the offshore lenders; and settlements with Bechtel and GE shared by OPIC and the Indian government. A comprehensive deal was reached and signed in July 2005.

Dabhol Today

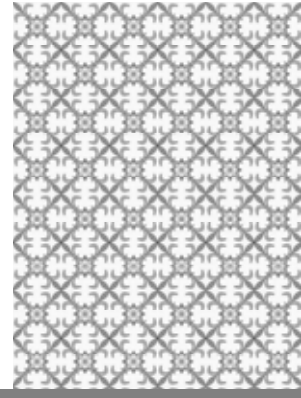
The Dabhol plant was restarted in May 2006 under a joint venture of the Gas Authority of India Ltd. (GAIL) and the National Thermal Power Corp. A consortium of Indian banks committed to assume 85% of completion cost as debt. The project has since been plagued by problems: interrupted fuel and water supplies, court challenges over electricity prices, turbine failures, and work stoppage on the



Legal Services

LNG for non-payment to the contractors. In the meantime, the estimated completion cost for the full project grew from 8.7 billion rupees (\$217.5 million) to 23.65 billion rupees (\$591.2 million), causing lenders to cut back support.

In 2008, Dabhol still operated at less than full output due to gas shortages, supplying at most 1,400 megawatts of power to customers; as of April 2009, two turbines provided output of 600 megawatts and three more turbines were idle and in need of repair.



C: Semiconductors

“When we look at innovation, there are three key ingredients: the right mindset and culture; exposure to end markets; and the ability to innovate. All three of these vectors have now started to align in India.”

Jaswinder Ahuja, Vice President, Cadence Design Systems

Key Findings:

- Indian chip industry is focused on design; no fabrication plants are in operation.
- Telecom, electronic payment, and auto and industrial controls dominate the segment.
- Companies partner with universities to train and expand a skilled design workforce.
- Low-power/low-cost chips and photovoltaics drive new business in India and emerging markets.

Market Overview

As it has continued to grow in size and sophistication, India’s semiconductor sector has been “full of promise” and “poised for a breakout” for much of this decade. Multinational corporations such as Texas Instruments and Intel have been in India since the mid-1980s, starting with sales and support offices and gradually establishing full-scale, “captive” (foreign-owned) design centers.

Semiconductor demand has grown steadily in India’s domestic market—primarily from rapid expansion in:

- telecommunications, including mobile handsets, base transceiver stations, routers, and switches;
- smart cards, point of sale terminals, and ATM machines;
- automotive, defense and aerospace electronics; and
- industrial sensors, monitors, actuators and digital signal processors—used in everything from power plants and factories to medical equipment and “smart” appliances, such as washing machines, refrigerators, and microwave ovens.

A 2008 study by the India Semiconductor Association (ISA) and the technology research company IDC estimated the total design services market in India at \$6.08 in U.S. dollars in 2007, and it is expected to grow at a compound annual growth rate (CAGR) of 21.7% to become \$10.96 billion by 2010. The total engineering workforce inclusive of VLSI, hardware/board design and embedded software development was estimated at 130,000 in 2007 and is expected to grow at a CAGR of 19% reaching 218,800 by 2010.

The chip industry in India today is focused primarily on design. Demand has accelerated for ever smaller, higher-capacity, lower-power chips, extending into microprocessor-based system-on-a-chip

(SoC) technology, microelectromechanical systems (MEMS), and electronic design automation (EDA), in addition to less complex system in package (SIP) chips, application-specific integrated circuits (ASICs), and assembly-test-mark-pack (ATMP) services. Indian designers have kept pace, earning a reputation for quality, productivity and time-to-market, at about 20% of the cost. Multinationals have also felt comfortable, in terms of IP protection, turning over portions of complex design solutions to Indian engineers.

Top Indian universities have been turning out an expanding talent pool of engineers qualified in chip design—a relatively recent phenomenon, due in part to collaborations with multinationals. But the semiconductor segment still has a low profile in India relative to IT and software, leading to an engineer shortage: only an estimated 60% of engineering school graduates in India have the specialized qualifications to work in the chip industry.

The VLSI Society of India estimates that the semiconductor sector will require 10,000 engineers trained in very large scale integration (VLSI) by 2010 to do advanced system-on-chip work and achieve end-to-end design at the 65-nanometer level; at the beginning of 2006 there were perhaps 2,000.

The extent to which the absence of a chip manufacturing base has held back India's semiconductor industry is a subject of debate. At minimum, chip design work that might otherwise have stayed in India is said to have gravitated to China, Germany, Israel, and elsewhere because of the close links between designers and manufacturers that allow validation of designs for production.

To date, no semiconductor wafer fabrication (or "fab") facility has been built in India, for several reasons. Infrastructure is one problem—in particular, reliable water and power supplies, as well as efficient road and airfreight logistics to ship the physical product. "In contrast, for software and IT services, there is no requirement for well functioning logistics systems to move goods. The data packages move from servers to wired or wireless carriers to their destination, and those transmission services are well developed in India," Semiconductor Industry Association president George Scalise points out.

"A great deal of the semiconductor opportunity involves manufacturing," Scalise explains. "In India there is in place now very little infrastructure and there are minimal investment policies and incentives to facilitate manufacturing investment, and this situation is not likely to improve any-time soon. India has a very bureaucratic system for dealing with new investment. The existing industrial parks in India are well designed, built, and maintained with policies and infrastructure that allow investors to function effectively. Most areas outside the parks lack the infrastructure that would make it easy to build and operate a design or manufacturing facility."

Additionally, India has been slow in forging the government-academic-NRI investor-entrepreneur links seen in China's innovation clusters. Finally, whereas the Chinese government provided incentives to the Semiconductor Manufacturing International Corp. (SMIC) equivalent to 50–100% of project cost, policy differences between the Indian Information Technology Ministry and the Finance Ministry have both delayed adoption of a clear semiconductor policy and reduced the development incentives first proposed.

A long-awaited package of government reforms and incentives to encourage development of fab foundries, unveiled in February 2007, was intended to attract some \$10 billion in new investment for as many as three new wafer facilities, plus ancillary manufacture of displays, storage devices, photovoltaic cells, nanotech, assembly/testing, and so on. Under the new policy, special incentives will be offered for minimum investments of (a) \$625 million for a fab plant with a threshold value of \$2.5 billion, or (b) \$250 million for an ancillary project with a threshold \$1 billion value. The government will cover 20% of capital expenditures for the first 10 years if a facility is located in a special economic zone (SEZ), or 25% if it is not. The new rules waive countervailing duties on capital goods for plants outside the SEZs, as they are already waived for those in the zones.

Skepticism remains: with a delay of more than two years in rolling out the semiconductor policy, Texas Instruments ruled out a planned fab facility in April 2007, and Intel opted in September 2007 to site new fab operations in China and Vietnam instead of India. As of August 2009, India's Department of Information Technology (DIT) had received 17 formal proposals in response to the new policy. Of these, 15 are for photovoltaic panel manufacture by companies such as Moser Baer India, Titan Energy Systems, and KSK Power Ventures, and the other two are a Reliance Industries fab project and Videocon LCD panel facility.



Two NRI partnerships that include tech leaders and academics from Silicon Valley, **Semindia**, and **Hindustan Semiconductor Manufacturing Corp.** (HSMC), had expressed an interest in developing fab projects in the \$2–3 billion range. But progress has been slow in fundraising, and questions have arisen as to whether current government incentives are sufficient for projects of that scale to pencil out.

Semindia, led by Dr. Vinod K. Agarwal—founder of San Jose-based embedded semiconductor test software LogicVision—joined with Advanced Micro Devices (AMD), Flextronics, Broadcom and venture firm Sandalwood Partners as the anchor tenant in Fab City, a 1,050-acre chip industry technology park near Hyderabad, launched in February 2006 by the government of Andhra Pradesh. The partnership broke up in mid-2008, however, and Semindia announced in February 2009 that it would shelve its fab plans in favor of an ATMP facility.

Semindia has been offered 100 acres on an 88-year lease for 1 rupee per acre per year, with subsidized water and power, and full or partial reimbursement of value added taxes on product sales for 15 years. So far, the consortium has committed to a \$1 billion Phase I investment in a 25-acre ATMP facility employing 2,000 workers and producing 30,000 wafers a month. Political opposition, plus delays in transferring land and finalizing water and electricity pricing, have held up the project.

HSMC—whose partners include Redwood Ventures founder Rajvir Singh, Stanford professor Krishna Saraswat, former Bell Laboratories director Dr. C. Kumar Patel, and former Sun Microsystems senior executives Raj Parekh and Anant Agarwal—is also negotiating a 100-acre site within Fab City. Nano Tech Silicon India (NTSI), a South Korean venture, had broken ground on the site of a new airport at Shamsabad, outside Hyderabad, in 2005. At various times, NTSI was said to be partnering with IBM, Intel and Samsung, to make chips for consumer elec-

tronics, but its principal investor backed out of the project in January 2008, and the facility will be used to make solar cells.

Bay Area Connections



One of the first Bay Area firms in Bangalore, **Intel Corp.**, has been in India since 1988. Through the 1990s, the company had mainly a sales and marketing presence. Then, in 1998-99, it also began some design and IT support work, according to Intel India director Arjun Batra. “We started in India because this was where you could get the talent relatively easily; during the Internet bubble days you couldn’t find the people back home,” he says.

Initially there was no concerted corporate strategy in this direction. Intel’s desktop processor products group first arrived in India in the late 1990s and hired about 20 software engineers to develop and support 2-D graphic drivers. The numbers slowly grew to several hundred until 2002, when the Intel enterprise processor group started a server processor design project. After the dot-com bubble burst in the U.S., Intel recognized India’s market and talent potential—a rapidly growing economy with a low penetration of personal computers and a large, highly-educated English-speaking population.

Additionally, many engineers of Indian heritage working in the U.S. were receptive to moving back to India for high-tech jobs, and that made staffing a design team in India easier. More Intel groups came, one by one—communications, chip sets, mobile processor and corporate technology—leading to rapid growth of the Intel India Development Center in Bangalore.

With the ability to ramp up a large team quickly, Batra explains, “it was easier to get approval for growth in India than in the U.S. The drivers were talent and competitive cost structure, plus increasingly the customers were expected to be there.” Intel’s India presence grew 40% annually over 2003-05. From only a few dozen employees in 1999, its workforce numbers 2,700 today. As it has for many tech firms, India has evolved into a global platform for Intel’s product development in two principal areas: enterprise (business computers, servers and peripherals) and mobility (notebooks, wireless communications, graphics).

Product development accounts for 65% of Intel’s India activities. Recently it has begun designing in India products aimed at developing country markets. Among its projects to date are:

- The Jaagruti (“awakening”) community computer—hardened to withstand dust, heat, and humidity, with an auxiliary power source—is distributed to Indian rural villages and set up in kiosks to be shared.
- The Classmate (formerly EduWise) school laptop, piloted at schools in Tamil Nadu and elsewhere worldwide, runs Windows as well as Linux, and has WiMax features that enable students to collaborate on projects and teachers to monitor students’ Internet use while at school.
- A prototype handheld health monitoring device alerts an at-risk patient and his or her doctor to a pending medical emergency.

- Intel, Tata Consulting Services (TCS), and software startup Microsense have teamed to deliver remote WiMax telemedicine services via the Narayana Hridalaya Hospital in Bangalore and the TCS-designed portal WebHealthCentral, serving as many as 200,000 residents.
- A long-distance WiMax network linking 13 rural villages in Tamil Nadu has enabled the Aravind Eye Hospital (in a project with UC Berkeley; see Chapter 4) to remotely diagnose more than 30,000 cases of cataracts, glaucoma, and cornea problems and restore vision to some 3,000 patients.

In October 2007, Intel launched the India Design Program, an alliance network with Indian design houses to bring to market new applications for Intel's embedded systems. It is inviting the design houses to produce reference designs for a range of emerging market products, including low-cost PCs and cell phones.

Intel's venture capital arm, Intel Capital, has invested over \$100 million in approximately 60 Indian ventures since 1998 and, in 2005, it established a \$250 million Intel Capital India Technology Fund as part of a \$1 billion long-term commitment to India. The fund looks for innovative technology startups and companies, invests at all stages of funding, and plays an active role in making its companies successful. A number of its companies have gone public or been acquired, including:

- Deccanet Designs, a communications design and software services company;
- Sharekhan, an online brokerage firm;
- Nipuna, offering business process outsourcing (BPO) and other services;
- FutureSoft, a telecommunications product and services company;
- Online portals Rediff and India Infoline.com Ltd.; and
- R Systems, a provider of outsourced and offshore product development and customer support services.

Intel Capital has had 13 exits so far, with six in 2007 that include online brokerage India Infoline Ltd., wireless 3G and broadband DSL software firm Sasken Communication Technologies, and computer education firm NIIT Technologies. The new fund has invested in 20 companies as of the end of 2008, among them IntraSoft Technologies, which owns 123greetings.com.

Educational development has been a key focus of Intel's engagement in India. At the primary and secondary levels, it has developed teaching tools and materials to interest students in math and science, assisted teachers with professional development, donated computers to schools, and funded a Community Education for Youth program for underprivileged children. At the university level, it has helped train professors in multicore programming and donated computers; sought out and funded collaborative university research projects; sponsored student internships and research competitions; and established a rewards program for employees serving as technical mentors to faculty and students.

Intel's India experience has not been without challenges. Sophisticated hardware and product design requires experienced silicon design engineers, and India did not have them initially; Intel was able to find about 400, with advanced degrees and many years' experience with U.S. firms, who were willing to relocate. Excessive employee turnover in its Bangalore design center required special management attention and programs to ensure continuity of design teams through the life of a long project. Intel also found that it needed to foster a local research ecosystem so that Indian universities were pursuing research in technologies and areas of interest to high-tech companies.



Sunnyvale-based **AMD** established a sales/support presence in India in 2001 through its AMD Far East Ltd. (India) arm. It later opened a 38,000-square foot Bangalore very large-scale integration (VLSI) design and software development center in 2004, part of an initial \$5 million, three-year investment commitment. In November 2007, it replaced that center with a second 52,000-square foot silicon design and platform R&D site, coinciding with release of AMD's first quad-core processor, codenamed Barcelona, which had been designed partly in Bangalore. Engineers at the new facility are leading development, testing, and optimization of a new Shanghai 45-nanometer quad-core microprocessor.

With the 2006 acquisition of Array Technologies Inc. (ATI), AMD took over a \$15 million, 48,000-square foot ATI design center in Hyderabad with 250 engineers, that designed mobile handset chips, as well as 3D graphics and virtualization technology chips for Microsoft Xbox and Nintendo game stations. In January 2008, AMD opened a second Hyderabad R&D center specializing in multimedia products and housing a center of excellence for audio technology. AMD now employs 400–450 engineers in Hyderabad plus another 300 in Bangalore. The work in Bangalore is mainly silicon design, product design, platform design, and customer support, while Hyderabad focuses on ASICs design, software, graphics, chipsets, and media processors for consumer electronics, from handheld devices to digital TV.

AMD's Athlon chips have done well in India's home, small office and educational markets, and have made inroads, directly and through OEMs like Wipro and HCL, to enterprise customers including the Indian Institute of Science (IIS), the Institute of Management (IIM), the Indian Army, Tata Group, and state governments. As mentioned earlier, AMD will license its process technology to Semindia for the planned Fab City ATMP facility outside Hyderabad as funds are raised and construction goes forward. It also intends to be a customer once the plant is operational.

On the education side, AMD teamed with the American India Foundation (see Chapter 3) to set up a computer/Internet learning laboratory at the Government High School, Doddanakundi in Bangalore in November 2006. Another such lab has since been set up in Hyderabad. The program, featuring personal computers and broadband connections for some 200 students, is part of the American India Foundation's Digital Equalizer program and is one of more than two dozen programs operating worldwide as part of AMD's 2004 50x15 Initiative to connect 50% of the world's population to the Internet by 2015.

AMD is also a technical partner with News Corp., Google, Nortel Networks and Linux developer Red Hat in the One Laptop Per Child (OLPC) initiative originated by Nicholas Negroponte of the MIT Media Lab in 2005. Two million dollars in R&D has been donated for the project,

and AMD's Geode processor used in the XO laptop has been designed for resistance to dust, extended battery life, and an ability to operate in extreme environments. India is an early target country for OLPC's distribution of its \$100 laptop to schoolchildren.



National Semiconductor opened an India design center in 1995 in Bangalore, with 15 engineers working in cubicles in the top floor of a house. By 2002, the center had moved to a 14,000-square foot, five-story office building housing 60 engineers. Initially the India design center was charged with project work—specific projects, typically validation and quality assurance, for National Semiconductor's personal systems and local area network groups, and for its Mediamatics subsidiary.

Beginning in 2001, the company focused increasingly on product development—specifically, system-on-chip products for phones, flat-panel displays, games, handheld devices, and audio equipment. More recently, India design center teams have moved into power management and computer-aided design (CAD) software. National Semiconductor invests an estimated \$3 million annually on the India design center, and it has collaborated with IIT-Kharagpur on a number of testing, modeling and development projects.

In 1999, National Semiconductor licensed its Geode reference platform to three Indian consumer electronics and telecom firms for customization of interactive cable set-top boxes. The partnerships have, in turn, targeted banks, stock exchanges, hotels, and schools for their internal systems, in addition to the cable TV market in India.



Mountain View-based chip design software and services firm **Synopsys** entered India in 1995 with a \$4 million investment in a small design center on two floors in Sheriff Chambers in Bangalore. The firm hired 10 engineers to help with tool application and evaluation for its synthesis business unit. Today, Synopsys India has followed the global migration of semiconductor R&D to India, with more than 500 employees and 100 business associates at locations in Bangalore, Hyderabad, and Noida. Synopsys activities focus on development of electronic design automation (EDA) software tools; chip design applications and methodologies; design services; and consulting.



Cypress Semiconductor also launched an India design center in Bangalore in 1995, with an activities focus on designing USB controllers, static random access memory (SRAM) chips, framers, and clocks. Bangalore played a key role in the development of Cypress's programmable system-on-chip (PSoC) mixed signal arrays. Cypress located a second design center in Hyderabad in 2003, in part due to a tight property market in Bangalore, but also to take advantage of a growing and differentiated talent pool. Hyderabad began with 15 engineers and focused on network search engine designs, 90-nanometer scale logic designs, and systems engineering.

From 1995–2005, Cypress design teams in India earned more than 40 U.S. patents and published numerous technical papers. The company developed a center of excellence in data communications in Bangalore and moved one of its business units there. An Information Technology Group has also designed manufacturing, finance and sales solutions for the Indian market. Over 2004–05,

Cypress's India team grew to about 200 in Bangalore—its largest overseas design operation—and 40 in Hyderabad. About 30% of its global workforce is made up of Indian nationals.

Since 2005, Cypress has considered further expansion, including at Fab City. A planned \$50 million Hyderabad investment by Cypress unit SunPower, to manufacture photovoltaic cells, fell through in 2005 when an Indian joint venture partner backed out; Cypress instead expanded existing capacity in the Philippines. SunPower has since been spun off as a public company.



San Jose's **Cadence Design Systems**, which does computer-aided design of integrated circuits, has been in India since 1987, when it opened a small R&D site in the Noida export processing zone. Beginning in 1997, its presence expanded with the opening of regional sales and customer support offices in Bangalore and, later, Hyderabad. Over time, Cadence's cumulative investment in India has passed \$250 million, and it employs some 900 people.

In the beginning, multinational and local customers established and grew their presences in India and Cadence expanded its operations to be close to its customers. Leveraging the pool of available talent and access to customers helped its India center move up the value chain. Today, the Cadence India R&D center works closely with worldwide counterparts and is involved in leading-edge development at the 65nm and 45nm technology levels.

Early entrants were initially attracted to India because of the cost arbitrage factor. However, companies who recognized its strategic potential have benefited the most. Cadence corporate vice president Jaswinder Ahuja points to two important inflection points for the industry: the first was in 2000, when career opportunities in Silicon Valley began to dry up, the India ecosystem was growing, and Indian nationals on H-1B visas began to return home; and the second was in 2002, when multinationals doubled or tripled their operations in India in search of talent and new markets. He credits early movers such as Texas Instruments for launching the trend, when it shifted its 90nm design work to India in an important vote of confidence.

In 2006, Cadence Inc. launched the "Power Forward Initiative" with seven other firms—AMD, ARM, ATI Technologies, Freescale Semiconductor, Fujitsu, NEC Electronics, and Taiwan Semiconductor Manufacturing Co.—to develop an open industry standard for low-power chip designs, and it has actively promoted open standardization in India. Currently the PFI has over 30 members. In late 2006, Cadence added 13 Indian companies to its Verification Alliance Program—a worldwide partner network of some 50 companies in the verification field that collaborate on complex verification solutions around the Cadence platform.

Cadence opened a new, 93,000-square foot R&D center on its Noida campus in late 2007, its largest such facility outside the U.S.

As part of its community engagement, Cadence participates in the Indian government's Special Manpower Development Project, developing special curriculum and training programs at elite Indian universities. But it also maintains relationships, through its University Relations Program, with over 200 institutions that train VLSI students on Cadence EDA platforms. Participating degree-granting schools get Cadence design technology at greatly reduced rates, faculty training, and participation in Cadence-sponsored events.

The Cadence Design Contest, begun in 2005, challenges engineering students to submit analog, mixed signal, and digital design projects, with the winning entry presented at Cadence's CDNLive! India conference. Shri Sant Gajanan Maharaj College of Engineering won the first contest, with subsequent winners representing IIT-Kharagpur and the Indian Institute of Information Technology (IIIT) Hyderabad.

In a unique cross-border collaboration, Cadence has teamed with UC Santa Cruz (UCSC) Extension and private technical training firm TTM Institute for Information Technology (TIIT) to offer the Finishing School Program, a certificate program in VLSI design engineering for either physical or logic design. To increase India's pool of specialized, design-aware VLSI engineers, year-round advanced classes are offered in Bangalore, Hyderabad, and Delhi, using Cadence EDA tools and UCSC curriculum and course design.



KLA-Tencor Corp. is a San Jose developer of yield management and process control solutions for the manufacture of semiconductors. Its India presence began in 2000 in partnership with IT and software services firm HCL technologies. HCL set up a dedicated development center for KLA-Tencor at its Chennai facility, installing advanced wafer inspection equipment in its clean room and high-speed data links to KLA-Tencor in the U.S.

Today, the company operates its own captive center in Chennai, employing some 200 workers, and also contracts with HCL, Wipro, and Infosys for another 500 engineers and programmers. The work is divided between “core” IP related functions done by the captive center—advanced motion control, applications engineering, optical calibrations, algorithms, and other basic technology elements of KLA-Tencor's product line—and non-core “context” functions done by partners—user interface development, quality control, look and feel, and back office services, for example.

KLA-Tencor acknowledges having gone through a learning curve in India, growing out of its early emphasis on cost arbitrage rather than talent. “Our initial strategy was to have 1,000 engineers in our captive,” says KLA-Tencor president and managing director Dr. Ashwin Ballal. “We went there thinking that we could take advantage of the cheap talent pool and be able to ramp very quickly. That turned out to be more challenging than our expectations and plans. So we had to change course and strategy.”

Relying on local partners to provide business process support has helped in controlling attrition and has enabled the company to focus its attentions on core activities. Dr. Ballal confirms that KLA-Tencor's India presence today is about the engineering and programming talent pool, and not just about the cost savings. “There's only so much talent in the U.S.; if you don't tap the talent and human capital of India for software development, you risk falling behind,” he says. Dr. Ballal adds that companies typically have finite resources to direct toward customized solutions or new product development, so the ability to outsource some portions of a project frees the most highly-skilled engineers at home for more advanced work. Finally, he says, “70% of the KLA-Tencor customer base is in Asia, and the global imperative is strong: if you want to call yourself a global company, you can't continue to act only locally.” Dr. Ballal sees continued strong chip growth for India in the thin-film photovoltaic solar cell market—“India has 300 days

of sunshine a year and solar doesn't require infrastructure"—as well as in the mobile communications space—"You've got farmers out in the fields on their cell phones searching for the markets with the best prices for their crops, meanwhile no one in the village has a landline phone."



SanDisk Corp., founded in 1988, invented flash memory storage cards and is a leading manufacturer and seller of storage cards and flash drives for digital cameras, phones and audio/video players; plug-in USB memory drives for computers; and a line of lower-cost MP3 players that compete with Apple's iPod. It has been steadily ramping up its presence in India (in addition to Japan, Israel and Scotland) since 2004, following growth in emerging consumer markets for mobile phones and consumer electronics. SanDisk president and chief operating officer Sanjay Mehrotra, whose background includes B.S. and M.S. degrees in electrical engineering and computer science from UC Berkeley, has led the expansion.

In January 2004, SanDisk began selling its full line of storage, media, and wi-fi cards, as well as USB memory drives in New Delhi and Mumbai. In February 2006, the firm opened its India Device Design Center in Bangalore with 10 engineers, in addition to employing another 50 engineers through third-party vendors such as Wipro.

Like other Silicon Valley companies, SanDisk has grown its presence in India in order to access specialized technical talent for global growth and to be closer to evolving needs and trends in one of its largest potential markets. Global cell phone and digital consumer device sales continue to grow dramatically, and Indian consumers have been a particularly strong market for memory devices to archive music, movies and personal photos.

In April 2008, SanDisk announced new distributor partnerships to take its retail reach beyond 15,000 storefronts in major cities. It signed with Ingram Micro to sell camera and phone flash memory cards through 70 vendors in 28 Indian states, reaching an estimated 12,000 retail customers.



Indian entrepreneur Rajeev Madhavan founded Cupertino-based electronic design automation (EDA) developer **Magma Design Automation** in 1997. Madhavan began his career with Bell North Research (BNR), an R&D unit of Nortel Networks, in Ottawa, where he began writing his own EDA tools to help with design projects. In 1991, he transferred to Silicon Valley to work for Cadence Design Systems as a BNR engineer.

In 1992, Madhavan jumped from Cadence, to join with Vinod Agarwal (now at SemIndia) and Michael Howells in co-founding LogicVision. He jumped again in 1994, to found Ambit Design Systems with \$750,000 from a group of angel investors, this time making synthesis tools to compete directly with Synopsys. Cadence bought Ambit in 1998 for \$260 million, but by then Madhavan had already left and raised \$2.5 million from another group of angels—most notably Sun co-founder and Cisco senior executive Andy Bechtolsheim—to launch Magma. At that point Madhavan was 31 years old.

Magma had, by 2003, grown organically and through acquisitions to be the fourth largest EDA software developer, behind Cadence, Synopsys and Oregon-based Mentor Graphics. The same year, Wipro Ltd. licensed the company's Blast Fusion integrated tool suite for use in its system-on-a-chip (SoC) designs. KPIT Cummins followed suit in 2005. Many of Magma's established

customers—Broadcom, Infineon, Samsung, TI—were also increasingly using India as a global design center.

Following the business and building a local base, in December 2003, Magma launched an IC Excellence Initiative in India, donating IC design software and launching an IC Physical Design PG Diploma Course with VLSI training institutions, including IIT-Madras, IIT-Kharagpur, Birla Institute of Technology and Science-Pilani, and Amrita Institute. In 2005, it established a Magma Design Automation India subsidiary in Bangalore and added partnerships with IIT-Hyderabad and Anna University. The Anna relationship led to completion of a new CDMA telecom receiver IC. It also has partner relationships with the Karnataka state government and with Science and Technology Parks of India-Bangalore.

In 2006, Magma's acquisition of Knights Technology, a developer of yield management and failure analysis software, added a Mumbai facility, and Magma opened a Noida center. In early 2007, it expanded its Bangalore operations into new 40,000-square foot quarters. The company currently has about 200 employees in India.



As the world's leading supplier of semiconductor equipment and related services, Santa Clara-based **Applied Materials Inc.** has been in China since 1984, and its Asia activities are spread primarily among the PRC, Taiwan and Singapore. Given the fact that it only established a foothold in India beginning in 2001, however, its presence there has grown dramatically.

Its India Global Development Center in Bangalore's International Technology Park and its R&D center in Chennai together employ approximately 1,000 people involved in software development, engineering design and services, and business and information technology applications. It has strategic partnerships with Satyam Computer, Wipro, Mindtek, and TCS, and it has been active in university collaborations with IIT-Delhi, IIT-Mumbai and IIS-Bangalore.

Collaborations have included research programs and graduate fellowships at IIT-Delhi in semiconductor processing and electromechanical engineering, as well as a November 2007 donation of \$7.5 million in equipment to help establish an Applied Materials Nanotechnology Laboratory at IIT-Mumbai's government-funded Centre of Excellence in Nanotechnology. Applied Materials has also sponsored projects at IIT-Mumbai in solar and fuel cells and chemical synthesis, and it has both hosted Mumbai faculty and graduate students at its Santa Clara facility and lent engineers to work at the Nanotech Centre.

Applied Materials has been in talks with both SemIndia and Hindustan Semiconductor about providing equipment to their proposed fab plant projects, once those plans become viable. Like Cypress and other firms in the chip sector, Applied Materials is leveraging its extensive silicon expertise to branch into the solar power field amid sluggish chip and flat-panel display orders. Its first India contract was signed in March 2007 with Moser Baer India to develop a fully integrated production line to manufacture 40-megawatt, thin-film solar panels in Delhi.

On the social front, Applied Materials partnered with the American India Foundation in 2005 to open a Digital Equalizer computer learning center at Government High School B Narayanapura—

the first of five centers opened through 2006 to provide computer instruction for both male and female high school students. Among other support, Applied Materials provided the solar panels to power computers at the centers.



Xilinx Inc., headquartered in San Jose, is a leader in programmable logic solutions, emphasizing field programmable gate array (FPGA) technology. Like other semiconductor design firms after the tech bubble burst, Xilinx moved increasingly into foreign markets and Asia in particular. From 1999–2003, the Asia-Pacific market grew from 13% to more than 35% of the company's business.

Xilinx began designing chipsets in India in 2004 under a strategic partnership with Tata Group embedded design subsidiary CMC Ltd. A joint Xilinx-CMC India Development Center (XCIDC) in Hyderabad began designing solutions for the consumer electronics, automotive and telecom sectors. The XCIDC engineering staff doubled from 30 to 60, and the center was so successful that Xilinx and CMC explored the possibility of opening a spin-off of the facility as a separate company in 2005. Instead, Xilinx opened its own 33,000-square foot captive R&D center in Hyderabad in October 2006, with a staff of 75 and capacity for 300.

Xilinx India managing director Akshya Prakash explained the company's strategy for attracting and retaining talent in a February 2007 interview with the Cybermedia India Online (CIOL) Network saying, "In a high-end industry like semiconductors, one of the primary motivators for engineers to work is to allow them to work at the cutting edge of technology. At our design center in Hyderabad, we work across what we call 'full life cycle'. This means that the engineers are not just involved at the last stage of the product life cycle, but right from the beginning. From the conception of the idea, design, coding, and the final delivery of the product, engineers are fully involved."

Xilinx CEO Wim Roelandts acknowledged in the same interview that the FPGA talent pool is still relatively small in India, and experienced managers with 10–15 years of training are in even shorter supply. The answer has been to encourage longtime Indian engineers at Xilinx in the U.S. to return to India as managers. The company is also involved in the Special Manpower Development Program, assisting elite Indian universities with specialized tech curricula and programs.

Today, Xilinx employs about 100 design engineers in India and sees India as a global R&D hub, providing designs for production by primarily Chinese original equipment manufacturers. Where 80% of its business in 2000 was in telecommunications, that share is now 45%, with another 45% in networking, and the remainder in consumer electronics.

The future, Xilinx management believes, lies increasingly in the digital convergence of communications, computing, the Internet, "smart" handheld devices, and appliances, in fields ranging from cell phones, to automobiles, to aerospace, to health care, to home entertainment, to energy distribution and management. In 2007, Xilinx launched a \$75 million Asia Pacific Technology Growth Fund, headquartered in Singapore, to invest in innovative FPGA applications, as well as new technologies throughout the Asia-Pacific region, including India.

D: Software/IT Services/Business Process Outsourcing

Key Findings:

- Bay Area and India IT/software firms collaborate as well as compete.
- Indian tech workers have filled a global talent gap as demand has soared.
- An enterprise IT focus has integrated Indian firms into global businesses.
- U.S. schools have not produced an adequate workforce.
- Pure cost arbitrage offshoring strategies are becoming less important.
- Using Indian talent enables high-end growth in the U.S. and expansion in emerging markets.
- U.S. Immigration policy drives away top tech graduates.

The industry sector for which India is best known has its roots in the 1969 decision by IBM to shift to an open-standards strategy, unbundling the computer hardware, mainframe operating system, and applications software components of its business. The same unbundling that jump-started personal computing also produced an entirely new, global market for independent software vendors (ISVs).

Stanford scholar Rafiq Dossani has chronicled the history of India's software industry in a 2005 paper published by the University's Shorenstein Asia-Pacific Research Center (APARC). Up until the 1970s, most computing was done on mainframe systems by large corporate, government, and institutional users. Custom software applications, to the extent they existed, were developed internally because of the physical constraint that programming had to be done on site.

In the new decentralized market, traditional functions, such as basic data processing and tech support, expanded to include system integration and maintenance, as separately developed software programs were combined to perform customized tasks. Banks and other large enterprises needed increased support for off-the-shelf software and began looking for low-cost options. Israel, Ireland, and India were logical locations. Each had a domestic computer industry, a pool of engineering talent, and English as the primary business language.

Israel, looking to support its defense industry, offered transnational software firms incentives to relocate and hire local engineers, and Ireland opened its market upon joining the European Community in 1973. India, in contrast, encouraged national champions. The 1973 Foreign Exchange Regulation Act (FERA) restricted foreign investment except through minority-ownership joint ventures, which raised intellectual property concerns. Tariffs on imported computer hardware and software were set high (135% and 100%, respectively) to protect domestic industry.

In response in 1974, mainframe computer manufacturer Burroughs asked its India sales agent, Tata Consulting Services, if it could send some of its programmers to the U.S. to assist a

Burroughs customer with system software installation. Banks and other IBM end users contracted with Indian firms to ensure IBM compatibility of new applications software packages. By 1980, 21 Indian firms were actively exporting programmers overseas, earning a combined \$4 million annually.

Many of those Indian programmers opted to stay on after their assignments. Many of the foreign firms that left India, following the tightening of investment rules under FERA, were the early clients utilizing India's exported programmers. And by 1986, Dossani reports, nearly 60% of IIT engineering graduates were also migrating overseas. Indian government "protection" had produced a brain drain.

The Workstation Changes Everything

A convergence of factors in the mid-1980s altered the Indian IT landscape:

- Development of the Unix workstation decentralized computing power; the programmer could be located offsite and networked in.
- Prime Minister Rajiv Gandhi's 1984 New Computer Law lowered hardware and software tariffs; made software exports eligible for bank financing and exempt from the licensing raj; allowed foreign firms to set up wholly-owned software development operations for export; established technology parks to promote the industry; and exempted exports from income tax.

Texas Instruments and Hewlett-Packard branched into software R&D. Citigroup developed custom software for internal use. TCS, Wipro Ltd., and other Indian firms shifted from exporting programmers to outsourced custom software and product development based in India. India's 35 software firms in 1984 grew to 700 by 1990.

The new industry needed space, and Mumbai was expensive. Bangalore offered cheaper real estate and infrastructure, including the first technology park created under the New Computer Law. It was geographically located at the center of four states that produced more than half of India's engineering graduates, and it had been the birthplace of the Indian Institute of Science in 1909. TI, HP, IBM, Accenture, Oracle, Dell, and General Electric added to the critical mass, setting up India headquarters there.

The presence of the transnationals attracted new domestic market entrants, ratcheted up competition for talent and clients, and raised both the quality and technical sophistication of work being done in Bangalore.

By focusing on exports—first of programmers and later of custom software—Indian companies avoided the obstacles of a small domestic market, weak IP protection, and lack of adequate university R&D or university-business links. And, where traditional Indian manufacturing industries were heavily regulated, software and IT services were a new sector, offering relatively intangible products and services that largely escaped the heavy hand of government intervention.

India's large industrial conglomerates also saw the opportunity, launching firms such as Tata Consultancy Services (TCS) and transforming an established Indian edible oils company, Western India Vegetable Products, into Wipro Ltd. Economic reforms during the 1990s liberalized foreign investment, IP protection, financial markets, and telecommunications practices, while commercial development of the Internet brought still more players—from large transnationals to startups—into the IT services market.

The Back Office Moves

Concurrent with the shift in software development, companies began looking at India as a location for cutting back office costs. Cheap ubiquitous global telecommunications networks, along with rising wages and real estate prices at home, were gradually moving back office functions—customer service call centers, data processing, and records maintenance—out of city centers toward the suburbs and eventually overseas.

British Airways and other airlines were among the first to relocate back offices to India in the late 1980s; American Express also consolidated its Japan/Asia-Pacific back office operations in New Delhi at that time. General Electric poached some of Amex's top management in the 1990s to launch GE Capital International Services (GECIS) in the New Delhi suburb Gurgaon in the 1990s. Raman Roy, who had set up Amex's operation and then jumped to GE, left with some of the GECIS team to form an independent BPO firm, Spectramind, that would eventually be acquired by Wipro in 2002. In 2004, with help from private equity investors, GECIS was spun off as a stand-alone BPO provider, Genpact. By 2002, all major Indian firms (Infosys, Wipro, HCL, TCS, Satyam) offered BPO services, while Accenture and IBM provided BPO services through their captive centers.

While IT and BPO services proceeded to grow along parallel tracks, outsourcing of business processes to India was clearly an issue of comparative advantage—or, put more bluntly, cost arbitrage—while outsourcing of IT services and software was as much about accessing a pool of engineering talent quickly and easily that was not available in the U.S., either in the domestic workforce or through the H-1B visa process.

In India, BPO centers provided relatively clean, well-paying, entry-level work for which training could be provided on the job in an economy where most other industry sectors remained paralyzed by bureaucracy and poor management.

For U.S. and other overseas companies desperate to control costs, BPO extended the efficiencies obtained with contract manufacturing, into the realm of increasingly sophisticated business-related services. From call centers and basic data processing, BPO has grown to include a wide range of specialized contract services from preparation of legal documents, to processing of insurance claims and loan applications, human resources management, remote medical diagnostic services, architectural design drawings, computerized animation, and more.

Growth Constraints

India's IT-BPO sector grew during the 1990s, largely due to the relative absence of government interference. As Wipro co-founder Vivek Paul puts it, "We love to remind the government that the only reason we've been so successful is because they didn't know we exist." Still, the industry had, by the late 1990s, begun to bump up against the limits of that success, including:

- lack of access to early stage venture capital to help small and startup firms expand;
- lack of a domestic market, due to the focus on custom software development for an overseas customer base;
- a shortage of qualified graduate talent in specialized skill areas (only 300 master's and 25 doctoral graduates annually as of 2000, according to NASSCOM);
- outdated university curricula and lab facilities;
- poor university-industry linkages, with faculty not encouraged to publish or consult; and
- scarcity of project management skills, placing domestic firms at a competitive disadvantage versus transnationals.

The Y2K crisis exacerbated these problems, but also created an opportunity. A number of India's best and brightest engineers and programmers were already in Silicon Valley, working for tech companies and research institutions, or attending graduate school. In the late 1990s, speculation began to build that computer operating systems and applications worldwide might crash at midnight on December 31, 1999 as their internal clocks might fail to recognize the new millennium. Indian engineers and programmers were in place, at the center of the storm, doing cutting edge work in computing and software.

But the sheer scope of the potential problem required even larger numbers of trained bodies, working around the clock, company by company, to avert a possible crisis. It was the chance Indian IT services and software firms were looking for to scale up, broaden their offerings, and prove themselves in the global market. They not only gained unprecedented visibility into the complex enterprise computing functions of the world's largest companies and government agencies, but in the U.S., they also encountered—and embraced—the lifestyle and culture of Silicon Valley.

In research conducted by the Public Policy Institute of California and UC Berkeley professor AnnaLee Saxenian, it was reported that the number of Indian-run tech startup companies in Silicon Valley grew from 47 firms in 1984 to 774 in 1998. By 1998, Indian-run firms represented 7% of all Silicon Valley startups, accounting for \$3.6 billion in sales and employing more than 16,000 people.

Subsequent research by Saxenian and a team from Duke University showed that 25.3% of the nearly 29,000 engineering and technology companies formed in the U.S. over 1995–2005 (about 7,300 firms) had immigrant founders. Of those, 26% had Indian founders—a larger percentage than immigrant founders from the UK, China, Taiwan, and Japan combined. California had the largest share of Indian-founded engineering and tech companies.

Global Reach

The Bay Area exerted a strong pull on newly-arrived Indian engineers and programmers. Workers were choosing to extend their stays; students came to pursue graduate opportunities were unavailable back home. Indian firms had, up to that point, relied heavily on returning engineers and programmers with updated skills to advance their own capabilities. The brain drain that began in the late 1990s slowed that transfer and limited Indian firms' competitiveness.

Several factors have quietly reversed this brain drain since 2000, among them:

- the unexpectedly quick resolution of Y2K issues;
- shrinking U.S. job prospects after the bursting of the tech bubble over 2000–01;
- increased travel fears and visa restrictions after the 9/11 attacks in the U.S.;
- restricted availability of H-1B visas and green cards;
- increasing economic opportunity in India; and
- a desire building abroad to return home, start families, and “give back” to Indian society.

By 2003, IT work in India had moved up the value chain to include more product development, and Indian IT firms had also begun to achieve global scale. New transnationals were entering the market and looking to India, along with Israel and Ireland, to lower their development costs and access engineering and programming talent. Projects increased in scale and dollar value. India's IT industry has since grown from \$21.6 billion in 2004 to \$48 billion in 2007, and reached over \$71 billion in 2008.



India IT Industry Sector Performance, 2004–08 (\$ billions, U.S.)

	2004	2005	2006	2007	2008*
IT Services	10.4	13.5	17.8	23.5	35.5
Exports	7.3	10.0	13.3	18.0	26.9
Domestic	3.1	3.5	4.5	.5	8.6
BPO Services	3.4	5.2	7.2	9.5	14.8
Exports	3.1	4.6	6.3	8.4	12.8
Domestic	0.3	0.6	0.9	1.1	2.0
Engineering/R&D, Software	2.9	3.8	5.3	6.5	9.6
Exports	2.5	3.1	4.0	4.9	7.3
Domestic	0.4	0.7	1.3	1.6	2.3
Total Software	16.7	22.5	30.3	39.5	59.9
Exports	12.9	17.7	23.6	31.3	47.0
Domestic	3.8	4.8	6.7	8.2	12.9
Hardware	5.0	5.6	7.1	8.5	11.7
Exports	n/a	0.5	0.6	0.5	---
Domestic	n/a	5.1	6.5	8.0	11.7
Total IT Industry	21.6	28.2	37.4	48.0	71.7.0

*2008 figures are estimates.

Note: Domestic numbers were reported in rupees in the source material and have been converted to dollars using an exchange rate of 44 rupees to the dollar.

Source: NASSCOM FY 2008-09 Report, Feb. 2009

India's IT industry employed 1.1 million professionals in FY 2004–05; NASSCOM places employment in the sector at about 2.3 million as of February 2009. (While these are large numbers that represent important opportunities for young Indian professionals, it should be noted that they still account for only a small fraction of India's population and employment base.)

Where IT-BPO services comprised 1.2% of India GDP in 1998, the portion is now estimated by NASSCOM at 5.8%. The industry grew by 28% in 2007 and by another 33% in fiscal 2008, reaching total revenues of \$64 billion—roughly \$40 billion in exports and \$23 billion in domestic sales. NASSCOM estimated fiscal 2009 growth in the much slower 16–17% range, to \$71.7 billion, with exports at \$47 billion and sales in India at about \$25 billion. Market intelligence firm

IDC India forecasts 16.4% average annual industry growth over 2008–2013, moderated from 24.3% over 2003–08.

Captives and Vendors Shift Up

Today, as captive (foreign owned) R&D centers are being given a larger role by their parent companies in global product development, many of India's smaller IT service companies are struggling, and its major IT firms are working hard to move up the value-added ladder, from simple business process outsourcing (BPO) and writing basic code, to knowledge process outsourcing (KPO), systems integration, and the development of expertise in key industry segments ("verticals") such as health care, telecommunications, life sciences, and financial services.

Employment in legal services offshoring, a form of KPO, is projected by ValueNotes to grow from 7,500 professionals in 2006 to 32,000 by 2010. Financial service firms are expected to increase their use of offshore resources, as are engineering firms. India's Engineering Promotion Export Council estimates that the country's engineering process outsourcing (EPO) market is likely to reach \$30 billion by 2015, reflecting growth in the global EPO market to a range of \$110–140 billion.

For most of India's IT majors, a key to the future lies in IT systems integration—which helps an enterprise's disparate proprietary and incompatible legacy systems work together more effectively or replaces them with a single, unified solution updated for the enterprise's current and future needs. The global market has become increasingly specialized, both by function and by sector:

- *Specialized product development.* Outsourced IT is now designing custom IT products and systems for the automotive, energy, medical, financial services, and other sectors.
- *Web-based IT and software.* Vendors are offering a variety of off-the-shelf enterprise software solutions—from human resources and customer relations, to document storage and retrieval, to project management—on a subscription basis, run from their servers via the Web. Some have made available on a license basis the source code for specific software modules, or platforms, that users can access to build their own custom solutions.
- *Remote infrastructure management (RIM) services.* A 2008 McKinsey study suggests RIM services may be the most potent long-term growth area for Indian IT, involving design and development of integrated service infrastructures—including hardware, software, connectivity and people—across an entire enterprise, such as a power generation grid, school system, manufacturing supply chain, hospital network, or smart highway system. Infrastructures may be managed by the enterprise from a central location or outsourced to a third-party vendor. McKinsey foresees a \$524 billion in global expenditures. After stripping out emerging market countries unlikely to commission projects in the foreseeable future and government or business services likely to be maintained in-house for security, IP, or competitive reasons, McKinsey sees an addressable \$96–104 billion outsourcing market over time. As much as 75% of infrastructure management can be outsourced but to date, vendors and captives in low-cost locations such as India have only

captured \$6–7 billion of the business. McKinsey forecasts the RIM outsourcing industry to reach \$26–28 billion by 2013, with India accounting for as much as 55%, or \$13–15 billion, and a workforce of 375,000.

Offshoring Restructures

If, as expected, India can execute this upward shift successfully, its role in the global services market will change significantly. While India will likely remain the world's leading site for call centers and back office services, the low-end “captive” and third-party outsourcing operations that sparked a job “offshoring” debate earlier in this decade are declining in relative importance.

A 2007 report by Zinnov, a management consultancy, places the number of such centers, opened and operated by transnational firms for their exclusive use, at about 600, with slightly over half located in Bangalore. The “captives” generated \$5.8 billion in annual business, compared to \$3.5 billion generated by some 450 centers operated by third-party vendors—mainly a combination of large Indian IT firms (Infosys, Wipro, HCL, Tata Consulting Services); large multinational players (IBM, Accenture, Genpact); and smaller Indian niche IT service providers, engineer/programmer body shops, and call/data center operators. More than half of the market involves software product development.

Many foreign firms that opened low-skill back office centers with a focus on cost savings alone have, in large part, fared less well than expected. Specifically:

- Education, language proficiency, and basic skill levels have often been lower than expected (offshore phone agents, for example, can take longer to handle a customer query than agents located onshore), and training has cost more and taken longer than anticipated.
- With 10-hour overnight shifts (to allow for time differences), data security audits and practices workers view as intrusive, verbal abuse from foreign customers, uninteresting work, and few career opportunities, average attrition rates have risen to 15–30% industrywide, and 30–40% among captives; recruiting, training and HR management has increased costs further.
- Manpower shortages and better conditions in other sectors are drawing workers away from IT. Competition to attract and retain trained workers has bid up captive center wages from about \$136 to \$204 per month, according to market research firm Gartner Inc., and by an average 12% a year; Zinnov sees wages rising an average 14.3% annually through 2013.
- The average cost per full-time software product development employee had risen to \$41,000 annually by 2008.
- Scarcity of built-out sites and property price spikes of as much as 100% in major cities have also increased costs, pushing new facilities out of Tier 1 urban centers to Tier 2 cities and outlying areas.

- A 15% appreciation in the rupee since mid-2006, from 46 to the dollar to about 40 in early 2008, narrowed the wage gap with home countries, raised local currency costs in India, and eroded margins in contracts with U.S. firms, which accounted for 60–70% of the India BPO market. (More recently, the global economic downturn and a rapidly falling dollar reversed the situation; the exchange rate in late 2009 settled at around 48.)
- Mixed messages about extension of the Software Technology Parks of India (STPI) program has created uncertainty among software developers and exporters, as well as among technology part developers. The tax exemption offered to software firms under the scheme initially had a March 2009 sunset date and was only extended for one year to March 31, 2010.

As the 6:1 “India cost advantage” at the beginning of this decade has shrunk to less than 3:1, it is estimated that more than 60% of foreign captive centers are likely to close, relocate outside India, or see their operations shift to larger third-party vendors who can operate more efficiently. While at least 500 western companies now operate captive centers in India, Forrester Research finds that it costs approximately 20% more to run a captive than to outsource to an external provider. According to a Zinnov survey of 594 companies, the number of overseas technology firms opening new India captives declined from 76 in 2004 to 48 in 2006, to just 15 in 2007. This trend has continued into 2009.

Other studies point in the same direction. A 2007 Forrester Research survey comparing client perceptions in 2003 and 2007 showed that 14% fewer businesses expressed preference for an offshore back office or R&D solution; 23% fewer saw value for the money; and 6% fewer viewed offshore vendors favorably in terms of on-time delivery with respect to assignments. AT Kearney found in the same period that 60% of the companies surveyed said that offshoring did not help them achieve their expected operational performance, and 34% said they were not able to achieve the cost savings they had expected.

Several factors appear to influence a captive center’s success and performance:

- Scale is important; a workforce of at least 80 workers is typically needed to be cost-effective.
- Function matters; R&D captives have a better track record than back-office call or data centers.
- Workplace amenities, higher-end work and upward mobility for tech workers help ensure retention.
- Knowledge of the local real estate market, wage scales, HR practices, and customs is critical.

Several Bay Area examples suggest the mixed experience with offshore captive centers:

- **Riya Inc.**, a San Mateo image recognition search engine developer, opened a Bangalore office in 2005, hiring 20 engineers. By 2007, rising wages and time zone differences prompted Riya to close the office and offer half of the engineers jobs in San Mateo on H-1B visas. Eight of them accepted the new assignments.

- Menlo Park customer service software developer **Kana Software Inc.** eliminated 100 development jobs in India in 2005 and began hiring again in the U.S.
- **Teneros Inc.**, a Mountain View company whose “appliances” ensure continuous operation of unified email communications and other Microsoft infrastructure functions in the event of power failures, network outages, server failures, or data corruption, closed a 30-person office in India and brought 12 developers to California.
- **GlobalLogic**, a Virginia-based outsourced software product development company, funded in part by Silicon Valley VC firms Sequoia Capital and New Enterprise Associates, has committed \$50 million to India expansion, much of it through acquisitions of distressed captive product development centers started by mid-sized firms. GlobalLogic believes it can operate these facilities more efficiently or consolidate them; it has facilities in Noida, Pune and Nagpur and expects to add two more locations, increasing its India workforce to 4,000 over time.

Don't Blame the Model

A common Indian response has been, “If you don't know how to make the model work, don't blame the model.” Major Indian and multinational firms are gradually abandoning the low-end, relatively low-revenue back office center, in favor of large-scale, specialized product development centers catering to specific industries, often housed in a single mega-complex.

The objective is to merge India's IT, software, and semiconductor advantages with industry-specific “domain” expertise, expanding India's role as a global R&D outsourcing platform. And in addition to simply providing contract services, Indian third-party vendors are looking at new kinds of revenue models (revenue sharing, build-operate-transfer, joint licensing of new technologies and products, etc.) in mobile telephony, medicine, materials research, energy management, and other fields.

Major Indian IT firms may each employ 40,000+ people in India alone; the top 20 together employ nearly 500,000. By moving up the value chain in their R&D and service offerings, global vendors like Tata, Infosys, Wipro, Satyam, HCL, IBM, and Accenture can offer top Indian graduates higher pay, cutting-edge work, and a range of career options. Local recruitment, management autonomy, and an understanding of India's complex language and cultural differences and sensitivities provide a further advantage. The most successful foreign firms are quick to point out the value of giving workers greater responsibility and autonomy, allowing their operations to develop as uniquely Indian enterprises.

India's indigenous IT-BPO sector has, to an extent, undergone consolidation in recent years. Tata, Infosys and Wipro accounted for a combined 26% of Indian outsourcing export revenue in 2004; by 2007, their share had risen to 41%. Small and mid-sized firms have carved out niches in certain industry, technology or business process areas, have settled into the lower end job shop or call center segments, or have closed.

Faced with rising costs, congestion, and attrition and job-hopping in their workforce, Indian and global IT firms that were once based predominantly in Bangalore and the National Capital Region (New Delhi, Gurgaon and Noida) are now increasingly looking to Tier 2 and 3 cities such as Hyderabad, Chennai, Chandigarh, Jaipur, Pune, and Kolkata for expansion. Major IT firms are also expanding their global presence by establishing service and employment centers to serve regional markets outside India. Locally based software development and customer support centers now operate in the U.S., China, Southeast Asia, Western and Eastern Europe, the Middle East, Mexico, Canada, and Brazil.

In 2007, five of India's seven leading IT companies had a presence in China, often with multiple locations. Geographic expansion is also happening through acquisitions. While employees at these overseas sites are largely Indian, efforts are underway to increase local hires. In the United States, TCS has a facility in Ohio employing 1,000 professionals. Wipro employs more than 8,000 professionals across the U.S., principally in locations such as Austin and Atlanta with high concentrations of educational institutions and trained workers.

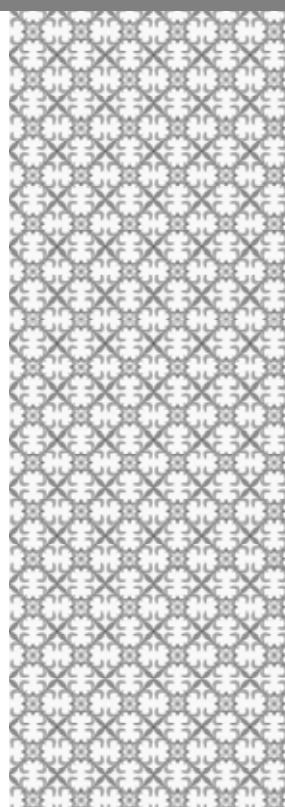
The flow of talent has not been exclusively one-way: when a shortage of more highly-skilled R&D center workers in India became apparent in 2006, large Indian firms began recruiting from U.S. universities, first placing graduates in India and then eventually returning them to the U.S. in positions starting in the \$50–60,000 annual salary range. To date, the number of such recruits does not appear to be large, and retention levels are unclear.

To H-1B or Not to H-1B

A debate over U.S. visa policy began in the early years of this decade, extending from Washington, D.C. to Silicon Valley to India, with no resolution in sight.

Until the early 1990s, there was no cap on the number of H-1B visas issued to foreign workers with special skills admitted to the U.S. to work for sponsoring companies or organizations. In 1991, however, Congress set a cap of 65,000 visas. As the U.S. tech industry grew during the 1990s and companies increased their reliance on foreign engineers and programmers, the cap was raised in 1997 and 1998. Congress approved temporary increases to 115,000 visas in 1999–2000 and to 165,000 in 2001–03.

The higher caps expired in 2004, and with the technology sector in a post dot-com slump, they were not renewed. The current 65,000-visa cap has two exceptions: an additional 20,000 visas are reserved for master's and doctoral graduates of U.S. universities, and U.S. universities and academic research institutions are exempt altogether from the cap.



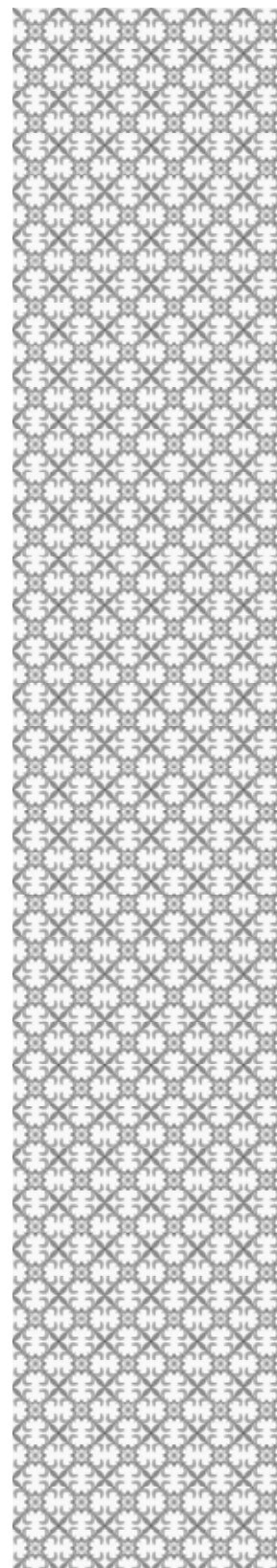
Though the global recession that began in 2007 has reduced pressure for the moment, in recent years, demand for visas has greatly exceeded supply. In April 2007, when the application period opened for visas with an October 2007 start date, nearly 150,000 applications flooded in for the 65,000 basic H-1B slots, and the application process was closed within 48 hours. The April 2008 application process closed in only one day after being flooded with 163,000 applications.

In 2008, eight of the top fifteen H-1B recipient companies were outsourcing firms. The top four were Indian companies. All these firms, including the non-Indian outsourcing firms and three large U.S. technology companies, have a substantial back office/R&D center presence in India.

These numbers, however, do not reveal the full extent of the visa story. The H-1B cap fell in 2004 just as demand began to grow dramatically. In particular, demand from the outsourcing sector competes with applications from technology firms looking to directly import scientific, engineering and programming support. While a major Silicon Valley company might submit applications numbering in the hundreds or low thousands, Accenture and Deloitte & Touche each filed 7,000–8,000 applications in 2006; Infosys and Wipro filed 22,600 and 19,400, respectively. Some of these were multiple applications for a single worker in different jobs.

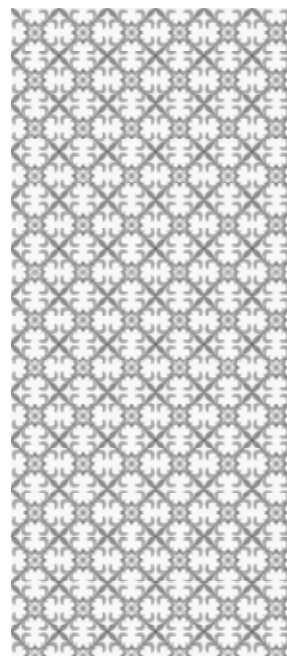
As the 2004 H-1B visa caps were extended, companies applied for L-1B temporary visas (which had no cap or pay requirements) for workers with specialized skills. Where Indian nationals received 10% of L-1B visas in 2002, they received 48% in 2005, while the total number of visas stayed constant at about 40,000. When Siemens Information Communications Networks decided to outsource some of its IT functions to Tata Consultancy Services (TCS) as a cost-cutting step, TCS brought a group of L-1B workers from India to Florida for “training” by the employees they were to replace. The story attracted attention in Congress and prompted hearings and reform of the L-1 program.

Restrictions were put in place in 2008 to prohibit multiple applications for the same worker. U.S. free trade agreements with Chile and Singapore provide for H-1B worker set-asides that lower the 65,000 visa cap to 58,200. And in February 2009, Congress extended additional visa application restrictions for “H-1B-dependent employers”—those with visa workers making up 15% or more of their workforces—to any firm receiving TARP or TALF government



assistance. The added restrictions, on top of the economic downturn, slowed H-1B applications in 2009. As of May 2009, U.S. Citizenship and Immigration Services (USCIS) reported receiving only 45,500 applications toward the cap and was continuing to accept applications.

At the same time, while the system has its flaws, the U.S. clearly confronts a major IT workforce challenge. The Bureau of Labor Statistics (BLS) has estimated that 854,000 professional IT jobs will be added from 2006–2016, a 24% increase in demand. Add replacement jobs, and the number climbs to 1.6 million jobs. BLS has predicted that 1 in 19 new jobs created through 2016 will be in IT services, software, and related fields. With the number of university graduates with bachelor's degrees in computer science and engineering falling, and more than half of doctoral students coming from overseas, the U.S. will be challenged to fill these positions internally.



Top H-1B Visa Applicants, 2008

Firm	Visas Approved
1. Infosys Technologies	4,559
2. Wipro Ltd.	2,678
3. Satyam Computer Services	1,917
4. Tata Consultancy Services	1,539
5. Microsoft Corp.	1,037
6. Accenture LLP	731
7. Cognizant Technology Solutions	467
8. Cisco Systems Inc.	422
9. Larsen & Toubro Infotech Ltd.	403
10. IBM India Pvt. Ltd.	381
11. Intel Corp.	351
12. Ernst & Young LLP	321
13. Patni Americas Inc.	296
14. Terra Infotech Inc.	281
15. Qualcomm Inc.	255

Source: BusinessWeek/U.S. Citizenship and Immigration Services.

Bay Area Connections

Not surprisingly, it is in the IT Services/BPO/software space that cross-border relationships are most prevalent. Bay Area tech firms understood early the value of India's considerable and underutilized talent pool of engineers, programmers, and computer scientists. As computing became more complex with the emergence of the graphical user interface (Windows and Mac versus MS-DOS), faster and higher-storage chips, new Unix-based business applications, and Internet commercialization, companies needing to throw skilled employees at increasingly sophisticated problems found themselves with a shortage of workers at all levels.

Moore's Law (the name given to Intel founder Gordon Moore's 1958 assertion that the number of transistors on an integrated circuit—and thus computing power—will double approximately every two years) began to bump up against the California (and eventually the U.S.) labor market.

The 1999 Y2K crisis multiplied the demand for talent. Much of the work was not particularly high-end, but required large numbers of reasonably skilled people. The already robust population of Indian tech workers and students in Silicon Valley was joined by a flood of new workers arriving on H-1B visas. These workers were embedded deep in the core business processes of the largest Bay Area and U.S. corporations, learning the structures of their legacy IT systems and gaining an understanding of how IT could unlock efficiencies and productivity.

Offshoring and cost arbitrage entered the picture in 2002, after the tech industry collapse dried up new investment and forced companies to scale back their operations and focus on cost control. At the same time 9/11 had led to stringent visa restrictions. Tech went increasingly to China for its manufacturing and to India for its IT services and software, leveraging relationships with local Indian employees, entrepreneurs and professional networks.

Over time, successful companies have discovered the true value proposition that sees India as a platform for (a) developing IT services and software that can foster innovation across industry sectors, and (b) developing new products and services that deliver basic and mid-level technology solutions for governments, businesses, and billions of new consumers in emerging markets.



Oracle Corp. entered the India market in 1987, selling its software and services through a distributor until 1993, when it established a wholly-owned subsidiary. In 1994, it opened its India Development Center in Bangalore, which successfully delivered the first version of Oracle's Internet computing technology in 1996. A second India Development Center branch opened in 1998 in Hyderabad, to focus on enterprise business software.

Oracle also joined with Hewlett-Packard in 2003 to launch an E-Governance Centre of Excellence in Gurgaon, supporting Linux-based open source e-governance initiatives by central, state, and local government agencies. Among the projects are:

- eSeva, a web portal delivering government-to-consumer (G2C) services in Andhra Pradesh;
- online ticketing reservations for the Indian Railway Catering and Tourism Corp.;

Global Reach

- billing, energy audit, and back office solutions for the Maharashtra State Electricity Board; and
- the Education and Research Network (ERNET), linking 200 universities and 500 engineering colleges.

Oracle's Retail Centre of Excellence—opened in Bangalore in 2006 following the company's formation of a retail business unit—has a staff of 200 experts that showcase scalable IT solutions in merchandising, planning, optimization, analytics, store operations, and supply chain and enterprise application integration.

In October 2007, Oracle established two new centers in Gurgaon: the Oracle Partner Solution Centre, a secure facility—with hardware provided by AMD and Sun Microsystems—where strategic partners can build, port, enable, and test solutions based on Oracle platforms; and the company's sixth Oracle Asia Research & Development Centre (OARDC), focusing on solutions for the Indian market, as well as global product development in collaboration with the other OARDCs in Japan, Korea, China and Singapore. Gurgaon OARDC's focus includes specific areas of innovation such as:

- delivery of government services through mobile communications devices;
- inclusive computing to enable rural finance, business development, and NGO services; and
- ubiquitous computing that uses embedded sensors to monitor traffic and weather patterns and track products in a supply chain.

Oracle's India workforce grew to 6,000 in 2004 and 8,000 in 2005, as the company acquired PeopleSoft and brought third-party development activities in-house to the Bangalore development center. India represents Oracle's largest investment outside the U.S. (\$3 billion since 2002) and is its fourth largest Asian market, with some 6,700 technology and applications customers; 400 channel and alliance partners in the Oracle PartnerNetwork, including Infosys, Satyam, Sonata, TCS and Wipro; and an online and developer community numbering about 700,000.

Today, Oracle has an Indian workforce of more than 24,000 that includes, in addition to the centers described above, dedicated employees at outsource partner facilities; i-Flex Solutions, Ltd., an Indian banking IT services firm in which Oracle has acquired an 81% stake and which was rebranded in 2008 as Oracle Financial Services; the Global Consulting unit, assisting clients with specialized applications and solutions; one of Oracle's four global technical support centers; an OracleDirect direct sales unit; and the Global Financial Information Center, managing Oracle's worldwide internal financial planning, accounting, and transaction processing functions.

School is in Session

Since 1995, Oracle has trained and certified more than 42,000 IT professionals through its Oracle University program at six classrooms throughout India (New Delhi, Mumbai, Bangalore, Hyderabad, Chennai and Kolkata), as well as on the Web. Among its 325 training partners are

Mumbai-based technology and training firm NIIT, Hyderabad IT consulting and training firm SQL Star, and California computer education company New Horizons. Training is offered in Oracle Database as well as technologies gained through the firm's acquisitions of PeopleSoft (human resource/customer relations management), JD Edwards (localization/regulatory compliance), and Siebel (customer relations management).

In the area of general education, the Oracle School of Software Technology at IIT-Hyderabad offers IIT students specialized training in core Oracle and JavaScript technologies as well as enterprise resource planning (ERP) applications. After completing the courses, which run from 14–45 days, students take part in compulsory workshops that include projects at the IDC.

Oracle Academy, a global initiative to teach high school, college and vocational school students database design, programming, presentation, and problem-solving skills, was launched in India in 2004. In a partnership with Delhi Public Schools Society, a nonprofit network of schools in 13 countries, Oracle trained 24 Delhi public school teachers in 2006. Later that year, it partnered with the Board of IT Education Standards (BITES) and the Karnataka state Ministry of Higher Education to integrate Oracle Academy curriculum into 100 polytechnic schools reaching 5,000 students.

Oracle's global online K–12 education portal, Think.com, was introduced in India in 2003 via two pilot projects at government schools in Haryana and West Bengal. The secure, teacher-monitored learning community was developed jointly by Oracle and Symantec Corp. to encourage collaborative education worldwide in science, math, language, and literature. Oracle has since made Think.com available in Hindi. Today, some 75,000 students and teachers in 1,100 Indian schools share curricula, participate in lecture and workshop programs, and work on joint projects.

From Farming to Pharma

Oracle holds a 53% market share in the relational database management systems (RDBMS) segment of India's software market, with 40% of its business in the mid-market segment. More than 80% of Indian banks, including State Bank of India, ICICI Bank, HDFC Bank, UTI Bank and Yes Bank, have relied on Oracle applications to integrate, automate, and scale their networks. Beginning in May 2007, Oracle began marketing to rural cooperative banks simple, affordable back office solutions—in particular the ability to consolidate transactions daily. The initiative is focusing first on the 50 banks that use EBZ Online for front-end solutions. The first customer was Pune District Central Cooperative Bank.

India's Ministry of Finance chose Oracle in 2006 to integrate its 36 regional income tax databases into a single national database, linking 745 income tax offices in 510 cities, to streamline processing of returns and issuing of refunds and enable electronic filing. Software Technology Parks of India (STPI), part of the Ministry of Communications and Information Technology, uses Oracle applications for registering and certifying for duty exemption exports from some 7,000 software exporters.

Oracle provides Oracle Database, Siebel CRM, and other technology to India's largest public telecom provider, Bharat Sanchar Nigam Ltd. (BSNL), and recently won a contract to build a

next-generation call records, billing, and customer service system that will serve 70 million customers nationwide.

Oracle life sciences applications have been used by SINO Clinpharm, D&O Clinical Research Organization, and others, to manage and audit clinical trial data, assure regulatory compliance, and shorten time to market for drug treatments. India has been an early adopter of distributed or grid computing—networking clusters of servers to increase computing power and build in redundancy and security across an enterprise, in order to achieve scale. As of mid-2007, Oracle had signed some 70 grid computing customers in government, manufacturing, retail, banking, utilities, telecom, and health care.



The predecessor company that became Cupertino-based utilities and security software maker **Symantec**, Veritas Software, entered the Indian market in the early 1990s, first outsourcing some product development for its Unix-based data storage and management software and then moving that work in-house at a Pune R&D center in 1992. By 1999, Symantec had expanded its product line through acquisitions to include Norton utilities and anti-virus software, and WinFax Pro software for formatting, sending, and receiving faxes via the PC. It entered a sales/distribution tie-in for India with Godrej Pacific Technology Ltd., a joint venture formed by regional Asia distributor Tech Pacific, and it eventually launched a wholly-owned Mumbai subsidiary.

A convergence of Y2K compliance requirements, an increasingly sophisticated Indian computer market with emerging network needs, and a proliferation of computer viruses hosted from Asia all prompted Symantec to broaden its India presence. The new Mumbai office focused on sales and marketing through a team of 25 value-added resellers and on technical support.

In 1999, Symantec signed contracts with PC manufacturers HCL and Zenith Ltd., to include its software in their computers. In 2001, Symantec entered into an alliance with Wipro Infotech, the Wipro Ltd. IT services and consulting unit, which had been slowly building and marketing a security practice targeted at financial and software firms, data centers, and multinationals upgrading their overall IT in India.

Symantec also hoped to tap into India's potentially huge small office-home office (SOHO) market. A 2006 Gartner Research study identified 1.9 million small businesses with computers, plus some 30,000 mid-market enterprises, operating in India. Roughly 70% of the personal computers and servers in India ran on the Microsoft Windows operating system, as did Symantec software.

Symantec saw an opportunity to use India as an R&D platform to diversify its product line and develop small office, Linux and Unix versions of its existing storage, backup, and security suites. The captive R&D center in Pune grew to a workforce of 1,100 employees—at that time 20% of Symantec's worldwide development staff. Its mission evolved from translation, quality assurance and other product engineering to include product innovation. Symantec began sending senior engineering managers out into the field to meet with customers and identify product opportunities that could be engineered in India. The center branched into product R&D for the disaster recovery market, and began working with Wipro on storage and productivity solutions for SAP enterprise software.

The Mid-Market/Security Nexus

Competition has intensified in the storage and security space, whether from Microsoft, Trend Micro, and McAfee, or from Indian providers such as former Satyam subsidiary Sify Ltd. A particularly important nexus is developing in the mid-market segment where companies are looking for scalable storage and backup solutions that will help them grow. As they do, they are open to security attacks through the most vulnerable point of contact, the “endpoint infrastructure”—a customer’s, vendor’s or employee’s computer that may have both business and personal uses.

Symantec managing director Vishal Dhupar told the Economic Times in 2006 that 86% of automated network attacks in 2006 were against home users in Mumbai, Delhi and Bangalore. As broadband usage in India has grown, an estimated 59% of Indian home PC users share music and video, play games online and visit social networking sites. These same computers may be also be used in an office: In 2006, more than one in six Indian companies experienced a security breach aimed at extortion, fraud, or intellectual property theft, most often through various endpoints. That, in turn, has potential implications for domestic and offshore firms outsourcing from all but the largest Indian IT services vendors.

Attacks include data theft and manipulation, disruption of business critical services, and damage to company brand and reputation. These attacks have become increasingly sophisticated, commercially focused, and multi-staged, initiated by corrupting or duplicating trusted sites of a targeted end user. A Symantec study released in March 2008 said that the number of distinct, monthly “phishing” attacks on Indian banks—fraudulent emails and website links aimed at soliciting personal identification and financial information—grew from 20 in October 2007 to 120 in January 2008 alone. Each potentially reached tens or hundreds of thousands of bank customers.

In April 2007, Symantec opened a Centre of Innovation in Chennai that now employs some 200 staff, making India its second largest engineering site, behind the U.S. (Other global centers include Australia, New Zealand, Estonia, Poland, the UK and Belgium.) The center is a focal point for Symantec Research Labs (SRL) and Advanced Concept Group (ACG) projects in India. Chennai also provides backup redundancy for Symantec India operations and helps broaden the talent pool from which the company has been hiring. Within its Pune facility, whose workforce is currently about 2,500, Symantec has set up a Global Security Response (GSR) lab that gathers security threat information from some 40,000 third-party “sensors” in 180 countries, analyzes threats and the code running them, and develops signatures to protect clients worldwide.

Symantec executive vice president and chief technology officer Mark Bregman says mid-sized businesses will be an important market in India itself for integrated security solutions:

Any large enterprise today is already all over security. In the consumer market there’s some awareness and it’s growing. In the mid-market, which is subject to all of the same risks, they need security but don’t always know they need it. What we’re seeing is a consumerization of the enterprise, where consumers want to use their systems to communicate with the enterprise’s back end and we don’t know what’s on their computers. At the same time you have employees

with corporate machines and all kinds of policies that the company computer is not for personal use, but like most of us, they don't want to carry around two machines, so they put personal things on their work computers. We're looking at ways to allow consumer-owned PCs to access the enterprise safely and to segregate work and personal information on the same computer.

A Young Workforce, A Broad Portfolio

Symantec's division of labor among its global locations is a function of legacy, security, cost, and talent. Veritas legacy products remain in Silicon Valley where the company was founded. Security products are developed in Culver City, not far from the Santa Monica location where programmer Peter Norton wrote the original version of the Disk Operating System (DOS) in 1981 and the later set of Norton Utilities to improve system performance for Microsoft's MS-DOS. Some security program work is kept in California due to cryptography or other elements with U.S. Department of Defense export control considerations.

The India facilities, Bregman says, do some work on more than 80% of Symantec products—mostly through the captive Pune and Chennai centers, but also through outside vendors. Most engineers and programmers working for Symantec in India have five years' experience or less, owing to a combination of the company's fast ramp-up and H-1B visa difficulties in terms of bringing Indian nationals here. But he adds that the employees the company would like to recruit and bring to the U.S. "would be in the dozens, not the hundreds or thousands," and would ideally have 10 to 15 years' experience. This might include recruitment of doctoral graduates or visiting scholars and researchers at U.S. universities who are prompted under current visa restrictions to return home instead.

"The educational system and the engineering culture in India is very industrial process-oriented," Bregman explains. "When you meet with a developer team in India, the first thing they want to tell you is that they're CMM (Capability Maturity Model, an industry process capability measure) Level 5 or higher. A developer here listening to that would turn and walk away; on the U.S. side, in many cases, it's an artisan culture. Both are important. As a company we would be unsuccessful if we decided to hire only in low-cost markets. The same would be true if we restricted ourselves to hiring only in the U.S. We would not get access to the full spectrum of talent." More experienced Indian engineers bring a cultural balance between the two extremes, either through direct work experience or by virtue of overseas education and employment.

Symantec has gone through a learning curve in growing its captive centers, gradually reducing attrition by giving technical staff interesting and specialized work, increased responsibility, and real career opportunities. It has also developed strong ties with faculty at the IITs and other educational institutions. Pune and Chennai offer the multiple benefits of lower real estate and utility costs, access to specialized software talent with lower attrition rates, and growing Tier 2 customer markets. India in general offers staffing talent, cost savings, proximity to a growing source of global malware, and location in a time zone allowing 24/7 global client response.



Security software maker **McAfee, Inc.** has elevated India from a relatively minor sales and support operation, launched by predecessor company Network Associates in 1998, to a key component in the Santa Clara firm's global strategy. The McAfee India Centre in Bangalore, established in 2002, grew to 600 employees in 2006 and today totals more than 900. McAfee has committed \$80 million in new investment to India over 2006–2010; India accounts for one-third of the McAfee workforce, and the India Centre generated about 100 patent submissions in 2007. It is also credited with doubling McAfee's global margins, from 13% to 25%, over 2002–06.

The company was drawn to India earlier in this decade by the same factors influencing other companies—a need to lower costs in the depressed post-tech bubble market; access to talent in the post 9/11 visa environment; proliferation of security attacks on Windows-based PCs; and rapid demand growth for security products in the India market, particularly from the banking, insurance and telecom sectors. In addition to its captive centre, McAfee has partnered with Wipro, HCL, Infosys and TCS.

Building an End-to-End SMB Solution

A key challenge for McAfee has been to differentiate itself and grow market share in a highly competitive market dominated by a small number of large Indian distributors without strong loyalties. Until recently, Indian market interest in security has not ventured far beyond basic antivirus and firewall protection.

McAfee uses three distributors—Ingram Micro, Inflow Technologies, and Redington India—and has a three-tiered program for its approximately 400 channel partners that rewards loyalty and performance with special training and certification, increased levels of tech support, expanded product lines and other benefits. It has also pushed the concept of “proactive security,” an end-to-end security solution integrating antivirus, firewall and intrusion protection that is able to identify new viruses based on abnormal system behavior and responding quickly to segregate it.

In July 2004, McAfee added Bangalore to its network of 11 global sites to monitor threats, identify attacks, and develop software patches in response. Half of McAfee's worldwide staff of antivirus researchers already worked in Bangalore; with viral and worm attacks taking place with increasing speed, India's time zone helped complete a 24/7 response capability.

In March 2006, McAfee turned over full responsibility for six security product lifecycles—from requirements to development to customer support—to the India Centre and put programs in place to bring Asia-Pacific customers into the product innovation process. This includes a joint development program to solicit customer input in solution design, access to global development lab resources and technology, and full deployment support.



Dublin-based **Sybase Inc.** has had an India presence since 1997. Prior to that time, it had an outsourced IT relationship with HCL Technologies, dating back the late 1980s. Today, it has offices in Mumbai, Pune, Delhi, Bangalore, and Chennai, plus a captive technology development center in Pune that collaborates with the firm's other centers worldwide. Sybase develops database software solutions, focusing on internal enterprise data flow and


analysis for the financial services, telecommunications, health care, and government sectors. Among its India clients are HDFC Bank, Indian Overseas Bank, Tata Consultancy Services, the Bombay Stock Exchange, the Center of Railway Information Systems (CRIS), and AIRCEL.

Drawn by India's global IT vendors and huge developer community, Sybase has expanded its capabilities in ancillary areas such as disaster recovery, business analytics, and middleware to extend traditional customer relations, sales force automation, and enterprise resource planning functions to mobile and wireless devices.

A Sybase subsidiary, iAnywhere, holds more than 70% of the mobile database market. Another subsidiary, Sybase 365, offers short message service (SMS) interoperability and distribution of mobile content. Among its uses:

- Utility customers of Eastern Power Distribution Company of AP Ltd. (EPDCL) in Andhra Pradesh access billing information, billing and disconnection alerts, and advance notices of power shutdowns through their mobile phones.
- Users of Just Dial Services, a telephone search provider, can type in a code and access hotel, restaurant, shopping, entertainment, and other information by reply text message across 40 cities in India.

For the small and mid-sized business market, Sybase has offered its database product, including development tools, in Linux format since 1998. Using Redington India as its national distributor, Sybase also has a network of value-added resellers (VARs) in major cities. It markets off-the-shelf products to new customers through its VARs and bundled solutions to existing ones via third-party system integrators.

 **Autodesk**, the San Rafael maker of computer-aided design (CAD) software, entered the Indian market in the mid-1990s through a sales/distribution arrangement with Tech Pacific. In 1999, it established a wholly-owned India subsidiary, Autodesk India Pvt. Ltd., with three divisions—sales and marketing, developer consulting, and software development.

But it was not until 2003, in a depressed post-tech bubble economy and facing difficulties finding domestic or foreign engineering talent, that the company took a hard look at India. Autodesk vice president of global engineering and platform engineering Gary Lang says he and two of the firm's other top technologists visited India that year, scouting locations for a captive R&D center that would take over work outsourced at the time to its third party vendor, Symphony.

Pune offered lower overall costs, a traditional manufacturing focus (which was appealing because people could be found there who understood mechanical design), lower attrition and less poaching of trained staff by competitors than was typical in Bangalore and Hyderabad, as well as a high concentration of developers expert in CAD. "We saw a building in Pune that had just been built by one of our competitors, that was capable of housing a thousand people," Lang recalls. "That got our attention."

Chasing Talent and New Markets

As with other tech companies setting up shop in India at that time, cost was a part of the equation, but not a large part. “While we appreciate the price difference, that’s not why we’re doing this,” Lang stresses. “The numbers are working against us; we simply can’t hire enough people to do what we want to do.” The number of computer science majors graduated from U.S. universities has fallen 48% since 2000, he says. Many of the remaining graduates were foreign nationals in the U.S. on student visas and are now discouraged from staying on to work, under visa rules that Lang says are “policies to solve a six-year old problem that is largely going away.”

Most new product development is for global markets, so India has become an increasingly logical and attractive choice. Autodesk initially selected China for its Asia operations and today has some 1,400 employees in Shanghai, but IP considerations and a need to further broaden the talent pool have prompted further Asia diversification. India represents a sizable market opportunity for Autodesk in four areas: manufacturing; infrastructure; architecture, planning and construction; and media and entertainment. Working through its nearly 60 channel partners, the company wants to expand its customer base in these areas and also upgrade existing users to newer 3-D modeling programs.

In 2005, Autodesk acquired a firm to which it had been outsourcing some development work, and it is transitioning those engineers and programmers to become the core of the Pune center. At present, the Pune staff is about two dozen; plans to grow it to 100 have been slowed temporarily due to the current market downturn. Autodesk’s back office applications, administrative, and data center work in India remains outsourced to HCL Technologies under a five-year contract signed in 2005.

Among Autodesk’s India customers:

- Brakes India, Ltd. a manufacturer of automotive brakes for all Indian car brands, as well as for Volvo, Ford and Mercedes Benz;
- Rollcon Engineering India, a designer and builder of precision tube, pipe, and cold rolling steel mills;
- GB Engineering Enterprises, a manufacturer of boilers and components, heat recovery steam generators, and desalination plants;
- Arjun Technologies, an engineering company that builds process plants for the pulp and paper industry; and
- Anibrain Digital, a Mumbai video effects and animation studio whose credits include the Hollywood films *Highlander* and *Resident Evil: Extinction*.

In recent years, Autodesk has moved aggressively to strengthen its Indian reseller network and form new university partnerships. A 12-city roadshow in late 2007 with distributor Aditya Infotech focused on raising the firm’s value added resellers from 30 to more than 50, extending its reach into Tier 2 and 3 cities, and marketing heavily to online gaming and other media users.

Tapping the Universities

Since 2006, Autodesk has opened a Center of Excellence (CoE) in Architecture Design at the University of Mumbai's Sir JJ College of Architecture; a CoE for Innovative Design and Research at IIT-Madras, focusing on the small and mid-sized business market; a Digital Innovation Lab at IIT-Kanpur, geared to the mechanical, civil, and aeronautical engineering sectors; and a CoE for Digital Innovation, plus a research chair for design education innovation, at the National Institute of Design (NID), equipping three NID campuses with software and developing design curriculum and standards. Supporting these efforts are Autodesk's Global Student Community Portal, launched in India and four other countries in 2006 to provide free access to software, technical help and an online student/designer community.

In October 2006, Autodesk rolled out its Education Solution Sets (ESS) 2007 package of software, tools, courseware, and training for the broad academic community across India. Offered on a multi-year subscription basis, the ESS package addresses two important challenges, providing automatic updates for users while ensuring greater intellectual property protection.



VMware of Palo Alto enjoys a dominant position in the nascent market for virtualization, a software solution that enables individual or networked servers or PCs to run multiple operating systems and applications through a single interface. Virtualization of data centers can increase efficiency by 50-70%, provide immediate backup redundancy, reduce power consumption and prevent overheating. VMware cites the case of one IT services company in India that has deployed virtualization to manage a data center of 1,300 servers with an IT staff of three.

VMware, acquired in 2004 by information management and storage solutions firm EMC Corp., reportedly holds in its customer base up to 80% of the market, including all of the Fortune 100 companies, and it earned \$1.33 billion in 2007. But several big competitors, including Microsoft, Red Hat, and Symantec, have entered the market, and an open source virtualization product, XenSource, is driving down prices.

VMware established an India development center in Bangalore in 2004 and has more recently opened a second R&D center in Pune. These are part of a larger network of similar facilities in Silicon Valley, Massachusetts, Colorado, Bulgaria, Denmark, China, and the UK. The company also has India sales and support offices in Chennai, Delhi, and Mumbai. Its India workforce numbers 500 engineers and 700 total employees, serving 300 customers and working with 160 channel partners. It has relationships with the IITs in Mumbai, Delhi and Madras; the National Institutes of Technology in Trichi and Surathkal; IISc; College of Engineering and Pune University, in Pune; the National Institute of Engineering, Mysore; Birla Institute of Technology and Science, Pilani; and RV College of Engineering. It also uses Indian third-party systems integrators to leverage its product offerings.

Among VMware's success stories in India:

- Bharat Petroleum was able to consolidate 17 servers, each running separate applications, into a single integrated server, lowering operating costs and allowing easier development, testing, and migration of applications.

- i2 Technologies, a provider of supply chain management software and services to multinationals such as Best Buy, Caterpillar, Dell, and Nokia, consolidated 160 servers to 14; cut power, cooling and maintenance costs by 30%; and improved server utilization from 10–20% to 60–70%.
- Chitale Dairy consolidated 10 physical servers in two data centers to three servers at a single center; in the process, it cut hardware, software, storage, and energy costs, while lowering server deployment time from three weeks to three hours and server restoration time in the event of failure from six hours to 10 minutes.

In March 2008, VMware CEO and co-founder Diane Greene announced \$100 million in new investment planned for India by 2010, doubling its engineering workforce to 1,000 and building a new 82,000-square-foot R&D center in Bangalore. In 2007, it began an initiative to target small and medium-sized enterprises by adding two sales offices and a second distributor, as well as upgrading incentives for channel partners.



Adobe Systems established an initial foothold in India in 1997, investing \$3 million in a Noida product engineering facility with 50 employees. Unlike other software firms, Adobe did not begin with retail sales, distribution, and support; in fact, it held off doing so for several years because of intellectual property concerns—some 90% of Adobe users in India are believed to be working with pirated software.

The Noida facility grew incrementally, as Adobe shifted a growing share of its R&D work to India. In 2001, the company announced a \$10 million expansion at Noida, coinciding with the launch of Pagemaker 7.0 and, three months later, a version of Acrobat Reader for handheld devices—both developed entirely in India for global markets. Later versions of FrameMaker, Acrobat Reader for Linux, PostScript, Photoshop Album and Premiere Elements were also developed there. Over 2001–07, Adobe’s India team was responsible for more than 50 new patent filings. In 2003, Adobe committed another \$50 million to India.

Adobe’s \$3.4 billion acquisition of San Francisco-based Macromedia added 150 employees at Macromedia’s Bangalore R&D campus in late 2005. By then, the Noida workforce had expanded to 500. In 2006, the company announced plans to expand the overall workforce by another 300 people, half of them connected to establishment of Adobe’s first wholly offshore global business unit, for print and classic publishing. Another \$200 million in new investment was committed over five years, \$100 million of that for land acquisition at Noida and Bangalore. The combined Adobe workforce in India now stands at 1,200 and plans are to continue growing it to as many as 2,000. India currently accounts for about a third of Adobe’s global engineering workforce.

Naresh Gupta, senior vice president of Adobe’s print and classic publishing solutions business unit and managing director for India R&D, says the company’s five-year expansion plan is on track, and is focused in three key areas: sales and marketing within its main verticals—design, architecture and engineering, manufacturing, media and entertainment, among others; building a more robust developer “ecosystem“ for its products; and growing its engineering base to meet increasingly diverse needs.

Finding New Niches

Gupta acknowledges the difficult tradeoff Adobe has had to face between protecting its intellectual property and encouraging developers to create new applications by making its products and pieces of its platforms more accessible to the developer community. “Piracy is an ongoing issue,” he says. “We don’t have a web download; you can walk across the street and buy the software for \$2. Adobe looks at India in three ways: for captive software development, for selling our products, and for getting developers to develop applications using the Adobe platform.” Increasingly, the products for sale are tailored to verticals in key industries—manufacturing, infrastructure, education, and entertainment.

Adobe has had a network of some 40 resellers in India. It had originally used Wipro Ltd. as its distributor, but in 2008 signed with Redington India to expand marketing and sales for its print and publishing software products. Redington gives Adobe a presence in 60 cities, targeting vertical markets such as government, education, and media.

Adobe has targeted manufacturers, architects, and the engineering/construction sector in Tier 2 and 3 cities for its Acrobat 3D software. The company offers integrated packages, with engineering and design software provider Bentley Systems and with industrial product life cycle management software firm Parametric Technology Corp., that enable creation and sharing of secure three-dimensional PDF files.

On the education front, Adobe announced in October 2007 two new licensing options for its Creative Suite 3 package of 13 print, web and video design programs. The first, a K-12 School Site License, allows installation of CS3 on up to 500 primary and secondary school computers (both Windows and Mac OS), along with rights for home use by teachers, but it does not include upgrades. The license comes with a DVD offering curricula in design and production. A second, 12-month Term Site License is for college and university faculty. It includes upgrades and is linked to training and certification programs for teachers and students.

The American India Foundation has also partnered with Adobe to bring the Adobe Youth Voices initiative—a global program that encourages young people to share ideas and comment on their world through multimedia and digital tools—to 25 sites in Delhi and Bangalore as part of AIF’s Digital Equalizer program. Projects are designed to build skills in digital photography, photojournalism, animation, website development, and multimedia.

Game On

Adobe’s acquisition of Macromedia brought together Adobe’s strengths in digital print, photography and video with Macromedia’s flash technology. Adobe’s Flex open-source framework builds content-rich web applications for any browser, desktop, or operating system. Adobe Integrated Runtime (AIR) is a platform for designing web applications that run from a desktop or mobile phone. These compete with offerings from Google (Gears), Yahoo! (Widgets), Mozilla (Prism), Curl (Nitro) and others.

India is a significant early battleground in this competition, particularly in the mobile phone segment. Adobe is an investor in Mumbai-based Indiagames Ltd., which had three of the top 10 games in India in 2007—two cricket games and a Hollywood action game based on Bruce Lee. Indiagames already uses Flash in many of its games because it works across all phone brands and screen sizes. Indiagames has overseas offices in Los Angeles, London and Beijing and has developed games for Fox, Universal, and Miramax, as well as for Bollywood studios in India.

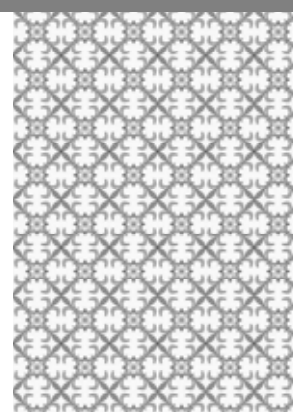
The mobile gaming market is expected to grow almost ten-fold in India over 2007–2010, from \$29 million to \$250 million. Currently, 100,000 games are downloaded daily on mobile phones in India, according to a study presented by Indiagames founder and CEO Vishal Gondal at the Mobile World Congress in February 2008 in Barcelona. Game revenues have surpassed music download revenues for some Indian mobile carriers, and games are seen as key to raising per subscriber revenues overall.

Flash, Flex, and AIR have made Adobe a cutting-edge company in the Indian market, particularly at the nexus of mobile phones and the Internet. Gupta estimates that perhaps 50,000 developers in India use Flash in their applications, with growing upside demand. He says workforce attrition at Adobe captive centers tends to be “in the single digits” and in some years has been zero; the average age of the engineering and programming staff is 27.

Through 2003, managers were recruited from Indian staff that had spent time in the U.S. on assignment. “In the last two or three years,” Gupta says, “we’ve seen resumes from people who have worked many, many years in the U.S., in senior positions with companies like Cisco or IBM, who want to come back to India. A lot of them are coming back not to be close to family, although that is a consideration, but because they believe the best growth opportunities are in India.” While all of Adobe’s global centers—in China, India, Japan, Romania, Germany and the U.S.—are growing in terms of staffing and ownership of particular products and innovation, Gupta believes that India is likely to grow faster over time, due to domestic market growth and the potential for development of emerging market innovation that can be applied globally. While work can still be done in India at one-third the cost of the U.S., the company sees its presence in India as a global business and a growing source of intellectual property: its per capita filing of patents from India is equivalent to that in the U.S.

Salesforce.com: Build it Yourself

Software firms strike a delicate balance in emerging markets, between nurturing a vibrant developer community and clamping down on developers engaging in illegal use of their software. One fast-growing San Francisco firm, Salesforce.com is building a new model in India with its software-as-a-service and platform-as-a-service offerings. With no downloadable software and no software on CDs, Salesforce.com doesn’t face the usual headaches of software piracy as it expands its reach into India.



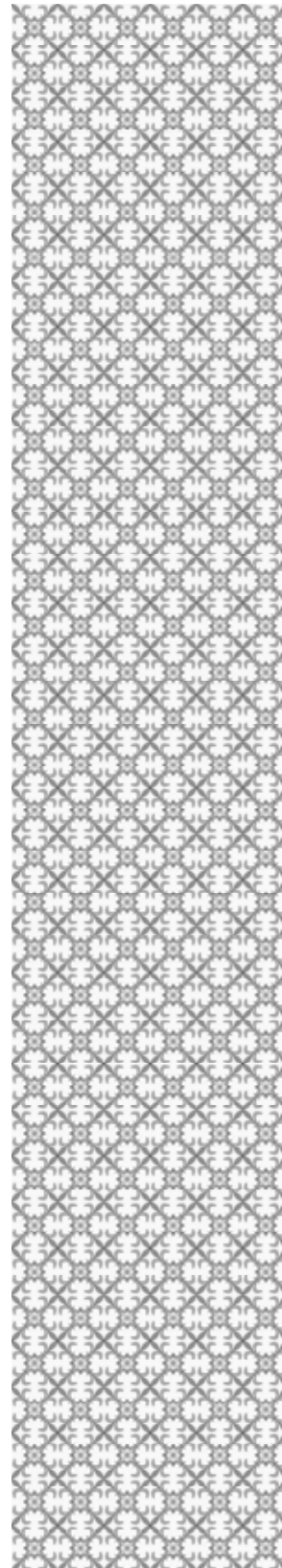
As noted elsewhere in this section, India is a challenging market for traditional software firms: there are nearly as many developers and programmers as customers; skilled technicians jump from company to company, taking knowledge and training with them and freelancing along the way; resellers play rival brands off one another to bump up the financial incentives; price-conscious business owners look first for their “enterprise solutions” from a family friend or employee’s cousin.

Large players like Sun, Oracle, or SAP frequently give their technology to government enterprises, universities, or other institutions, looking to become the industry standard in certain large niche markets and to build a critical mass of users and programmers of new, localized applications. Software firms shifting R&D and programming to India speak of “concentric circles” or “peeling an onion from the outside in,” in describing how they decide the division of labor—what portion of the work stays in Silicon Valley and what portion moves to India.

Salesforce.com has so far bypassed most of those considerations since it seriously jumped into the India market in 2006. Salesforce.com offers customer relationship management (CRM) software that businesses can access over the Internet. The software resides on Salesforce.com’s servers and can be accessed by users from anywhere in the world. This model of delivering software is referred to as software-as-a-service (SaaS).

Under the SaaS model, businesses sign up for subscriptions rather than buying packaged software, installing it and running it. The Salesforce program manages customer and sales lead data, schedules appointments, tracks projects, and generates sales performance and other analytics, all from the company’s servers. More than 55,000 companies and 1.5 million users worldwide employ the service in 16 languages. With no boxed CDs in the public realm, Salesforce.com’s code is protected. A relatively steady income stream from subscriptions replaces one-time sales and costly upgrade rollouts.

As demand for CRM and other IT services begins to spread into Tier 2 and 3 cities and among small and medium-sized enterprises in India, Salesforce.com has made inroads against traditional enterprise software providers like Oracle and SAP. Salesforce.com, founded in 1999 by former Oracle executive Marc Benioff and three partners, began selling into India through its Singapore office in late 2006. “The software-as-a-service message resonates



strongly in the Indian market,” says vice president for international development & strategy Kaiser Mulla-Feroze. “Most Indian companies have not used CRM previously. Salesforce.com gives them an easy path to upgrading their operations compared to deploying traditional software.”

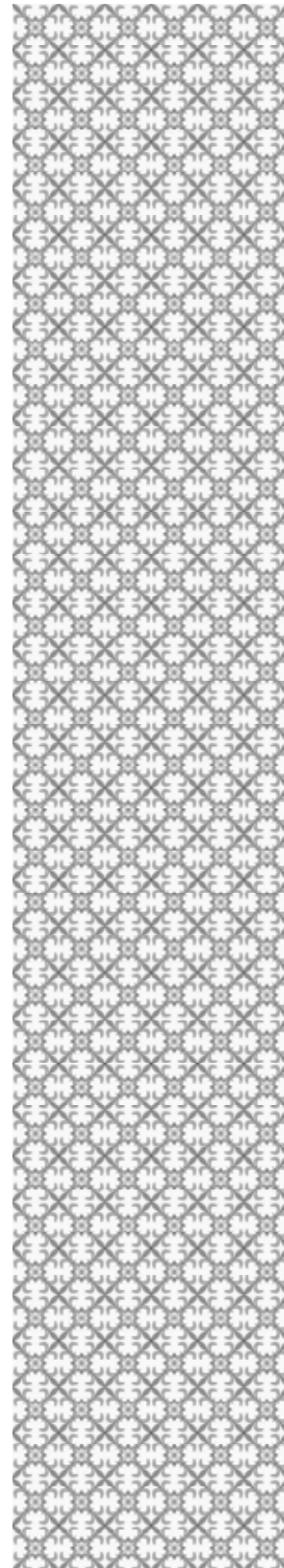
In the meantime, India has become one of Salesforce.com’s top-performing Asian markets, and the company has opened an office in Gurgaon. “It’s a volume play with lots of small and mid-size companies,” Mulla-Feroze explains as he talks about the Indian market. “Barring the biggest conglomerates and corporations, even most large companies in India would be considered mid-sized organizations by U.S. standards in terms of revenue base.” While that may be the right profile for Salesforce.com, reaching those huge numbers of customers and working with them to optimize use of the service can be a daunting prospect for any company. “That is what has differentiated us from the competition since our early days,” says Mulla-Feroze, who has been with the company since 2001. “With the software-as-a-service, subscription-based model you have to prove your worth to the customer every month.”

Salesforce.com saw an opportunity to scale up quickly through Indian IT alliance partners serving both Indian and multinational customers. TCS, Infosys, and Wipro have all integrated Salesforce.com elements into their CRM practices, and have trained and deployed hundreds of their own consultants to implement Salesforce.com solutions at customer sites.

In 2006, IT solutions provider Wipro Technologies announced an alliance under which it would offer on-demand computing, applications consulting and implementation services, lifecycle management, and support services, deploying Salesforce.com’s CRM applications and platform. Cognizant formed a similar alliance in 2007.

But CRM is only the beginning. Part of Salesforce.com’s sales pitch to customers and partners has been the ease with which they can use its platform, called Force.com, to customize the software and even build their own applications. “Traditionally, when developers build new applications, they need to invest in all the infrastructure: the hardware, the database, the application server, the web server,” Mulla-Feroze says. “Here, all you need is a Web browser.”

A few years ago, the company launched a developer network with access to discussion boards, development tools, and a directory of open source code. Users were encouraged to build their own



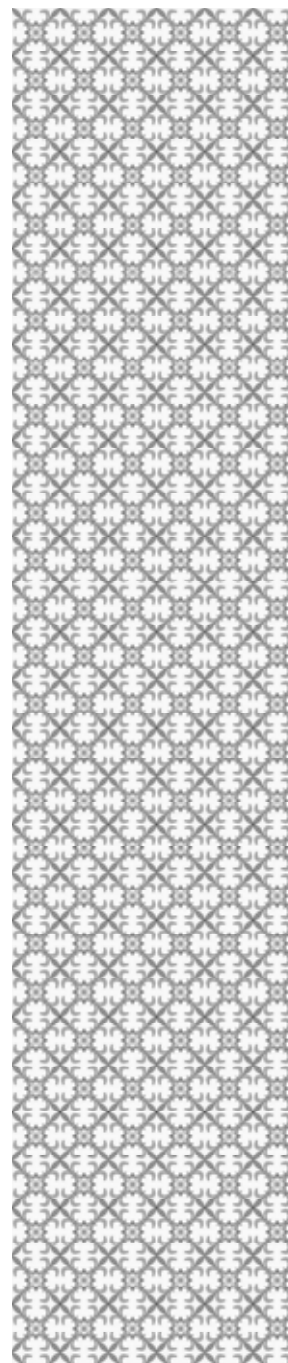
applications, and then put them up on the AppExchange, a marketplace for software-as-a-service business applications. Indian partners took them up on the offer: Salesforce.com had 70,000 developers signed up in the first year, of which 10,000 were from India, the largest number from any country outside of the United States.

New Delhi-based software firm Compro Technologies builds customized applications, integrates them with legacy CRM systems and software, and provides training, under a Salesforce.com-certified program. Theikos Inc., a Boston CRM consulting firm recently acquired by Atlanta SaaS solutions provider Astadia, has an office in Delhi to develop customized solutions with Salesforce.com technology, and it helps companies transition their CRM functions to SaaS. Astadia also develops Salesforce.com-based applications.

In 2008, Salesforce.com went a step further, enabling developers to build new applications that can work on all web-enabled devices ranging from laptops to PDAs to iPhones to public Internet kiosks to medical devices.

Students at IIT-Delhi used the Force.com “platform-as-a-service” (PaaS) for an e-government project with the Delhi municipality that was eventually localized in Hindi. IT consulting group CRMOrbit in Chennai has launched a 24-Hour Healthcare Clinic application from AppExchange that tracks patient records, test procedures, physician workload, billing, and scheduling. Other PaaS modules have included emergency room staffing, food ingredient management, expense reporting, time management, and employee compliance and training.

A number of major software firms either have shifted or are planning to shift at least part of their business to the on-demand SaaS model. Research firm Gartner estimates that the on-demand segment already accounts for 25% of the \$220 billion software industry worldwide.



Indian IT Establishes a Base in California

In many cases, Indian IT firms have had a California presence long before Silicon Valley tech companies actively looked overseas. The earliest arrivals were in the late 1980s—computer, soft-

ware, and consulting firms, some with existing relationships in the Valley—gravitating to the emerging power center of the tech world.

Some were largely job shops at first, providing Indian engineers and programmers on an outsourced contract basis by project. They coordinated on-site personnel with India staff to attack problems with large numbers of technicians working 24/7. They primarily assisted with integration and networking of legacy Oracle, SAP, Siebel, or other hardware/software systems, and later helped companies web-enable back office functions and customer interfaces. As they developed expertise across various platforms in key verticals such as finance, health care, automotive, telecommunications, and retail, they offered U.S. clients customized solutions.

Basic IT services still account for 50–60% of the top Indian players' businesses. Still, Indian IT firms have been steadily moving up the value chain— from IT/BPO services and systems integration to product development, systems management, and consulting; from isolated projects to ongoing relationships; and from basic time and materials or fixed cost/fixed timeframe contracts to more creative revenue-sharing, build-operate-transfer or other outcome-based models. Licensing of patents for new products developed through ongoing alliances has provided additional revenue streams.



Infosys Technologies Ltd. was founded in 1981 by N.R. Narayana Murthy and six partners. Its first employees were recruited from IIT-Chennai. In 1983, Infosys moved from Pune to Bangalore. Its first and most important overseas office, in Fremont, California, opened in 1987 and is now the firm's U.S. headquarters. The first Infosys overseas client, also signed in 1987, was Cleveland-based Data Basics Corp., a developer of field service, work order, accounting, and facilities management software. Infosys was listed on NASDAQ in 1999 and at that time established proximity development centers (PDCs) at Fremont and in Boston. In 2004, Infosys invested \$20 million in a high-end consulting unit launched at Fremont. With about 200 employees, the office focuses principally on client engagement.

Infosys was first to deploy the global development model (GDM) that broke up project work by location according to available capacity, cost advantage and skill level requirements—specifically, work to be done in India or another overseas location (offshore), versus at an Infosys facility near the client (nearshore), versus at the client's facility on site. GDM was, in essence, the “follow-the-sun” approach that enabled Infosys to throw the optimal number of employees at a project, across multiple time zones on a 24/7 basis, at the least possible cost without compromising quality.

Company revenues grew from \$414 million in fiscal 2001 to more than \$3 billion in 2007. The Infosys global workforce has grown from 10,000 in 2002 to 88,000 today, and with 5,000 rooms (soon going to 12,000) the company's Global Training center in Mysore is the largest such facility in the world. Its California client list has included Apple, 3Com, Hewlett-Packard, and PeopleSoft. Deal size has increased over time, with a growing number of projects in the \$100–200 million range, as well as clients spending more than \$1 million annually. U.S. clients accounted for 63% of Infosys' business in 2007, down from nearly 75% in recent years as Europe and Asia business has grown. Infosys' top 5 clients account for about 20% of revenues.

Bumpy California Roads

Infosys' California presence has not been without its challenges, as outsourced IT competition has come into conflict with older, less senior local programmers and developers expecting higher salaries; with California labor standards and tax rules; and with attorneys sensing opportunity in those discrepancies.

In 2007, Infosys paid out a reported \$26 million to settle a class action lawsuit on behalf of some 2,300 H-1B tech professionals employed in California from October 2004 through December 2007. The workers, initially solicited by a Southern California class action attorney, claimed back pay for overtime, meals, and breaks owed to employees making less than \$47.81 an hour over a full work week. The California Division of Labor Standards Enforcement had brought programmers, designers, systems analysts, and other tech professionals under state daily overtime pay rules in 2001, even as a growing share of that work began to move offshore.

Education Exchange

A Global Talent Program launched by Infosys in 2006 is beginning to reverse the offshoring trend. Following on an earlier pilot recruitment program that brought 10 U.S. university students to Bangalore in entry-level software engineering positions, the program has been expanded to include some 250 students from the U.S. and the U.K. Students are brought to the company's Global Education Centre campus at Mysore for initial orientation and training in their fields of specialization and are then placed within Infosys with salaries starting at about \$55,000 a year. A thousand U.S. graduates applied for 126 positions in the program's first year. In 2005–06, Infosys doubled its non-Indian workforce through global expansion, education, and other strategies.

In 1999, Infosys launched a global education internship program, InStep, tapping some 125 students annually from 83 colleges and universities worldwide—including more than two dozen U.S. schools, among them Cal Tech, Claremont McKenna College, UC Berkeley, Pomona College and Stanford. With access to senior Infosys management, students work on projects in enterprise solutions, corporate planning, marketing, education, research, communications, facilities, infrastructure management, health care, life sciences, software-as-a-service, finance, and more.

Airfare is paid and interns receive a variable stipend to cover living costs in the countries where they work. In India, accommodations, food and transportation are covered. Seven students from Stanford and one from Berkeley were among the 2007-08 interns; four each from Berkeley and Stanford were in the 2006-07 group. Last year, 12,000 students applied for 125 positions; 90 were selected as of mid-2007, 50 of those working in Bangalore.



Wipro Ltd., headquartered in Bangalore, grew out of the industrial conglomerate that began in 1945 as Western India Vegetable Products, Ltd. When company founder M. H. Premji passed away suddenly in 1966, Wipro's two main products were sunflower oil and laundry soap. His son, Azim Hasham Premji, then a 21-year-old computer science student at Stanford, was called home to take over the family business. This began a period of expansion and diversification.

Wipro ventured into production of soaps, shampoos, baby powder and other consumer products, as well as the manufacture of light bulbs in a joint venture with General Electric. In 1975, the Wipro Fluid Power unit was launched to make hydraulic and pneumatic cylinders.

At around that time, the government of Indira Gandhi passed the Foreign Exchange Regulation Act, which required foreign-owned firms to reduce their equity stakes to a minority position in a joint venture. IBM, which had operated in India since the 1930s, was asked to reduce its ownership to 26%. It refused and closed down operations in 1978, creating an opening for India's nascent computer and software industries. At the same time, duties on computer imports were set at 300%, creating an incentive for domestic industry to import components and assemble branded Indian computer hardware.

In 1980–81, Wipro branched into IT services and mini-computers that it built in India under license from a U.S. firm, Sentinel Computer Corp. In 1983, it released Wipro 4-5-6, a knockoff of the Lotus 1-2-3 spreadsheet/database program. In 1985, it began assembling personal computers in India for Taiwanese manufacturer Acer, eventually releasing a branded personal computer in 1986. Wipro BioMed, a business unit to market and service bio-analytical and medical diagnostic equipment, was formed in 1988, followed by a 1989 joint venture with GE Medical Systems.

Wipro began the transition from computing and software products to services in 1990, as it became apparent that tariffs would soon be reduced and the Indian market would open to foreign competition. The company added a finance arm in 1992 and was listed on the New York Stock Exchange in 2000.

An acquisition spree in 2002 netted Indian BPO firm Spectramind for \$175 million; Ericsson's India R&D centers, with 300 employees in Bangalore, Hyderabad and New Delhi; the global energy practice of American Management Services, with 90 domain experts and IT consultants and 50 electric utility and transmission clients in the U.S. and Europe, for \$26 million; and NerveWire, a Newton Massachusetts financial services IT consulting firm with 90 consultants and 40 major firms in the banking and securities sector, for \$18.7 million.

The Ericsson R&D operation, plus a series of small acquisitions in 2006 and a Motorola joint venture, WMNetServ, all positioned Wipro as a significant player in wireless chip design and network managed services. A high-end 90-nm graphics processor developed jointly with Santa Clara software startup **Ageia Technologies** for **Nvidia**, led to Nvidia's acquisition of Ageia in February 2008.

Wipro's 2007 acquisition of New Jersey-based Infocrossing for \$600 million provided Wipro with five U.S. data centers, some 900 employees, and a well-regarded U.S. brand with which to market remote infrastructure management services in the U.S.—most notably to health care and government clients. (Infocrossing served over 90 managed care organizations, processing 175 million claims annually, at the time of acquisition; over 2005–06, the Missouri State Department of Social Services accounted for 10% of Infocrossing's business.)

Wipro earned about \$1.5 million in annual revenues when Azim Premji took over in 1966. In fiscal 2007-08 it made \$806 million in net income on revenues totaling \$4.93 billion, of which

global IT services and products accounted for \$3.41 billion. Wipro employs a workforce of more than 79,000 worldwide.



In addition to well-established vendor relationships with Cisco and Oracle described earlier in this report, Wipro has a number of lesser-known Bay Area connections:

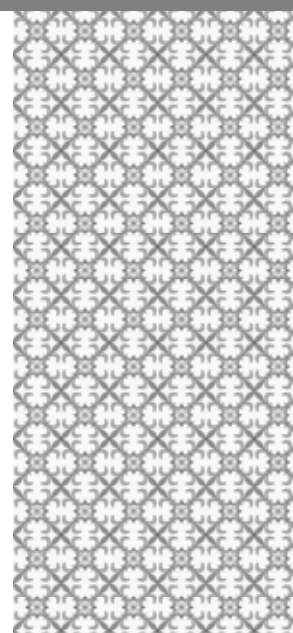
- Wipro teamed with Salesforce.com in 2006 to develop software tools, frameworks and methodologies using the Salesforce AppExchange CRM platform.
- Redwood Shores database management system vendor **Ingres Corp.** launched an open-source center of excellence within Wipro's Bangalore facility. (Ingres has also teamed with Satyam Computer for a global practice to offer open-source solutions to the retail, pharmaceutical, and government sectors).
- Spectramind call center employees in India analyzed and processed loans for Pleasanton-based **E-Loan**. (E-Loan offered customers an opt-out choice if they felt uncomfortable having the work done offshore, although processing would be slower in the U.S.; 85% opted for India, cutting E-Loan's back office costs by 60%.)
- Wipro has integrated South San Francisco-based **Actuate Corp.**'s enterprise reporting and performance management applications into its global business intelligence offering under a reseller agreement.
- **Skybox Security** of San Jose has partnered with Wipro on managed security, risk management, and regulatory compliance consulting.
- **Z Research**, a Fremont company specializing in clustering and virtualization technologies that enable high-capacity supercomputing and digital data storage (Z Research's team deployed the Thunder supercomputer at Lawrence Livermore Laboratory in 2004) has partnered with Wipro to launch the Supernova supercomputer in Bangalore that will provide data processing and storage for defense, geological mapping, biotech research, and high-end animation users.

- Wipro expanded its telecom capability by partnering with **IP Infusion**, a San Jose developer of intelligent network software platforms for Internet protocol (IP) communications equipment, to offer voice-over-Internet (VoIP), virtual private networking, and storage area networking (SAN) solutions.
- In 2006, Wipro acquired Sunnyvale business management services firm **cMango** for \$20 million, to help scale growth in IT infrastructure services through cMango's presence in the U.S., UK, Singapore, and India.
- **Tensilica**, a Santa Clara maker of configurable processors that drive systems-on-chip design, has teamed with Wipro on low-cost, high-performance biometric identification applications.
- Wipro and San Francisco-based **Embarcadero Technologies** established a joint center of excellence in Bangalore in 2004 to offer application and performance testing solutions as well as data lifecycle management tools to customers.
- Wipro uses Alameda-based **Wind River Systems'** device software optimization (DSO) technology to help device software of various kinds run faster and more reliably at lower cost. Wind River has also licensed Wipro USB 2.0 host software for its embedded solutions with clients such as NASA, Hewlett-Packard, Sony, and Honda.
- **VaST Systems**, a Sunnyvale developer of solutions that enable users to model embedded system and system-on-chip design, has licensed its technology to Wipro, with a particular eye toward leveraging both companies' offerings in the Japan semiconductor and consumer electronics markets.

\$150 Million to \$2 Billion in Six Years: Vivek Paul Takes Wipro for a Spin

In December 2008, Vivek Paul left San Francisco-based private equity firm Texas Pacific Group (TPG), where he had been a partner since 2005. Paul resurfaced in March 2009, with the launch of Akansa Capital, a "sector-agnostic" India-focused fund that has already raised seed capital and is expected to close by year-end in the \$300–400 million range.

Paul serves on the boards of Electronic Arts and Virginia-based Computer Sciences Corp., and on the advisory council of the Federal Reserve Bank of San Francisco. He is also an advisor to Stanford University's radiology and molecular imaging department and has been ranked among the top global managers by Business Week and among the world's top 30 global CEOs by Barron's.



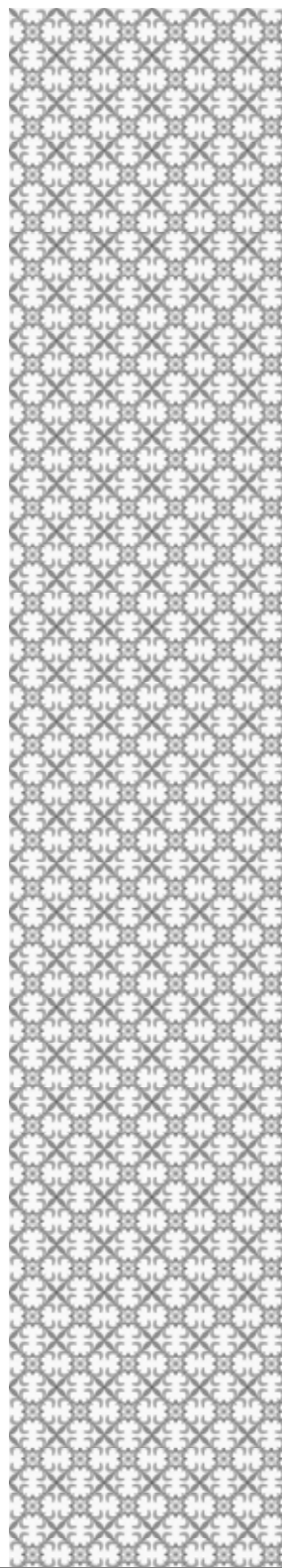
It's a long way from Pilani, in Rajasthan, where he earned his engineering degree from the Birla Institute of Technology and Science; from Boston, where he got his University of Massachusetts MBA and began a business career with Bain & Co.; and from Milwaukee where he was recruited by General Electric (GE) and spent 10 years, ultimately heading the firm's global CT scanner equipment division until 1999.

One of Paul's first assignments with GE in 1989 was to travel to India, meet with computer manufacturers, and set up a medical equipment product engineering joint venture. GE wanted Indian engineers to help design a "jukebox" image storage and retrieval system. The contract went to Wipro. Ten years later, Wipro CEO Azim Premji came back to Paul with an offer of his own: take over and grow Wipro's global IT, product engineering, and BPO services business.

"I took the job," he says, "but I told him that I was not coming to India. Instead, I came to the Bay Area. If Wipro was going to become one of the top global tech companies, being an exporter was not good enough. I came here to be with other leading technology companies, to understand these companies as customers."

Paul launched a series of acquisitions—NerveWire in financial services, AMS in energy and utilities, the Ericsson R&D centers in telecom—aimed at expanding capacity in key verticals, and aggressively capitalized on existing expertise in automotive and electronics. Wipro Technologies grew under Paul's direction to a nearly \$2 billion company with a global network of 50,000 employees. He remained based in Mountain View, making frequent trips to Bangalore and communicating with his workforce through video-conferencing, email, and an internal website.

Paul credits India's focus on IT, software, and BPO with transforming its economy as well as its place in the world and its self image: "Tech was this little spark of hope for India," he says, "where people began to think 'We can do this, and we can do it as well as anyone else in the world.' Tech companies became champions, flying the flag globally, and that changed the country's mindset. In the past parents dreamed that some day their son would join the civil service and retire as a bureaucrat. Tech drove a change in expectations; after a while they were dreaming that some day their son would become a tech entrepreneur. Today, across the board, in every segment," Paul adds, "it's all about hope."





Tata Consultancy Services (TCS) is the largest Indian IT firm, with more than 110,000 employees in 47 countries and \$5.7 billion in revenues for fiscal 2007–08. It is part of the Tata Group conglomerate that spans sectors including steel, automobiles and trucks, tea, chemicals, and luxury hotels (including Taj Hotels, which owns the Campton Place Hotel in San Francisco).

TCS began in 1968 as the Tata Computer Centre, to provide computer services within the group. Its first outside project was in 1974 and by 1980, TCS and another Tata firm accounted for 63% of the \$21 million Indian software export market, at the time made up of 21 firms. In 1984, TCS set up operations in a Mumbai export processing zone.

Today, TCS has 42 North America offices, 35 of them in the U.S. Its North America workforce totals more than 14,000. American Express, Microsoft, media research firm The AC Nielsen Company, Roche, and General Motors are major clients. In addition to regional offices in San Francisco, Santa Clara, San Diego and Irvine, one of the nine TCS innovation laboratories—focusing on new media and entertainment technologies—is located in Burbank. Since 2000, TCS has had a joint relationship with UC Riverside’s Bourns College of Engineering, funding collaborative R&D in the area of data management, computer security and networking.

Among its Bay Area activities, TCS has:

- made available through an affiliate laboratory the EKA supercomputer in Pune—the fourth fastest and only privately-funded supercomputer in the world—to Yahoo! Inc. for cloud computing research;
- upgraded and integrated Agilent Technologies’ internal applications/database and customer service functions into a consolidated, 24/7 network reaching 19,000 employees across 110 countries;
- replaced and upgraded legacy IT; centralized sales, inventory, leads and expense functions; and expanded web-based capabilities for McGuire Real Estate, at the time (in 2002) a \$1.35 billion seller of luxury real estate in the Bay Area, based in San Francisco and employing some 2,500 people; and
- initiated a strategic alliance with Salesforce.com, using Salesforce’s AppExchange to develop call management solutions that extend the Salesforce service and support capability.

TCS has also expanded its R&D capabilities through specialized strategic alliances with research laboratories, startups, venture investors, large independent software vendors, and users worldwide. These global talent clusters, which TCS calls “ecosystems,” are part of the overarching TCS Co-Innovation Network (COIN), which has a Bay Area presence and relationships with a wide range of small and mid-sized specialty tech firms. (More detail on COIN and its underlying strategy is provided in the *Knowledge Investment* section of Chapter 7.)

In March 2008, TCS opened a \$20 million delivery and software development center outside Cincinnati aimed at winning defense, aerospace, and government contracts. Most of this work

can only be done by U.S. citizens or green card holders. The 200,000-square foot facility will accommodate a workforce of 1,000, most of them local hires. One floor is a segregated facility for export-controlled work; the remainder will serve existing TCS contracts with Nielsen and with U.S. banks.

HCL Technologies: India's Homegrown Hewlett-Packard Diversifies

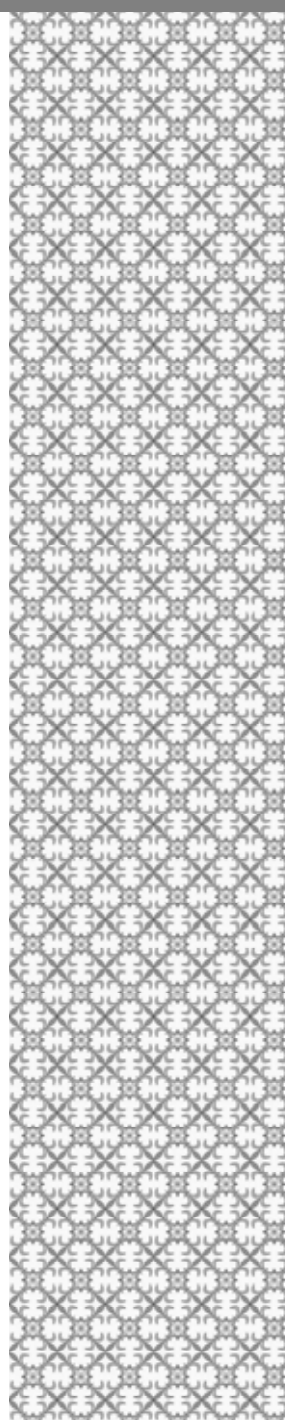
It's the well-known Silicon Valley garage startup story, except in India. Shiv Nadar was an executive with Delhi Cloth Mills (DCM) in 1976, shortly after the Foreign Exchange Regulation Act was passed. DCM was a diversified industrial company and Nadar worked in the electronic calculator division. Sensing opportunity in the market, he quit his job and, with Ajai Chowdry and four friends, formed Microcomp Ltd. in Noida to design and manufacture the Micro2200 scientific calculator.

Within a year, as it became apparent that IBM and other multinational competitors would soon be raising the local ownership stake in their operations or leaving India, Microcomp expanded into the microcomputer business with investment from the six founders and a 26% equity ownership by the Uttar Pradesh state government. The company was renamed **Hindustan Computers Ltd. (HCL)**.

Entrepreneurial Expansion

In 1980, HCL launched Far East Computers in Singapore to market computer products in Asia and in 1981, HCL introduced a 16-bit processor computer. HCL pioneered relational database management, networking, and client-server solutions in the Indian market in 1983. Liberalization of computer technology imports in the mid-1980s opened India to personal computing. HCL launched its own Unix-based BusyBee brand PC and formed HCL Office Automation to provide business IT and network solutions. In 1987, it was India's largest company by revenues.

With SCI Systems as its manufacturing partner, HCL acted on advice from McKinsey and briefly entered the U.S. computer market as HCL America, headquartered in Silicon Valley. As the first Indian IT company to start a U.S. company, HCL was making a bold move, but when the market collapsed for minicomputers soon after, HCL changed course, applying its Unix capability to consulting.



According to Yogesh Vaidya, one of HCL Technologies' founders and HCL America's first CEO, the company's first U.S. systems integration and consulting client was Sybase, and most of their engineers were HCL contract employees. Next came HP, and other tech firms with Unix systems followed. At the time, Vaidya was managing 200 engineers in the Bay Area.

In 1991, HCL formed a joint venture company, HCL HP, with international computer giant Hewlett-Packard (HP) and made a technological leap by developing manufacturing expertise in India for HP's RISC/UNIX based business servers and workstations. HCL HP Ltd. gave HP an India sales channel for its products, outsourced a share of HP's R&D to HCL in Noida, and developed joint business solutions.

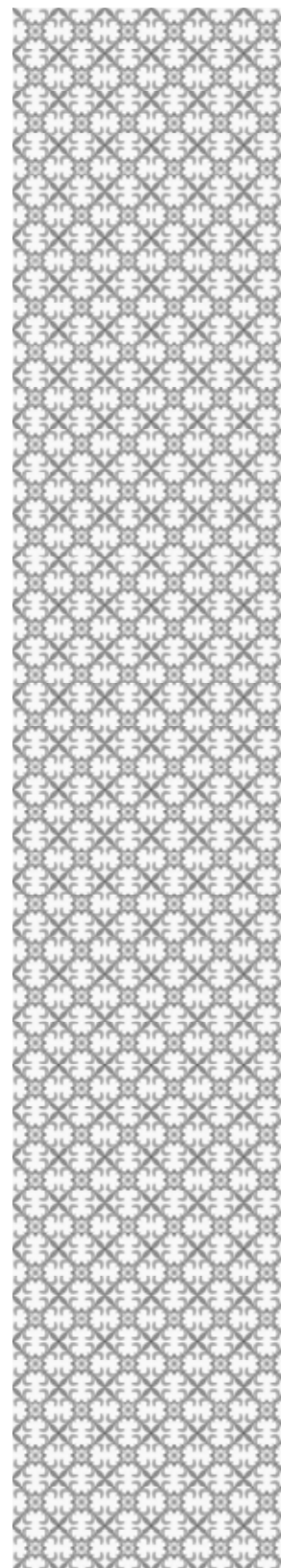
When the joint venture with HP ended in 1996, HCL Technologies was formed by merging an HCL Consulting unit with the R&D division of HCL HP Ltd. Consolidation continued, reducing HCL's 40 subsidiaries to 5 by 1998. Going into the Y2K period, the company remained heavily weighted toward hardware and product engineering R&D, while other Indian firms were moving increasingly into enterprise software and IT solutions.

HCL tried to catch up in IT services through further streamlining—including the sale of its share in a joint venture with Perot Systems and the acquisitions of British Telecom and Deutsche Bank captive centers. Five divisions became two: HCL Technologies (global IT services) and HCL Infosystems (hardware and network solutions for the India and Asia-Pacific markets).

The Next Level

But the most dramatic restructuring within HCL came in 2005 under a new president, Vineet Nayar, and became the subject of case studies by Harvard Business School (2006) and the University of Virginia's Darden School of Business (2008).

Nayar, an MBA graduate of Xavier Labour Relations Institute, Jamshedpur, joined HCL in 1985 as a senior management trainee. In 1992, he formed an IT infrastructure and networking business unit, HCL Comnet, to bid on a government project to create an electronic stock exchange; HCL won the bid and the exchange was up and running by 1994. Nayar grew HCL Comnet to 1,000 employees, with contracts in 11 countries, and HCL Comnet was eventually folded into HCL Technologies.

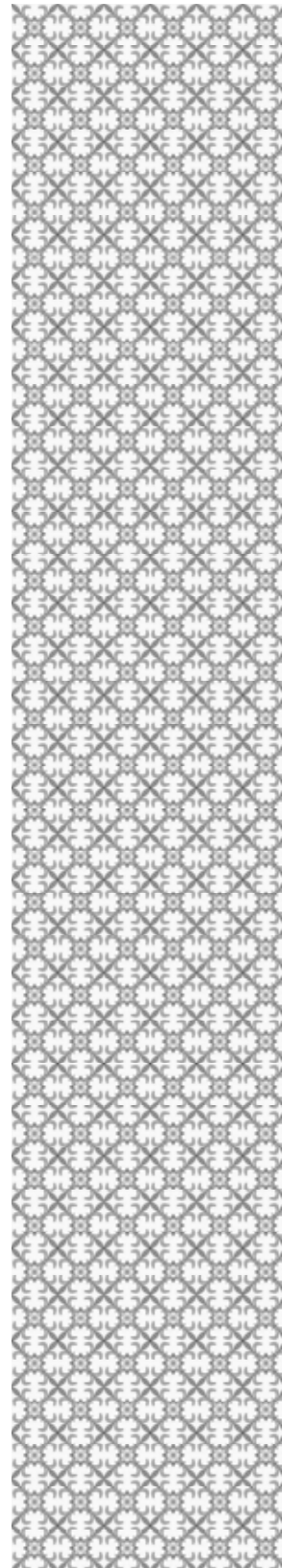


Nayar accepted the position of HCL Technologies president in April 2005, on the condition he could run the firm his way—as an entrepreneurial, cutting-edge company. As part of a new strategic direction, the firm:

- reorganized around five business lines: Tech and manufacturing, life sciences and healthcare, media and entertainment, retail and telecommunications, and financial services;
- moved up the value chain, turning down individual projects of less than \$1 million and actively pursuing large multi-year, multi-service partnerships, through a new Multi-Service Delivery (MSD) unit made up of HCL's 200 best engineers;
- shifted more broadly from “volume” business—mainly project work billed on a time and materials basis—to royalty and outcome-based revenue sharing “value” arrangements offering a steady revenue stream over time;
- abandoned highly competitive, increasingly low-margin business segments in favor of relatively untapped, uncontested markets referred to within the company as “blue oceans”; and
- adopted an “employee-first” approach internally, aimed at improving the customer interface by engaging and supporting employees through expanded internal communication, team building and career incentives.

HCL's first large deal was with a Bay Area firm: a five-year, \$50 million contract with Autodesk, under which Autodesk outsourced its applications and data center infrastructure—storage and data management, software configuration, technical support, and database administration—to HCL. Earlier, HCL had signed a 2003 multi-year co-sourcing agreement with AMD to manage and maintain AMD's IT infrastructure and applications.

A \$330 million co-sourcing deal with leading European consumer electronics retailer DSG International followed in January 2006. Creative pricing was key: HCL offered full visibility into its unit pricing structure and included cost reduction and productivity guarantees. Later that year, HCL signed long-term IT consulting, applications development, and infrastructure management agreements with



Boston automatic electronics test equipment supplier Teradyne (\$70 million) and with Toronto-based electronics contract manufacturer Celestica (\$100 million).

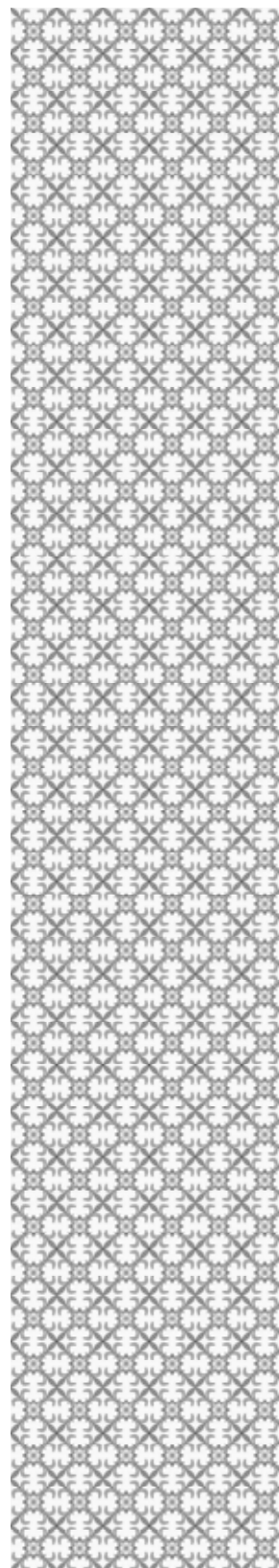
The Celestica deal was unusual for the time—a fully-integrated, concept-to-manufacturing (C2M) joint venture aimed at reducing time to market and costs across the product concept, design, engineering, manufacturing, fulfillment, sustaining engineering, and after-market services stages. More recent contracts using this same approach have been signed with New York IT management software firm CA Inc., as well as with Merck & Co. and Boeing.

HCL partnered with Cisco Systems in February 1996 to set up the Cisco Offshore Development Centre in Chennai. Beginning with 30 engineers, HCL helped develop Cisco's interoperability software (IOS) and network management products. In February 2006, Cisco licensed the technology behind one of its network management products to HCL, giving HCL full ownership of product engineering going forward and a share of the revenues. Today, HCL has more than 1,700 employees dedicated to providing outsourced and partner services to Cisco.

"We've had a very positive relationship with Cisco that has matured to a place where we've started doing some very innovative things with the business model," explains HCL senior vice president and head of hi-tech and manufacturing Sandeep Kishore. "They've said, 'We trust you with our core product.' At that point we're not dependent simply on putting x number of people on a particular job. We are now improving the product design and doing it more efficiently, we now reduce risk while adding value, and we have therefore moved to a revenue share, royalty-based model."

Like its Indian competitors, HCL aims to become a global company. Overseas acquisitions and partnerships therefore figure prominently in HCL's growth strategy and in its goal of developing end-to-end competence in key industries. The February 2008 purchase of Capital Steam, a U.S. company offering lending automation services for North American commercial banks, strengthened HCL's position in the commercial and retail finance market and gave HCL more critical mass in the U.S.

In July 2008, the company entered into a global systems integration contract with Bay Area software developer VM Ware to deliver virtualization lifecycle services aimed at improving efficiency and reducing power consumption in the deployment of IT services.



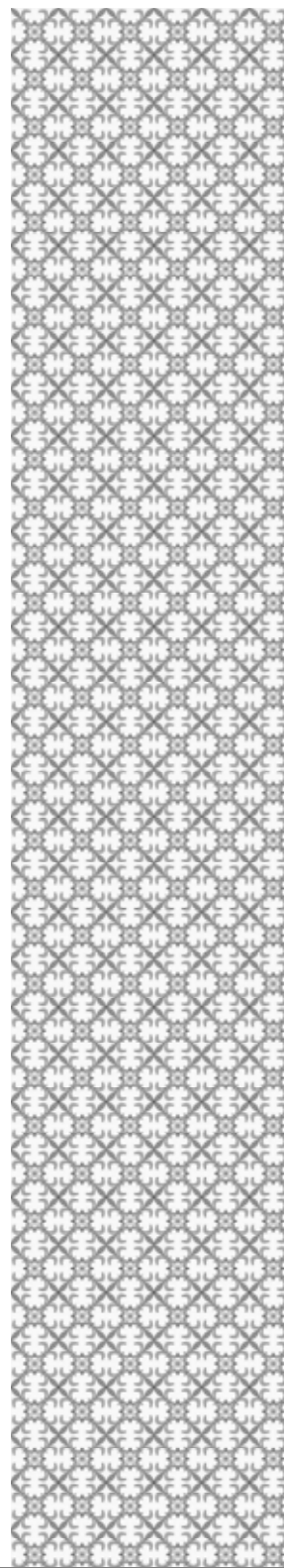
Besides Cisco, Autodesk, AMD, and VM Ware, other leading Bay Area clients and partners include BEA Systems, KLA-Tencor, Spansion, Juniper Networks, and the Franklin-Templeton Group.

In December 2008, HCL acquired Axon, a UK-based leading provider of implementation and support services for SAP enterprise software. The combined entity is now the largest SAP implementation firm in the world, further adding critical mass and additional customers in the U.S. Also in 2008, HCL broke ground on a 500-seat data center in North Carolina. Starting with clients from the defense and aerospace sectors, it will eventually serve clients from all of HCL's key verticals.

Speaking in his office in Noida, general manager for marketing Krishnan Chaterjee lays out an ambitious goal to have 50% of the company's services three years from now coming in service areas not being offered today. He points out that to reach that goal, the company must accelerate the shift from low-end services (wage arbitrage) to high-end IT consulting. In the end, he says, the "value-volume strategy" of just hiring more people to ramp up value (the old Indian model) will fail, requiring a strategic shift from customer/vendor relationships with clients toward collaboration and partnerships.

While "Silicon Valley and Bay Area companies have always been the pioneers in coming up with new models of engagement and are the first to go out and try new technologies," Kishore says, "the center of gravity has been shifting—it used to be in the 408 area code, but now it's in Finland or Bangalore. Constant innovation is the only way to keep going."

In 2007, HCL announced plans to open five new technology centers across India employing 100,000 professionals over the next 5–7 years. The first, which opened in Noida the same year, will employ 15,000 professionals focused on home entertainment, media, publishing and content delivery technologies. Following the strategy to develop specialized capability in select industry verticals, the next two centers, in Bangalore and Chennai, will focus on financial services and life sciences, respectively. With a global workforce of 57,000, HCL Technologies earned \$1.8 billion in fiscal 2007-08, 56% of that in the U.S. where it employs more than 3,000 people across 21 offices in 15 U.S. states. Its U.S. headquarters in Sunnyvale has a staff of about 450.



A Training Spinoff



In the early 1990s, as HCL America tried to crack the U.S. market, the new HCL unit had quality problems with the technical, language, and other skills of some of engineers coming from India. In response, then-CEO Yogesh Vaidya formed and later spun out a training company, **Software Technology Group (STG)**, to improve the Indian engineers' technical and business skills.

Over time, STG also began training laid-off U.S. engineers for software jobs and established an authorized education center for Microsoft. Today, Vaidya remains CEO of STG and divides his time between San Jose and India, where he has established more than 100 "Final Touch" training centers for Indian engineering graduates at Tier 2 and 3 schools to prepare them for global software positions.

Vaidya points out that while graduates of India's Tier 1 and Tier 2 engineering schools rank with the best in the world, many others lack the soft skills to be employed by global companies, a critical gap also identified by McKinsey Global Institute. Tapping into a major market, he expects 300 training centers to be operational by 2010. STG has also begun offering English language training for graduates wanting to work for multinationals, as well as a six-month intellectual property protection program with the University of Washington, designed for technologists, with courses remotely offered from the U.S. to classes in New Delhi, Mumbai, Bangalore, and Chennai.

While India has enormous resources, Vaidya doesn't see a time when Silicon Valley engineers will lack for jobs. "The real innovation takes place here. The problem is that not enough people here are going for engineering careers."

Not All Indian Outsourcing is Indian



Dan Easterlin and John Simpson, working in very different areas of the Bay Area enterprise software sector, saw a potentially lucrative niche in IT outsourcing services for the insurance brokerage industry. They seized the opportunity in 2005, launching San Carlos-based **Patra Corp.**

The two men had worked together years earlier at a software services company acquired by Ceridian, and they then crossed paths again at Ask Jeeves. "We were both tired of working in software and IT services, where there was a constant drive for sales without any real sensitivity to the customer," Easterlin says. In his nearly 4 years at AAA, he had learned about auto insurance from the carrier side. Simpson had run an Internet IT support system for large skyscraper construction projects where insurance certification of subcontractors was critical.

They saw a potential niche in providing insurance brokers with IT and outsourced staffing support for certain time-consuming back office tasks with high error rates, such as: certifying that contractors have proper insurance coverage to lease property, hold events, operate equipment, perform specific work, etc.; loss run orders (obtaining a prospective customer's record of prior

claims from the current carrier); and policy verification. Brokerages often create separate desks for these activities, with entry-level employees performing such functions all day, typically by phone. The work is tedious and turnover is high.

Patra began as a virtual company, working with a U.S. outsource firm based in Los Angeles, Encore India. Patra acted as an interface, marketing specialized outsourced services to insurance brokers throughout California. An onsite U.S. team would collect information about the customer's work processes, prepare standard forms and document templates, and create training materials and procedure manuals. They would then go to Encore's India center in Vizag (Visakhapatnam), 200 miles north of Chennai in Andhra Pradesh, and work with the outsource firm to train staff.

Encore was initially chosen in part based on price due to its location in a Tier 3 city. But Vizag was also attractive for its scenic beauty on the coast, new roads and broadband fiber optic networks under construction, proximity to three universities—two of which offered MBA programs—and thus a large talent pool relative to the work available locally. These were important factors in reducing attrition.

Patra (an Indian word that has evolved in meaning over centuries to mean leaf, parchment, legal document and, finally, certificate) was additionally offering day work that was a draw for women who needed to be home in the evenings. "There were no jobs like this before in this city," Easterlin says. "The competition created for this type of back office work has been huge. We've only lost a couple of people leaving to take better jobs in another city." Most attrition, he says, has been due to arranged marriages, as wives move away to live with the groom's family according to tradition.

Most Indian recruits were qualified college graduates, often MBAs eager to learn about how financial services are provided in the U.S. Staff were assigned to small teams, each specific to a particular client. Supervision was both onsite and via phone and videoconference with the U.S. Contact with U.S. clients and insurance companies was "invisible," via email and remotely accessing internal networks to exchange and process information with no phone contact. Documents were formatted as they would be in the U.S., on company letterheads and standard forms, and delivered via fax or email. Patra offered 40%+ savings in operational cost, fewer errors, 24-hour service, and printing and mailing of documents from the U.S.

Over time, Easterlin and Simpson felt they could improve both efficiency and long-term loyalty by managing the Vizag workforce themselves. In mid-2007, Patra bought out the contracts of the approximately 50 people employed by Encore and set up an Indian entity, Patra (India) BPO Services, as its own captive center. Patra took control of direct management and work hours, brought employees to the U.S. for additional training, introduced pay incentives, redesigned workspace to emphasize client team collaboration, and encouraged employee input.

In the first year after it opened the new center, Patra's client list grew to 25 and its workforce expanded to more than 125, bucking the trend among small captive centers to shrink or close.



Calibrated, another outsourcing company with Bay Area connections, followed a somewhat different model. The company was started in the U.S. by three partners—Arjun Bhagat, Mark Broido, and Madha Vijayan—based on their experience as co-founders of RMSI, company that produced software for the insurance industry with technology licensed from Stanford. RMSI had successfully established a captive center to support back office work.

When RMSI was sold, the three partners devised a hybrid model—to effectively outsource captive centers. The idea, as CFO Mark Broido describes it, is to create something that looks and feels like your own Indian office, but minimizes the problems of long-distance management: “It’s the difference between saying ‘we’re going to outsource to India’ and ‘we’re going to open an office in India.’” It helps companies come to India, set up operations, and lease the infrastructure they need. Calibrated’s human resources department recruits staff, and senior management oversees the operations. The resulting center then bears the client’s name, and operates as a joint venture in which Calibrated shares equity.

Broido notes that the goal of using third-party vendors (where clients lack control) for back office operations is traditionally to save money, while Calibrated’s goal is to build assets. A small company by Indian standards, Calibrated’s work mostly focuses on data processing, such as collections and claims processing.

Asked how the Calibrated’s business model helps create value, Broido cites a partner whose business is debt collection. Since coming to India, the company has created a new portfolio of debt in the \$200–700 dollar range. In the past, there was no market for debt under \$700 because of the cost of collecting. Now, because the company can afford to call and follow up, collection is possible and a new market exists. While Calibrated’s operations are entirely in India, the company is managed by Bhaghat, Broido, and Vijayan from their homes in Menlo Park, La Jolla and Venice Beach.

A Tough Time for IT

In recent years, India’s major IT companies have seen average annual growth of up to 40%. But earnings have slowed with the world economy, as tech spending is cut back and the global credit crisis has impacted banks and financial institutions that are among their biggest clients. Companies such as TCS and Infosys are lowering their revenue forecasts, even as business is shifting from smaller BPO firms to larger companies.

Infosys reported net profits 28.5% for the year ending in March 2009, and an increase in full-year revenues of 30%. Much of that, however, reflects a rupee depreciation from 40 to the dollar to around 50 (90% of Infosys’ client business is in the U.S. and Europe). The company offered guidance for a 3% to 7% year-on-year revenue decline in 2009–2010. Wipro, which earns 46% of its revenue from the U.S. and has a larger share of its client base in financial services, has also experienced a slowdown.

Global Reach

A major casualty of the current market environment—and of its own internal governance—was Satyam Computer Services. In January 2009, Satyam chairman B. Ramalingu Raju admitted to accounting fraud, inflating assets and understating liabilities on Satyam's balance sheet. This followed a World Bank announcement declaring Satyam ineligible to bid on procurement contracts for eight years, due to alleged payment of kickbacks and incomplete billing documentation. In April 2009, Tech Mahindra offered the winning bid to acquire 51% of Satyam.

The industry hopes for a 32% growth rate in 2009-10, thanks in part to a one-year extension of a tax holiday on software exports that had been scheduled to expire in March 2009. In the meantime, falling rupee-denominated costs can be expected to improve operating margins. NASSCOM projects that Indian IT companies could reap as much as \$47 billion in contracts from global enterprises in 2009, based on the need of companies hard hit by recession to cut IT budgets through outsourcing.



E: Architecture/Urban Planning/Infrastructure

Key Findings:

- India's property boom has moderated with the downturn, but demand remains strong.
- CalPERS and private equity have invested aggressively in India's property market.
- Development has focused on mixed-use planned housing/commercial complexes.
- Planning regulations have the effect of discouraging density and promoting sprawl.
- Site control is critical to project viability; India has no eminent domain.
- Foreign architects are limited to design, master planning, and landscape architecture.
- Bay Area firms team with Indian developers and bring branding power to projects.

Market Environment

India offers a largely untapped market for foreign architectural design and engineering firms, as well as for planners, developers, and builders, and it is at the nexus of several favorable trends:

- sustained economic growth;
- higher living standards and expectations among returnees and the growing middle class;
- infrastructure pressure as rural populations migrate to Indian cities;
- a growing focus on land use and environmental planning relating to urbanization;
- facilities investment related to offshoring by multinationals; and
- global investment capital pursuing emerging market returns from more stable asset classes.

A 2007 paper by UC Berkeley's Fisher Center for Real Estate and Urban Economics, "Globalization and Real Estate: Issues, Implications, Opportunities," notes that, since the 1990s, globalization has transformed real estate, traditionally viewed as a sector heavily reliant on local expertise and dealing in fixed, relatively non-tradable assets.

Investment in U.S. real estate, either directly or through trusts or various securitized financial instruments, has long been a fairly straightforward process. It is only recently, however, that many countries, particularly emerging markets, have relaxed licensing, taxation, and ownership barriers that have discouraged foreign participation in property markets.

Architectural, engineering and construction service firms have followed as U.S. multinationals have shifted manufacturing and distribution facilities, data centers, and R&D centers overseas. That shift, in turn, has generated residential and commercial property demand, serving communities of expatriates, returnees and an emerging professional class.

India has, to a degree, benefited from these global trends and, while impacted by the current global slowdown, is positioned for further gains. Like other aspects of doing business in India, land development and planning have their own complexities.

Regulatory Hurdles

Former World Bank urban planner Alain Bertaud (working as a consultant to the Bank in 2002–03) analyzed India's land use and urban planning regulatory framework and cited regulatory hurdles as some of the key factors that affect urban development.

India's 1976 Urban Land Ceiling Act, in effect until 1999, required that land parcels beyond a certain size that were left vacant beyond a specified time period must be declared surplus and sold back to the government, typically at below-market prices, to be banked for "public" use. A number of states also adopted similar statutes that are still in effect. Over time, these laws have restricted the supply of vacant land, driven up prices, prompted urban sprawl, and encouraged corruption in the allocation and development of "surplus" properties.

Strict rent control laws prohibit redevelopment or renovation of buildings until tenants voluntarily move out. Changes in land use—particularly in cases where farmland on city peripheries is to be developed for urban uses—require lengthy approvals, even when allowed under existing master plans, which results in the creation of pockets of "dead land."

Master plans perversely place tight restrictions on building floor size index (FSI), also known as the floor-area ratio (FAR), in the central business districts of cities like Mumbai and Bangalore. Ostensibly, this is done to limit congestion, but it also insulates municipal governments from having to fund major water, power, transportation, and other infrastructure improvements that would accompany higher density and urban growth. No distinction is made between commercial and residential buildings in determining the FSI.

A low FSI restricts the height and footprint of buildings, forcing up costs per square foot to developers and tenants. Indexes in Indian cities are generally below 2, compared with a range of 5 to 15 in most urban centers worldwide (downtown New York is 10–15; downtown Seoul is 8–10). The practical effect of a low FSI, plus large government and institutional landholdings kept off the market, has been to drive new development further out to the periphery of Indian cities, adding to sprawl and pressure on infrastructure.

Among the other difficulties facing new development:

- Urban master plans are often ignored by developers and politicians.
- High stamp duties for the transfer of property discourage transfers and encourage buyers and sellers to under-declare property values which, in turn, depresses collateral value for purposes of obtaining construction financing.
- A property tax structure based on actual rents rather than appraised land value creates a disincentive to develop.

- Minimum plot size rules for private developers affect the economics of multi-unit residential projects and planned communities.
- Land subdivision regulations build into subdivisions excessive rights-of way, set-asides, and open space plots that are rarely or never used.
- Property boundaries are often unclear, and property records are poorly maintained.
- The absence of an eminent domain mechanism makes it difficult to consolidate land parcels—particularly farmland on the outer edge of cities—for the creation of large, planned developments.
- Where projects are developed through government procurement, multinationals tend to submit realistic bids, while bids from Indian companies may be less so. If the Indian companies subsequently underperform, however, they are less likely to be criticized than multinationals. To avoid that risk, foreign companies often pass on independent bids and choose to participate as subcontractors.

Urbanization and Density

With a high proportion of its population still living in rural areas, India is facing a massive wave of urbanization in the coming decades. The U.N.'s *World Urbanization Prospects* report projects that nearly 200 million Indians will move to cities between 2007 and 2025. Other estimates, by the World Economic Forum and the Confederation of Indian Industry, suggest that by that year, India will have more than 13 urban centers with populations of more than 10 million. This comes on top of massive urban growth in recent decades. India currently has more than 40 cities with populations of more and 1 million, and it has 25 of the world's 100 fastest growing cities. Between 1950 and 2007, Mumbai's population grew from 2.8 million to 18.9 million; Delhi grew from 1.4 million to 16.6 million residents; Kolkata went from 4.5 million to 14.8 million, and Bangalore grew ten-fold from 700,000 people to nearly 7 million. Greater Mumbai has a population density of 27,000 people per square kilometer. At its center, Mumbai packs 101,000 people into a square kilometer, much of it slums.

Massive urbanization, built on already shaky infrastructure, poses major urban planning and sustainability challenges for India's cities. Nationwide, 70% of Indian households have no more than two rooms, and 40% of households with nine or more members have one or two rooms. Accommodating future growth alone—including replacement housing but with no change in the current housing backlog and no significant quality improvements—would require construction of some 4.7 million new housing units by 2030 and in excess of 6 million if the current trend of shrinking household size continues from 5.4 persons at present to the 4–5 range. Indian lender HDFC estimates India's total housing shortage at 20 million units, and Deutsche Bank places it at anywhere from 20–31 million, based on differing industry and government analyses.

Indian cities have grappled with a steady migration from rural villages since the 1950s. The combination of low-density development and large areas of vacant, government-held properties have lent themselves to squatters erecting makeshift shacks in empty lots and buildings, along drainage

ditches and railroad tracks, and on river banks. Using figures from the last 10-year census, minister for housing and urban poverty alleviation Kumari Selja reported in 2007 that the number of Indians living in slums more than doubled from 27.9 million in 1981 to 61.8 million in 2001. The trend has accelerated as rural/urban income disparities have widened and construction of affordable public housing has not kept pace with migration.

About 55% of Mumbai's population—some 11 million people—are slum dwellers, compared to 40% in Chennai and as many as 70% in Delhi. Mumbai is home to one of Asia's largest slums, Dharavi, where nearly 1 million people with their own informal economy and property market, inhabit one square mile. Another 300,000 occupy lands outside the city that are part of the city's airport. Significantly, these communities survive with communal water taps, public toilets and pirated electricity, and they pay no taxes. The government collects 100 rupees a month per hutment in rent, as a way of halting extortion of rents by criminal gangs.

Dharavi sits dead center in Mumbai, served by two railway lines and directly across a stretch of mangrove swamp from the 370-hectare Bandhra-Kurla commercial complex, with 12 million square feet of office and tech park space.

Relocation Strategies

Municipalities, states, and the central government have responded with alternating and often conflicting clearance, improvement, and relocation strategies. A 1981 eviction of Mumbai "pavement dwellers"—beggars, street vendors, cycle-rickshaw drivers and laborers living in sidewalk shanties—prompted the landmark Olga Tellis case, ending in a 1986 court ruling that the constitutional right to life included the right to a livelihood, and that the pavement dwellers chose to live where they did to be close to work, so that forcing them to move would deprive them of their livelihoods. The court ordered that they could not be moved without being provided with alternative accommodation.

More recently, as Indian cities have become more affluent, environmental protection and tourism promotion have emerged as competing priorities. In 2000, after a five-year court battle initiated by an environmental group to protect wildlife in the Sanjay Gandhi National Park in Mumbai, the city bulldozed 73,000 squatters' shacks on the park periphery in a mass eviction resulting in four deaths. Today, some 69,000 families occupying government land in Chennai and 75,000 camped along the banks of the Yamuna River—the largest tributary to the Ganges and one of the world's most polluted rivers, where Delhi dumps 57% of its waste—are targeted for relocation.

In May 2008, the 33-story, 202-room, five-star Four Seasons Hotel opened in South Mumbai—the first such hotel to go up in South Mumbai in 20 years - a reflection of the scarcity and cost of hotel rooms of any kind throughout India. The Four Seasons opening concluded a seven-year planning and construction process requiring 165 permits and relocation of slum dwellers who had previously occupied the property. The remainder of the slum remains in place nearby. The hotel ended up costing \$100 million to build (about \$500,000 per room), but is seen as a model for future redevelopment of Dharavi and the airport slum. Bangalore, meanwhile, has plans to replace 542 slum areas with multi-unit housing through a combination of state money and special

grant funds to help disadvantaged castes and tribes, with temporary relocation of slum residents to transit camps while buildings are constructed.

Relocation, even with the promise of new housing with clean water and electricity, has faced resistance: slum dwellers pay minimal or no rent and are not subject to tax or business regulation; configuration and use of hutment space is flexible. At least 60% of residents must agree to relocation unless they are evicted as part of a government-sponsored project, and there has been mixed support at best for most redevelopment schemes. A second question is where so many people can be physically relocated. Planning theory normally holds that slums be relocated from the urban center where land is most in demand and valuable, to the city periphery. But density restrictions in the city centers have also pushed new development outward, so that metropolitan areas in India simply keep expanding, creating new centers and increased demand for infrastructure and services.

New buildings, business parks, and campus complexes are built in the absence of connecting roadways, mass transit, and reliable water or power. Blackouts are common, requiring nearly all major commercial buildings and facilities to invest in their own backup generation. The fact that developers and owners often provide their own services, independent of public grids, in turn dilutes the critical mass of customers needed to expand those grids and services to meet future demand. Infosys Technologies, for example, spends \$5 million annually on buses, minivans, and taxis to enable its workforce of 18,000 to commute to and from its facilities in the Electronics City office park outside Bangalore. Electronics City has its own dedicated water and power supplies. (An excellent survey of urban planning issues in India can be found in the Worldwide Fund for Nature's 2009 report *The Alternative Urban Futures Report: Urbanization and Sustainability in India*.)

Foreign Investors Step In

As mentioned previously, India faces a total housing shortage in excess of 20 million units; its tourism secretary has predicted a shortfall of 100,000 hotel rooms through 2010. Urban office space throughout India totaled about 60 million square feet in 2007 (New York, by comparison, had 400 million square feet); 25 million square feet was in Bangalore alone, and 9 million of that had been built in 2006.

In its 2009 Real Estate Investment report, Cushman Wakefield India estimates nationwide demand for new residential housing at 7.5 million units for the 2009–2013 period—85% of that in the affordable and mid-market segments. Demand for commercial office space is projected at 196 million square feet, including 43 million square feet of retail. Most of this development (60% of housing; 40% of office space) will be concentrated in India's seven largest cities—the National Capital region (New Delhi and its surroundings, Mumbai, Bangalore, Chennai, Pune, Hyderabad, and Kolkata)—with Bangalore topping the list for both retail and commercial demand and Mumbai expected to see the highest demand for housing.

Foreign direct and portfolio investment have flowed in since early 2005 to help fill the gap. Previously, foreign ownership participation in real estate properties and development projects was restricted, except for hotels and for planned communities of more than 100 acres. In February 2005, rules were relaxed to allow 100% foreign participation in any construction/development venture

involving more than 25 acres of land area or 50,000 square meters (about 538,000 square feet) and a minimum capitalization of \$10 million for wholly-owned subsidiaries and \$5 million for joint ventures with Indian partners.

India's tax structure represents a continuing obstacle to direct investment: various taxes add up to 45% of project costs. Commercial leases are subject to service tax. These taxes, combined with high borrowing costs, add to purchase and lease costs in a market already hard-hit by a speculative bubble.

India's real estate market is estimated at about \$12 billion, with a growth rate of 30–40% annually since 2005. Though expected to slow in coming years, growth should remain at a still-healthy 12–20%. That growth expectation assumes sustained economic growth; urban migration of 2.5% of the population annually; a safe legal framework for property owners, developers, and investors; a growing India presence among multinational corporations; and a population with a median age of 24 years and rising disposable income.

Increased wealth and rising expectations have led to sustained demand for middle-income housing, typically in large complexes or planned communities linked to commercial and industrial development. Difficulties relating to land acquisition and commuting make the linkage between work—particularly in the IT/software sector—and workforce housing attractive for developers, businesses, and residents.

Green is Good



Environmentally-friendly development has taken hold in India. LEED certification for buildings and planned developments carries important cachet. One catalyst for green development has been the **CII-Sohrabi Godrej Green Business Centre** in Hyderabad, a public-private center for green building excellence opened in July 2004 by the Confederation of Indian Industries (CII), Godrej & Boyce Manufacturing Co., and the Andhra Pradesh state government. The 20,000-square foot Centre, itself a LEED Platinum facility, serves as a clearinghouse for green building best practices, helping companies meet the standards established by the National Building Code in 2005. The focus is on best practices and a cadre of consultants is paid to assist members on issues such as energy conservation. The Green Business Centre was designed based on a USAID-funded CII visit to San Francisco and Oakland in 2000, and is currently working with Lawrence Berkeley Laboratory on green buildings and cool roofs.

More than 25 million square feet of certified green building space has been developed since 2003, with more than 80 projects registered under the LEED rating system.

About \$6 billion in global private equity investment had flowed into Indian real estate funds as of mid-2007, including approximately \$3.5 billion from the U.S. Yet only about \$1 billion was actually invested in 2006, with a comparable amount in 2007. It is possible that too much money is chasing too few viable deals, as slow economic growth in the U.S. turns investors' attention toward emerging market growth potential. Rising land, regulatory approval, labor and raw materials costs, along with fears of overbuilding in certain market segments, have prompted a slower, more cautious approach among investors.

Real estate investment trusts (REITs) floated in Singapore have become popular as a means for landholders to derive shorter-term returns on their assets in a market with a relatively low cost of capital.

Recent investment has focused on equity stakes in listed or pre-IPO Indian property development firms rather than specific projects, since the Finance Ministry, Department of Industrial Policy and Promotion (DIPP) and the Securities and Exchange Board of India (SEBI) clarified rules for foreign institutional investors (FII) and foreign venture capital funds. To prevent speculation, foreign investment in development companies is treated as foreign direct investment (FDI) rather than portfolio investment, with minimum financial commitments and lock-in periods.

Investment has concentrated on 22 realty firms, emphasizing development in housing, retail, and IT parks. Indian firms such as DLF Ltd., Unitech Ltd., and Oberoi Construction, which are already holding large portfolios of property bought earlier at favorable prices, are particularly attractive; so are developers with expertise and reach into Tier 2 and 3 cities. Banks such as HDFC and ICICI, that are active in the mortgage segment, have formed respective joint ventures with Citigroup and Portman Holdings, and with U.S. developer Tishman Speyer. Hong Kong, Singapore, Dubai, and European investors compete aggressively in the market.

Non-resident Indians have more than \$3 billion parked in tax-free rupee and foreign currency accounts with Indian banks. Gradually, as opportunities open up, they are shifting that money to equities, bonds and property. NRI ownership of non-agricultural property in India—through purchase, inheritance, or gift—is now allowed without restriction, with sale proceeds and rental income fully repatriable.

India had a total 110,000 hotel rooms nationwide at the end of 2006, a comparable number to New York City and a tenth of the rooms available in China. The result—at least until the November 2008 terrorist attacks at two hotels in Mumbai and the current downturn—has been fully booked hotels in Delhi, Bangalore, and Mumbai, with rates of \$500 per night or more not uncommon. Many hotels operated at higher than 100% capacity in 2008, at times checking one guest in within hours of checking another out, and charging both for the same day.

The tourism ministry expects 140,000 more rooms to be added by 2010, although industry estimates are somewhat lower. Developers have pressed Indian Railways to privatize operation of its Yatri Niwas budget hotel chain and free up more of its large landholdings for new tourist-related development. They have also urged government to release more urban public land at auction, to ease prices in the market.

Special economic zone (SEZ) development has been popular, especially as part of or in combination with planned communities that offer workers housing and amenities within walking distance of home. Since the Special Economic Zones Act took effect in February 2006, some 370 zones have been approved, nearly 260 of them related to IT services and software. The zones offer export-oriented tenants duty-free treatment for inputs, concessionary loans, and exemption from income, service, sales, and alternative minimum taxes. Developers receive exemption from customs/excise duties, income tax, alternative minimum tax, dividend distribution tax, central sales tax and service tax.

Global credit tightening and rising inflation in 2008 slowed growth, especially in the housing market, where prices had jumped 25% in 2005 and kept rising. Lenders, meanwhile, are struggling to put in place the credit evaluation, title due diligence and collection infrastructure to accommodate unprecedented mortgage demand. Recently, planned IPOs have been cancelled and expected REIT listings withdrawn. Property prices in India's large cities fell 25–30% over late 2008 and early 2009 but, more recently, developers are reporting price increases of 15–30% from these lows as demand returns.

It is in this context that Bay Area architecture, construction and urban planning firms have entered a dynamic and complex emerging market.

Bay Area Connections

Roughly one-fourth of the California Public Employees' Retirement System (CalPERS) \$600 million investment in India at the end of 2007 (see the *Bay Area Connections* section of Chapter 7) was in two real estate investment funds: \$100 million in the IL & FS India Realty Fund launched by IL & FS Investment Managers, the private equity arm of India's Infrastructure Leasing and Financial Services, Ltd.; and \$50 million in the SUN-Apollo India Real Estate Fund, a joint venture between Indian family-owned diversified business conglomerate SUN Group, and U.S. property investment group Apollo Real Estate Advisors.



The initial IL & FS India Realty Fund (IIRF) was among the first to seek real estate investment funding in the U.S. Originally structured to raise \$300 million, it was oversubscribed and closed in June 2006 with \$525 million, including investments from CalPERS and the Oregon Public Retirement Fund. The IIRF has targeted a range of property market segments in India, including office, retail, condominiums, integrated townships and special economic zones. San Francisco-based **Presidio Partners LLC**, founded in 2003 by members of the Banc of America LLC Real Estate Private Equity Group, was the exclusive representative for the initial IL & FS fund. A second IL & FS fund closed in late 2007, raising another \$578 million.

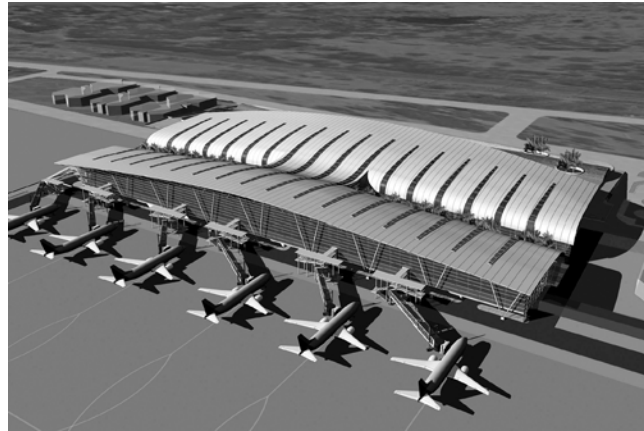


San Francisco architecture/design firm **Gensler** decided in 2006 that it needed to be in India, as many U.S. clients such as Legg-Mason, UBS, and Goldman-Sachs had been expanding their presence there. Managing principal Daniel Winey says the firm first contacted Indian interior design and space planner Space Matrix, using them as architect-of-record in India. (Foreign architecture firms are required to work with Indian counterparts beyond the design drawing phase in a project; Indian firms typically take the completed design drawings and work with developers from that point on, preparing final construction drawings and assisting with permits as needed.) While development opportunities for foreign architects are ample, India has started to generate its own high-end architectural firms such as **Morphogenesis**. Leading Indian firms have a growing client base that makes working as executive architect with foreign firms less attractive and is spurring intensified competition.



Gensler is a participant—along with San Francisco landscape architects **Hargreaves Associates**, New Delhi-based Creative Group, and lead architectural firm Frederic Schwartz Architects of New York—in the expansion and modernization of the Chennai


International Airport. The \$300 million project's sustainable design will increase capacity and improve security and circulation through a wing-like design centered around two landscaped gardens. Terminal and garage roofs are designed to capture and store rainwater for airport use.



Winey says Gensler is also “short-listed” to design a 10 million-square foot mixed residential, office, and commercial project, to be developed by DLF Ltd., and is in project discussions with the Reliance Group and an India REIT managed by Warburg-Pincus. The firm is exploring several new projects this year with top-tier clients, though Winey adds that “a week doesn’t go by when we don’t get maybe ten requests for proposals in India.” Gensler takes a cautious approach in evaluating the viability of project proposals, working primarily through introductions from trusted partners, clients, and contacts. Among the lessons Winey says the firm has learned, in part from its China experience: “If you don’t know the client, stay away. Even if you know the client but they’re not one of the majors, stay away. And if you don’t know the person at the top, you don’t know anyone.”

One important gain for Gensler growing out of its India relationships, he notes, has been the discovery of design talent. A new majority-owned joint venture with about 15 people will open soon in India as a Gensler office and is targeted to become a global design studio for the firm, producing drawings, modeling, and computer animation. Winey expects 10–15% of Gensler’s total business to shift overseas within a decade. As in China, he anticipates that the India joint venture will increasingly become a distinct “local” entity in its staffing and pursuit of new business.

But there will always be advantages to remaining connected to the Gensler knowledge network worldwide, he says, and a “follow the sun” model works well for projects in emerging markets like India, where project cycle time—from start to approvals—is typically three months and requires multiple architects with multiple specializations working around the clock.

 **Skidmore Owings & Merrill** (SOM) partner Gene Schnair points to a satellite photo of the project site for a planned community, Pioneer Park, in Gurgaon. Much of the site is farmland that has to be acquired from individual small landholders in one-acre plots that had been given to them by the government years ago, and, despite official government

support, there has been no eminent domain to help jump-start later stage negotiations or keep costs down. A road bisecting the site cannot be moved due to perpetual easement rights of a nearby village. While plans are on the drawing boards for a metro line, modern transit service does not yet extend from Delhi out to Pioneer Park, a 15-mile trip. Nor does utility service—the project will have its own dedicated water, sewage treatment, and electricity service.

Indian developer Pioneer Urban intends to build a new, sustainable urban community on the 75-acre site, including high-rise residential towers with 3, 4, and 5-bedroom condominiums, a hotel, a high-end shopping complex, and a 10-acre park with sports fields and clubhouse facilities. Designs call for an ecological community incorporating co-generation and centralized utility services to reclaim energy; use of local materials in buildings and landscaping; and structures ranging from 4 to 49 stories that induce cooling breezes and provide shade to public spaces. It is SOM's first master planning project in India, although the firm is well-established in India through its New York office.



Schnair says the juxtaposition of old and modern India can be jarring, with office parks and hotels co-existing with slums, small farms, or vast empty spaces next door. He shows a slide, part of a larger presentation, of a multi-use office, retail, and residential complex that appears to sit in the middle of nowhere, self-contained. There is a campus feel to such projects, which are designed to emulate the look and feel of suburban communities in the U.S—in particular, Silicon Valley.

Clearly, the idea is first to create livable communities in which people live close to where they work and second to build at higher density in order to provide more landscaped open space and amenities within each project. But where development is placed is often driven by where land can be acquired, not by how developments connect and interact with one another and with the urban core nearby.

To date, Schnair says, SOM has focused on planning projects where a partner is not required and it can do a greater share of the work. Most of that work is done through offshore entities for tax purposes, although SOM has an onshore entity in India that can handle certain bids and back office functions. The firm uses local partners to help with specific code, permitting, and other regulatory matters. Schnair says government master planning is often rudimentary, frequently leaving Indian planners and architects in uncharted territory when it comes to dealing with large complex projects such as planned communities. An absence of government direction and an orderly public review process increases uncertainty.

Add to this a shortage of qualified Indian architects as partners; 86 architecture schools in India, of varying levels of quality, turn out between 3,000 and 4,500 graduates annually—far short of the number needed to meet long-term demand. In addition, a 2007 survey by HR consultants E2e Business Solutions put the attrition rate for architecture firms at 50% for the entry level. All of these factors create opportunities for foreign firms, Schnair explains, but given that fees for Indian architects and planners are 25–30% of those paid to SOM, “clients really have to want SOM.” Among the firm’s other India projects are:

- a 75-acre special economic zone (SEZ) with a combined 8 million square feet of office and industrial space, built in conjunction with the 85-acre Maytas Hill County integrated township near Hyderabad;
- the Jet Airways headquarters building in Mumbai; and
- Unitech’s Santa City project, for which SOM will design replacement housing for 22,000 slum dwellers (a task involving master planning, new housing prototypes, and a team of sociologists and anthropologists working with slum residents).




Three Bay Area firms are among ten global architecture and design consultants hired by Unitech for its ambitious \$3 billion, 347-acre Unitech Grande project along the Western Expressway in Mumbai. **HOK** is designing the floor plans, while San Francisco-based **EDAW Inc.** and Sausalito-based **SWA Group** will serve as landscape architects. The project is to feature 12 residential towers, with 100 acres of themed gardens, plus shopping, restaurants, theaters, and recreational facilities.


HOK is also designing the residential and social amenities zone for a Mahindra Group new township project in New Chennai, Mahindra World City. The 50-acre project features 750 residential apartments along with retail and recreational facilities. A joint development of the Mahindra group and the Tamil Nadu Industrial Development Corporation (TIDCO), it has three sector-specific SEZs for information technology, auto ancillaries, and apparel and fashion accessories.


Finally, HOK is preparing the master plan for a 10,000-acre hill station—a term from the British colonial era to describe the hill towns where colonial officials moved to escape the heat and humidity of the lowlands—Lavasa, located between Pune and Mumbai. The new community will be roughly the size of Paris and is the vision of Ajit Gulabchand, managing director of Indian engineering and construction firm HCC.



 With funding support from the U.S. Agency for international Development (USAID), Palo Alto-based nonprofit **GeoHazards International** (GHI) is working with the Delhi Public Works Department, Ministry of Home Affairs, and National Disaster Management Agency to assess and retrofit seismically vulnerable structures, focusing initially on five buildings: the Delhi Secretariat, Delhi police headquarters, Guru Tegh Bahadur Hospital, Ludlow Castle School and the Office of the Divisional Commissioner. It has brought facilities managers, structural engineers and liquefaction experts from the Bay Area to Delhi to analyze problems and has hosted Delhi Public Works engineers in Palo Alto for training. Once assessments are completed, USAID provides funding for retrofitting by locals.

GHI has had an office in India since 2005, but first became involved in India in 2001, by invitation from USAID after two major quakes in the 1990s. Since then, the group has specialized in bringing the Bay Area's experience and expertise in earthquake engineering to India. It raised funds from two NGOs—Volunteers for India Development and Empowerment (VIDE) and The NGOs Kobe (now Citizen's Overseas Disaster Emergency or CODE)—to identify seismically unsafe school buildings in Ahmedabad, Baroda, and Surat. GHI and an Indian disaster preparedness organization, Sustainable Environment and Ecological Development Society (SEEDS), evaluated 153 schools and made recommendations to authorities for reducing risk. It has assessed earthquake risk and proposed siting and construction solutions to local officials in Shimla City, a city of 700,000 in the northwestern Himalayas, built in hillsides with slopes as steep as 70–80 degrees.

 San Francisco engineering firm **URS Corp.** is assisting the UK Department for International Development with resource planning and integration of government services delivery in Himachal Pradesh, where 91% of the population of 5.1 million lives in rural areas, relying mainly on the state's forests for their livelihood. In March 2005, URS signed a memorandum of understanding with Tata Consulting Engineers (TCE) to pursue projects worldwide. The two firms also partnered, along with W. G. Yates–Desbuild Joint Venture, to build the \$81 million U.S. Consulate complex in Mumbai, India.

 Privately held **Bechtel Corp.** of San Francisco came out of the Dabhol power plant litigation in 2005 (see *Dabhol: The Mother of All Cases* in the *Legal Services* section of this chapter) with \$145 million in compensation and a positive reputation. Bechtel continued to advise the plant's new operators after disposition of the case, and went on to bid in 2006 on five new power plant projects favored by the Central Government.

As early as 1990, Bechtel was working in India with metals and energy group Essar Global Ltd. on two projects: a \$120 million plant to manufacture iron pellets for export to the Middle East and Southeast Asia, and a \$700 million plant in eastern India to convert bauxite to alumina for export.

The firm has had an ongoing relationship with Reliance Industries Ltd. (RIL), involving two large refinery projects in Jamnagar in 2000 and 2005. The first refinery began with a capacity of 450,000 barrels per day, accounting for downstream activity totaling \$26 billion in 2001—one-sixth of India's economy and one-third of its refining capacity that year. It eventually expanded capacity to 650,000 barrels per day. Continued expansion will produce a refinery complex the size of London that doubles capacity to 1.2 billion barrels per day, including clean fuels. The

project has involved 2,800 professionals, working in 19 offices across five countries, and 70,000 construction workers.

Bechtel has also worked with Reliance on the K6–D6 Gas Project, a subsea gas development project in the Bay of Bengal involving 22 wells in water up to 4,000 feet deep, 22–25 miles offshore; seven pipelines routed up the Nilarevu River; and an onshore gas terminal south of Kakinada to receive and process gas for shipment by pipeline to Mumbai.

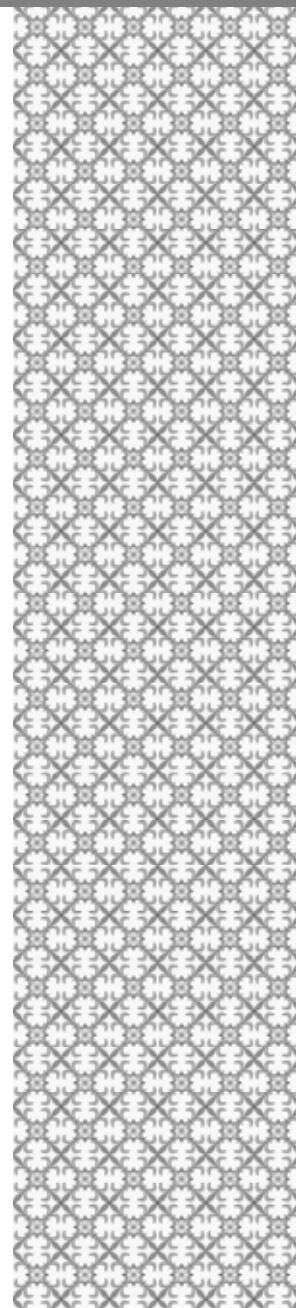
Nanocity: A Sustainable Urban Vision

Sabeer Bhatia likes simplicity and accessibility. Those two principles have guided his work as a technology entrepreneur, as an angel investor and, in the last several years, as visionary and development partner behind the 11,000-acre Nanocity project in the Himalayan foothills between Delhi and Chandigarh.

Born in 1969 in Chandigarh, Bhatia attended the Birla Institute of Technology and Science (BITS), Pilani, but left before finishing when he qualified for a transfer scholarship to Caltech in 1988. “When I came to the U.S. for an education, my first goal was to get my undergraduate degree and go back,” he recalls. “But by the time I got it, I found I wanted to study more.” In the course of pursuing a master’s degree in electrical engineering at Stanford, he took a class in business for engineers and came face to face with Silicon Valley.

“We were introduced to entrepreneurs who presented case studies for Apple, Sun, and Harvard Graphics and told us what motivated them to start,” he says. “They were to us like actors; they were role models—revered.” Bhatia also shared a lab at Stanford with Yahoo! founders Jerry Yang and David Filo. “I was on the path to earn a PhD, join the academy, and become a research scientist. Instead I went to Apple and worked for a year.”

He then jumped to FirePower Systems, a firm formed in 1993 by employees from Apple spin-off NeXT Computer Systems to build business workstations based on the same IBM PowerPC architecture that ran Apple computers. FirePower quickly found itself in direct competition with both Motorola, which designed and supplied Apple’s chips, and an ascendant Intel Corp. By 1995, it was becoming clear that Intel was winning the commercial micro-processor war. At the same time, emergence of mouse technology and the graphic user interface of the World Wide Web held out



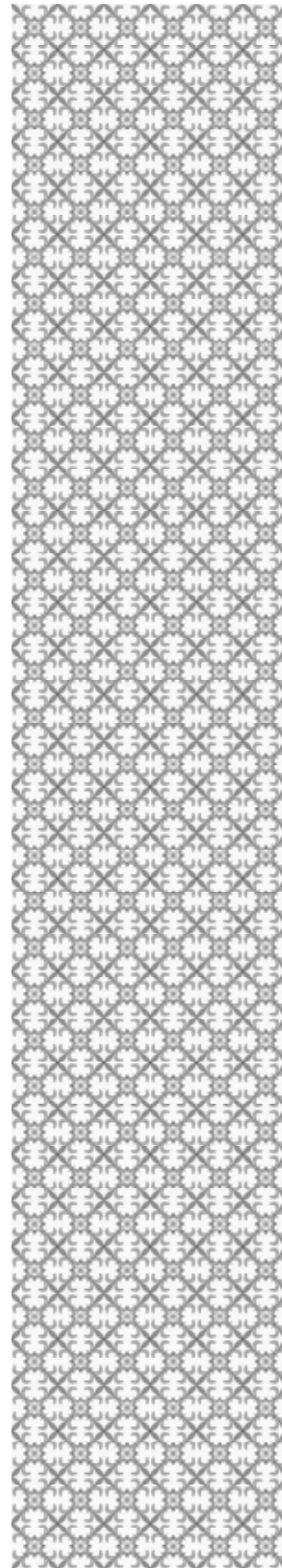
new promise for e-commerce, ubiquitous business applications, and communications.

Bhatia and colleague Jack Smith spent nights and weekends developing an Internet-based version of the database software program Filemaker Pro. “The Internet had the same interface no matter what kind of computer you were using,” Bhatia says. “We looked at the simplicity of the point-and-click interface, and instinctively felt it was going to be used by a lot more people.” As Bhatia and Smith worked on the Javasoft database program, they became increasingly frustrated with available email options—Bhatia on a restricted Stanford system and Smith paying high charges to America Online. So they developed their own, email network (dubbed HoTMaiL, for email in an HTML format) and put it up on the Web for free, under an advertising-driven model. Draper Fisher Ventures contributed \$300,000 to the startup. After six months, Hotmail had 1 million subscribers. In December 1997, when Microsoft bought Hotmail for \$400 million, it had 11 million users. Today it has 480 million.

Bhatia has since taken his basic philosophy a step further with several startups:

- Live Documents, a free Web-based service that replicates via flash technology Microsoft Office word processing, presentation, and spreadsheet applications without using any Microsoft code;
- Navin Communications, a Web-based voicemail provider;
- Telixo.com, a service allowing users to upload and sync contacts, notes and appointment calendars from their computers to a remote handheld device via text message prompts; and
- SabseBolo.com, a free web-based teleconferencing service.

He characterizes the Indian market as having a pyramid-type structure, with a minority of people at the top—India’s new rich and emerging middle classes—with money and a taste for the latest lifestyle trends and products, but who work long hours and have very little free time in their day; and a majority at the bottom—maids, drivers, laborers, farmers—with little money and more time. “The only way to get mass adoption of technology in developing countries,” he says, “is to make it free and generate revenue through advertising or some other type of service, on the simple



premise that all of these free users are one day going to become economically viable.” Beyond that, Bhatia says it is important to apply hybrid business models that appeal to and tap the disposable incomes of affluent users (by emphasizing time-saving convenience) and the fashion-conscious, aspirational youth market.

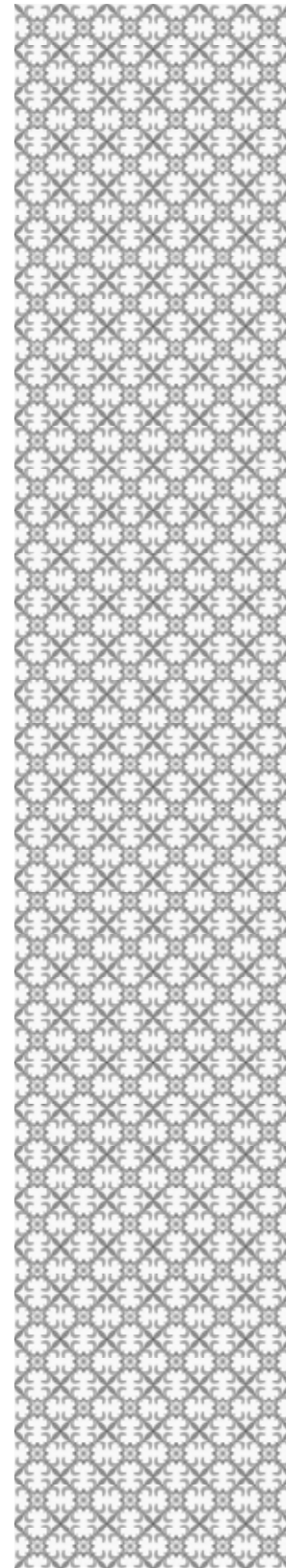
Just as simple accessible technology can make people’s lives easier and more fulfilling, so can a city that connects its residents through that technology, enables them to easily walk or take public transit to work, produces and conserves its own reliable energy and clean water, and accommodates urban professionals and rural villagers side by side. The Nanocity project, in India’s Haryana State, is the embodiment of Bhatia’s vision.

A joint venture of Bhatia’s Nanocity Developers (itself a public-private partnership of the **Bhatia Group** and the Haryana state government) and Parsvnath Developers has so far committed \$300 million for land acquisition. Up to \$1.5 billion more will be needed for infrastructure build-out alone on what is now farmland in the Panchkula district of Haryana. Seven existing rural villages, the largest with 4,000 residents, will have to be accommodated, as will construction workers who will need to be housed at the site.

Bhatia envisions a modern, sustainable, fully-wired community dedicated, like Silicon Valley, to innovation and the creation of intellectual property in software, materials, and pharmaceuticals. Half of the land is committed to parks and open space. Urban structures will be built to greater density, combining commercial development on the lower floors with residences above in four districts—IT, University, Airport and Biotech—that emphasize business, culture, trade and tourism, and basic research.

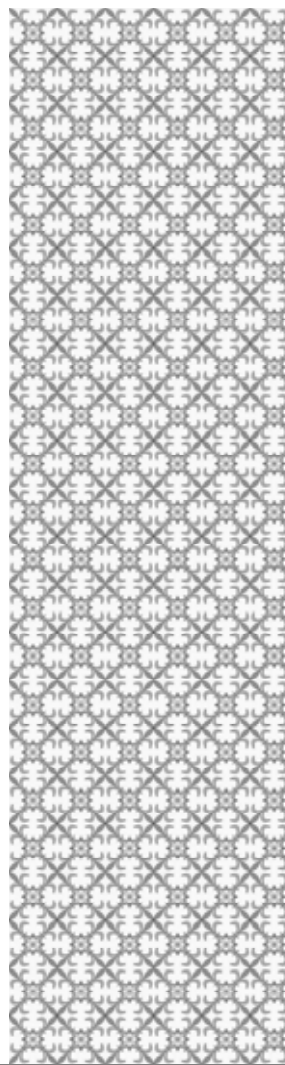
Rain harvesting, wastewater treatment, and green building design will provide much of the city’s water supply; energy will come from a combination of surplus hydropower from neighboring Himachal Pradesh state and renewable solar, wind, and biomass sources. Buildings will be designed to utilize sunshading, cross-ventilation, and other cooling techniques to reduce energy consumption. A public transit grid, special lanes for two-wheelers, and walkable distances are designed in to reduce automobile use.

Bhatia’s architectural and planning team is the **Berkeley Group for Architecture and Planning**, made up of 16 graduate students and 7 faculty from the UC Berkeley College of Environmental Design (see UC Berkeley information in Chapter 4).



Nanocity is now in the phase of land acquisition in 500-acre increments. The government has supported the project by ruling that each increment be treated as of equal value. Sellers may cooperate or not, plots may vary in price, but the similar 500-acre parcels ultimately have the same assessed value. This puts pressure on owners to negotiate and sell early to get the best price. "Anything to do with land acquisition takes time," Bhatia explains. "You put out an offer; it takes a few months to complete a purchase. Anything to do with physical infrastructure is a slow process. It's not like writing software; it takes years."

So far, the Nanocity developers have acquired one 500-acre unit and hope to break ground soon on a scaled-down Phase 1 development involving a self-contained activity such as an education institution, with supporting mixed-use development around it, to start building critical mass as acquisition progresses. The economic slowdown in both India and the U.S has impacted development plans, with expected financing by Indian banks put on hold, but Bhatia says a more extended timeframe won't derail the vision. His hope is that Nanocity will serve as a model to get governments and developers in India to think more creatively about planning. "If you look at the development that's taken place in Gugaon, Mumbai, and the outskirts of Delhi, a lot of the planning has been haphazard—done like an afterthought," he says. "India must start planning for future growth; there's not a single city in the whole country with even the most basic modern road system, water and sewage system, or electrical power supply. If we address these issues in one place, hopefully people can learn from it."



F: Energy/Environment/Clean Technology

Key Findings:

- While energy demand has soared in India, two-thirds of Indians are off the grid.
- A large share of electrical output is wasted or stolen; power outages are common.
- Coal, oil, and gas development has been slow and overreliant on state-owned companies.
- Local or regional solar, wind, and biomass projects hold promise for rural India.
- A growing share of semiconductor design resources is shifting to photovoltaics.
- Waste-to-energy, methane capture, and biofuels spur domestic and foreign investment.
- Bay Area laboratories and utilities advise on energy efficiency and conservation.

Market Environment

Growth in India has, for much of the past decade, favored relatively clean sectors such as software and IT services. That helped soften environmental impacts and enabled the national and state governments to defer tough, long-term energy and infrastructure planning decisions. But increased manufacturing, rising living standards, and consumer demand, along with the prospect of global competition under WTO rules, have gradually forced Indian industrial companies to expand, vertically integrate, and scale up.

The result has been a rush to meet new demand—from industry and from consumers—for reliable supplies of energy, materials, water and other basic resources. At the same time, significant bottom-up pressure is coming from opposition political parties, NGOs, and civic advocacy groups, pressing government to address the environmental by-products of growth.

Global pressure is also mounting on India to address the environmental impacts of growth, including CO₂ emissions and climate change. Like China, the Indian government has been reluctant to embrace mandatory cuts in CO₂ emissions, citing low per capita energy consumption and the need for economic growth. Energy security and melting Himalayan glaciers, however, are prompting change.

India's Energy Inventory

India is the world's fifth largest consumer of energy, and is expected to rise to third place, passing Japan and Russia, by 2030. A 2006 Brookings Institution study forecasts that by 2030, assuming a conservative 5% average annual GDP growth:

- Urbanization will increase the share of India's population in cities from 27.2% to 45.8%.
- Average per capita annual income will rise from \$728 to \$5,930.

- The number of cars on India's roads will grow from 5.7 million to 20 million.
- Commercial energy consumption will rise from 376 million to 812 million tons of oil equivalent.

A 2006 study by the Government of India Planning Commission, meanwhile, says that to meet demand growth, power generation capacity will need to increase five-fold, from a 2003–04 baseline of 160,000 megawatts to 800,000 megawatts in 2031–32. The International Energy Agency estimates that India will need to invest \$1.25 trillion in energy infrastructure—75% of that in power generation—through 2030. That would translate into more than a tripling of capacity, most of it coal-fired, adding at least 400,000 megawatts—equal to the combined capacity of Japan, Korea and Australia today.

It should be noted that two-thirds of Indian households—668 million people—are not even on the commercial energy grid and are not counted in these consumption forecast figures. An estimated 400 million Indians have no access to electricity service at all. These households derive energy from “traditional” sources such as wood, dung, biogas, and crop waste.

Per capita energy consumption in India is low—439 kilograms of oil equivalent (kgoe) in 2003, versus 1,090 kgoe in China, a world average of 1,688 kgoe, and 7,835 kgoe in the U.S. Similarly, electricity consumption in India is only 553 kilowatt-hours (kWh), compared to 1,379 kWh for China, 13,066 kWh for the U.S., and a world average of 2,429 kWh.

India had a single Ministry of Energy until 1992, when it was broken into distinct ministries of Coal, Petroleum and Natural Gas, New and Renewable Energy, and Power. The Planning Commission and Department of Atomic Energy also contribute to energy policy. Lack of integration among these agencies has constrained energy infrastructure development.

Coal

India has sizable domestic coal reserves—7% of total global supply—and coal provides 54% of the country's total energy consumption and 56% of its electricity. About 78% of domestic coal production is allocated to power generation, with the remainder used primarily in steel and cement production. Despite these large reserves, India's coal imports are rising as a result of underinvestment, poor technology, and inadequate infrastructure.

Oil and Gas

Oil consumption accounts for 32% of India's energy use, and demand has grown six-fold since the 1980s, primarily in transportation—as the trucking sector has grown and as more Indians upgrade from bicycles to scooters to automobiles—in captive power generation for buildings and planned towns; and in farm irrigation.

While the Ministry of Petroleum & Natural Gas reported 2006–07 petroleum reserves of 756 million metric tons (MMT) and crude oil consumption totaled 147 MMT, production only amounted to 34 MMT, while imports reached 111 MMT. India imported 76% of its oil in 2006–07, up from

68% in 2005–06. The Center for Strategic and International Studies sees the import share rising to 91% by 2025. The U.S. Department of Energy and the International Energy Agency forecast that India’s oil consumption will more than double from 2.5 million barrels per day (bpd) to 5.3 million by 2025, nearly all of it imported. (Indian government projections for 2025 are 500,000 to 1 million bpd higher.)

India Crude Oil Sector Profile 2002–2008, in Millions of Metric Tons (MMT)

	2002	2003	2004	2005	2006	(provisional) 2007–08
Reserves	741	733	739	786	756	725
Consumption	112.56	121.84	127.42	130.11	146.55	156.10
Production	33.04	33.37	33.98	32.19	33.99	34.12
Imports	81.99	90.43	95.86	99.41	111.50	121.67
Exports	10.29	14.62	18.21	21.51	33.62	39.33

of crude oil and refined petroleum products

Source: Ministry of Petroleum & Natural Gas

Only about a third of the country’s 26 sedimentary basins have been developed, suggesting that much of India’s reserves remain untouched. Still, at generally accepted rates of demand growth, India’s domestic crude oil supplies are forecast to last only about 40 years.

Beginning in the 1990s, demand began to rise dramatically relative to production, but the national oil companies (NOCs) lacked the technology or expertise to identify and tap significant potential reserves. The New Exploration Licensing Policy (NELP), launched in 1997, allowed foreign and private domestic firms to bid for exploration blocks on a level playing field with the NOCs. Six NELP bidding rounds already completed put 162 blocks out to bid, attracting \$8 billion in new private and joint venture investment and resulting in 49 discoveries in 15 blocks since 1999. A seventh round launched in 2008 offered another 57 blocks—19 in deep water, 9 in shallow water and 29 on land. NELP auctions have so far brought 20 foreign firms into the Indian oil market, most notably deepwater drillers like StatoilHydro, Petrobras, Cairn Energy, and Eni. Reliance Industries has become a major private domestic player. In all, more than 100 NELP exploration and development contracts are in effect.

Private refinery capacity has increased significantly in recent years, accounting for 26% of total capacity. However, most of this output is for export, due to domestic retail price controls and government-mandated pricing parity for domestic and imported oil products.

Indian public and private sector firms are also expanding their global reach in search of petroleum. They have tended to pursue interests in oilfield locations where competition from the

global majors is minimal, such as Russia, Sudan, Yemen, Iraq, Iran, Angola, Libya, Egypt, Syria, Qatar, Ivory Coast, Australia, Cuba, Vietnam, and Myanmar.

Reliance Industries is currently producing 20,000 bpd of oil in Yemen and has exploration efforts underway in Oman, East Timor, and offshore Colombia. It has also negotiated energy partnerships in Angola, Cameroon, Chad, Congo, and Nigeria.

Because of Ministry approvals required throughout the bid process, government pressures to keep domestic end user prices low, and high dividends that profitable operations must pay back into the public treasury rather than reinvest, India's public sector oil firms are generally at a disadvantage in international bidding and have lost several competitions to China. In particular, India's Oil and Natural Gas Corp. (ONGC) has faced tough competition from China and has been outbid by China National Petroleum Corp. (CNPC) in Angola and Sudan.

Natural gas is a relatively new but fast-growing energy source in India, used increasingly for power generation. Compressed natural gas (CNG) was mandated by the Supreme Court in 2001 for use in Delhi buses, taxi, and three-wheelers; other cities have since followed suit.

India Natural Gas Sector Profile 2002–2008, in Billions of Cubic Meters

	2002	2003	2004	2005	2006	(provisional) 2007–08
Reserves	751	854	923	1101	1075	1055
Production	31.39	31.96	31.76	32.20	31.75	32.27
Consumption	29.96	30.91	30.78	31.33	30.79	31.35

Source: Ministry of Petroleum & Natural Gas

Natural gas supply and demand within India have been closely aligned. As with oil, however, demand has begun to outpace supply as gas becomes the preferred source for residential, industrial, and utility users, and as tapping new gas reserves requires investment and technological capability beyond what a centralized, overtaxed and overregulated domestic industry can provide. Pipeline infrastructure throughout India is also still relatively undeveloped. Natural gas use is projected to grow by 5% annually through 2030, to 10-11% of India's energy consumption from the current 8%. In place of new exploration and drilling, gas imports are rising. Gas Authority of India, Ltd. (GAIL) has begun work on a National Gas Grid that will likely focus on imported liquefied natural gas (LNG). LNG imports are forecast to reach as much as 60 million tons annually by 2012, comparable to Japan's imports today.

Nuclear

India has 17 nuclear reactors in operation, producing a combined 4,120 megawatts of electricity in six states—Gujarat, Rajasthan, and Uttar Pradesh in the north, and Maharashtra, Karnataka, and Tamil Nadu in the south. All of the plants have been developed and are operated by the

Nuclear Power Corporation of India Ltd. (NPCIL). Three more plants under construction will add 2,660 megawatts by mid-2010, and another three plants are on the drawing boards. Nuclear power currently provides about 3% of the country's electricity. Siting of these plants generally reflects a policy of diversifying India's sources of energy and serving areas in the south and west where it has been difficult to transport coal.

A shortage of uranium has forced NPCIL to operate its plants at 50% capacity. India is in the process of expanding its domestic reserves through mining projects in Meghalaya, Rajasthan, and Karnataka. It also has large reserves of thorium and has explored the potential for development of a thorium fuel cycle. But the Singh government is counting on the U.S.-India civilian nuclear cooperation agreement, signed in July 2005, to provide the fuel, technology, and investment to meet a target of 40,000 megawatts of nuclear power by 2030. The agreement will provide India with processed fuel and technology, despite its past refusal to sign the Nuclear Non-Proliferation Treaty and give up nuclear weapons testing, and requires reactor safeguards inspections, certification by the International Atomic Energy Agency (IAEA) and approval from the 45-member Nuclear Supplier Group to provide fuel. The recent ratification of the agreement by both governments is expected to catalyze India's nuclear power market and accelerate its opening to international partnerships.

Hydroelectricity

Hydropower accounts for 5% of India's total commercial consumption. Installed capacity produces about 31,000 megawatts, with an estimated potential of as much as 150,000 megawatts. High development costs, long lead times for regulatory approvals and land acquisition, and the environmental and social controversy surrounding large dam projects have limited this energy option. The World Bank and other international lenders have de-emphasized hydroelectric projects, and the Indian government has financed new projects only sparingly. Private investment in hydroelectricity accounts for only 3% of total projects. The government has considered a reverse build-operate-transfer model for new projects, under which state-owned companies would manage projects to completion, at which time they would be turned over to private operators or operated under a joint venture structure.

India buys just over 1,400 megawatts of hydropower annually from neighboring Bhutan, which is supplied by three plants, all financed by India. Nepal also offers considerable potential as a hydropower supplier to India, with more than 6,000 rivers and streams and a potential to produce 83,000 megawatts of power annually, of which about 42,000 megawatts are currently economically feasible to develop. Nepal's total hydroelectricity production at present, however, is only 551 megawatts and serves 1.2 million domestic customers; Nepal's government and the Nepal Electricity Authority (NEA) have been distrustful of allowing in foreign investment and expanding hydropower and transmission capacity beyond its borders.

Renewable Sources

The potential for large-scale development of solar, wind, biomass and other alternative energy sources is growing as coal and oil prices remain volatile and as costs for related technology fall.

Given land acquisition and construction costs, as well as development lead times and environmental impacts of conventional power generation, renewable energy in India looks all the more attractive.

Energy security and climate change are also driving India's interest in renewables. The United Nations estimates that the Ganges River, which provides water for drinking and irrigation for upwards of 500 million people, may go dry by 2025 due to melting of the Himalayan glaciers that feed it. Falling water tables, and rising sea levels that threaten low-lying cities and coastal areas are other concerns. The fact that 90% of India's energy needs are currently met by coal or oil is exacerbating government concern over energy security and rising oil imports. While its government, fearing the impact on growth, has resisted pressure to commit to formal targets for CO₂ reduction, India is taking policy steps to improve energy efficiency and increase the share of energy production from renewable sources. The 11th Five Year Plan (2007–2012) requires that at least 10% of power generation come from renewable sources, and clean energy R&D is being supported by leading research institutions including the Centre for Wind Energy Technology (CWET), the Solar Energy Centre (SEC) and the National Institute for Renewable Energy (NIRE), which focuses on biofuels.

According to the Cleantech Group's 2008 report, "Cleantech Venture Capital and Private Equity Investments in India," cleantech venture and private equity investment in India more than doubled between 2006 and 2007; \$290 million was invested in 11 cleantech deals in 2007. Electrical generation—primarily wind and solar—is receiving the most attention, followed by waste and wastewater, energy storage, and transportation. While the sector is still nascent and most cleantech investments are small, investors are expecting major growth.

As of mid-2007, of grid-interactive solar capacity, only about 2.12 megawatts was installed in 33 projects, largely due to cost: 15–30 rupees per unit versus 2–6 rupees per unit for energy from conventional sources. Still, much of India has 250–300 days of sunshine a year, most notably in the northern states of Gujarat and Rajasthan, which are relatively unpopulated with open land available for solar development. Rajasthan has set aside for solar power 35,000 square kilometers (13,500 square miles) in the Thar Desert. In more populated areas, distributed generation from individual rooftop panels is a more likely scenario, but one that will also require significant grid improvements.

Solar energy is particularly well-suited to provide energy for cooling in buildings and for industrial processes, as cooling load demand corresponds to the sun's intensity during the year. It is also being used increasingly for rural electrification and for agricultural uses such as powering irrigation pumps and dryers.

To encourage solar development, the Ministry of New and Renewable Energy (MNRE) has offered subsidies, concessionary loans, and customs and duty exemptions on materials and components. An Indian Renewable Energy Development Agency (IREDA) revolving fund guarantees loans for photovoltaic systems. The Planning Commission's Integrated Energy Policy envisions at least 500 megawatts of conventional grid power displaced by solar by 2022. Private firms have invested a combined \$20 billion in photovoltaic development in India. (See the *Semiconductors* section of this chapter).

The government's National Action Plan on Climate Change, rolled out in June 2008, lists solar energy as one of eight long-term priority missions for addressing India's energy needs as well as global climate change. The plan outlines a program for government R&D funding, demonstration projects, support for new manufacturing capacity, training, and integration of research nationwide, toward a goal of establishing 1,000 megawatts of solar grid power and 1,000 megawatts annually of photovoltaic cell production for domestic energy consumption by 2017.

Domestic and multinational semiconductor firms are diversifying their product lines to include thin-film solar panels based on related technology. Moser Baer Photo Voltaic (MBPV) plans to increase its annual production capacity fifteen-fold over 2008–10, from 40 megawatts to 600 megawatts. MBPV has signed a silicon wafer sourcing agreement with China's LDK Solar, entered into an equipment partnership with Applied Materials in Santa Clara, and taken equity stakes in specialized Bay Area startups, including: **SolFocus**, a Mountain View developer of concentrator photovoltaic (CPV) thin-film panels; **Solaria**, a Fremont CPV module designer; and **Stion Corp.** (formerly nStructures), a San Jose nanomaterials startup focusing on solar photovoltaics.

Domestic government support for wind power dating back to the 1990s has provided India with the world's fourth largest installed wind generation capacity (behind Germany, Spain and the U.S.) of about 7,660 megawatts. The country's wind generation potential has been estimated at 45,000 MW. Most wind power is currently generated in Tamil Nadu, Maharashtra, Karnataka, Gujarat, and Rajasthan. About half of the total capacity has been built by a single Indian company, Suzlon Energy.

In 1995, Suzlon was established with 20 employees by Tulusi Tanti, the owner of a textiles company who first bought and installed two windmills to lower his power costs and then began building the systems himself. Suzlon now has a global workforce of 13,000 and holds a 10.5% share of the global wind generation equipment market.

Efforts at biofuel development in India have focused largely on three areas: rural electric power derived from gasification of farm and human waste; methane capture from coal mines, landfills, oil and gas wells, and agriculture; and jatropha-based biodiesel fuel. With much of rural India still heating and cooking with wood, kerosene, dung, and crop wastes, and using inefficient stoves and heaters, efforts are underway to either displace those sources with cleaner energy or make traditional methods more efficient.

The Biomass Energy for Rural India (BERI) project, successfully completed in 2006, provides a public-private model now being replicated around the country. Some examples:

- The Haryana State Renewable Energy Development Agency signed a \$745 million deal with seven independent power producers to build 21 biomass and four wind projects that will supply state utilities with a combined 686 megawatts of power beginning in mid-2009.
- Green Planet Energy Pte. Ltd., a joint venture of Indian agribusiness and renewable energy firms, signed a \$227.3 million agreement with Punjab Agro Industries Corp. to

install 14 biomass projects in Punjab State that will together generate 147 megawatts of power and employ 3,000 people.

- The Ministry of Non-conventional Energy Sources (MNES)' Programme on Energy Recovery from Urban Wastes has facilitated more than 46 megawatts of waste-to-energy projects linked to vegetable markets, slaughterhouses, tanneries, sewage treatment plants and pulp and paper mills.

A June 2008 study by The Associated Chambers of Commerce and Industry in India (ASSOCHAM) estimates that as much as 2,500 megawatts of electricity could be generated in urban areas throughout India by plants collecting and burning municipal and industrial wastes. The study suggests that building the waste-to-energy plants to produce this power might cost a total \$2 billion in city and state funds. Environmentalists and NGOs have been critical of the proposal, however, citing the power likely required to run these large plants and the potentially toxic emissions they would produce.

India is the world's third largest methane-emitting country. Methane released from India's more than 500 coal mines is estimated to have a gas production potential of 105 million cubic meters per day for 20 years. Coal mines are vented to allow methane gas to escape so as to prevent explosions. Oil and gas wells also release large amounts of methane during the drilling process and must be vented for safety reasons. Methane is 21 times more damaging than CO₂ in terms of its contribution to greenhouse gases.

Methane capture in the petroleum sector has been a government priority since 1997, when the Ministries of Coal and Petroleum & Natural Gas signed a memorandum of understanding to cooperate on sites and projects. Begun in 1997, a \$19.2 million demonstration project involving methane extraction, surface capture, and storage at the Jharia coalfield in Jharkand state was funded by the UN Development Program and a Global Environment Facility Grant, and was completed in 2007.

Since 2004, India has been a signatory to the U.S. Environmental Protection Agency (EPA) Methane-to-Markets Partnership, a global initiative to share methane capture technology and methods. Among the activities funded by EPA grants:

- pump tests to measure methane levels at the Deonar landfill near Mumbai;
- organizing dairy producers in Maharashtra and Gujarat to develop a program for methane capture from livestock wastes; and
- studying the feasibility of converting landfill gas to LNG and using that LNG to fuel buses and garbage trucks in Maharashtra.

Biofuel production is constrained by the fact that prime agricultural land can't be used for energy crops. Degraded lands, however, are eligible. India is aggressively pursuing biodiesel fuel production from the *Jatropha curcas* plant, a drought-resistant and pest-resistant tropical succulent that can be grown throughout the country. *Jatropha* seeds have a yield up to 40% oil that can be

used in a standard diesel engine, while the waste can be processed into biomass. Unlike corn or sugar used in the ethanol manufacturing process, jatropha is highly poisonous in its untreated form, so its use in fuel does not remove a potential food crop from the market.

Indian Railways runs locomotives between Delhi and Mumbai on a blend of jatropha and standard diesel fuel. Reliance Industries is growing 200 acres of jatropha in Andhra Pradesh for fuel production. Chhattisgarh State plans to be a biofuel self-reliant state by 2015 and is in the process of converting its vehicle fleet to run on a jatropha-diesel blend. In September 2007, Hindustan Petroleum partnered with the Maharashtra State Farming Corp. on a jatropha biodiesel project with 500 acres planted.

Reflecting its growing interest in a range of renewable energy sources, in August 2009 the Indian government announced its intention to launch a venture fund to promote renewable technology research. Decisions regarding the size and financing of the fund will be made by the National Mission of Strategic Knowledge for Climate Change (NMSKCC).

Electric Power Generation

India has an installed electric power generation capacity of about 129,000 megawatts across five regional grids that serve neighboring states, with limited interconnections among the grids. Under the 2003 Electricity Act, India modernized its regulatory framework to establish distinct generation, transmission, distribution, and trading entities; to provide for purchases from independent producers to displace less efficient clean power generated by conventional plants; to rationalize tariffs and create a transparent subsidy policy; and to encourage efficiency and conservation.

Public utilities deliver 88% of India's power, with states owning most of the plant capacity. The Central Electricity Authority (CEA) is charged with system planning; the Central Electricity Regulatory Commission (CERC) and the various State Electricity Regulatory Commissions (SERCs) set and enforce regulations.

The remaining 12% of power-generating capacity is privately owned. But this number does not count the large volume of off-grid distributed generation installed by businesses and households to ensure reliable power. As already noted (in the *Architecture/Urban Planning/Infrastructure* section of this chapter), grid unreliability and blackouts of 15 hours or more a day in rural areas and several hours a day in major towns and cities require nearly all large commercial and industrial facilities to invest in their own backup power.

Energy Shortfalls Persist

The government reports just under 19,000 megawatts of industrial electricity capacity, but unofficial sources put the total closer to 27,000 megawatts. And when households, small businesses, and medium and large commercial enterprises are added in, the off-grid total could approach 75,000–100,000 megawatts.

The Ministry of Power reports a 10% overall deficit between electricity capacity and consumption, rising to as much as 15% during peak periods. If India is to meet its 2005 National Electricity Policy goal of universal electricity access by 2012, the installed base will need to grow to 400,000 megawatts. The government forecasts that coal, oil, and gas will generate 75% of this power, though new consideration is being given to alternative hydroelectric, nuclear, and renewable fuels.

McKinsey estimates the total investment cost at about \$225 billion, with the public sector portion to include 102,000 megawatts of generation capacity, 60,000 kilometers (37,300 miles) of extra high voltage transmission lines, and an increase in interregional power transfer capacity from 9,500 to 37,000 megawatts. Government attempts to encourage private development of generating capacity have met with only limited success: investors have been concerned regarding the financial health of the state electricity boards, which are the exclusive buyers of power.

A 2008 Parliamentary report found that the government's efforts to address these issues are falling short. In the five years leading up to March 2007, India added only 21,080 megawatts of generation capacity, half the official target. Peak load deficits are expected to continue through 2012, and even after that infrastructure bottlenecks are likely to produce coal and gas supply interruptions and power outages.

Unscheduled outages, voltage fluctuations, and peak-period utility shutdowns when customers exceed contracted limits—called load shedding—have indirect cost impacts involving: over-designed motors; voltage stabilizers connected to expensive equipment; backup diesel generators; chargeable battery “inverters” that store utility power; replacement of burnt out transformers, cables, motors, compressors and pumps; and idled production lines and employees. They also deter potential investors in new industrial capacity.

Studies by the Planning Commission, the Brookings Institution, McKinsey, the Center for Strategic and International Studies, International Resources Group, and others all offer broadly similar prescriptions for addressing India's power generation difficulties in the shorter term:

- Encourage increased foreign investment in both generation and transmission infrastructure.
- Complete 2003 reforms that centralize transmission grid, plant construction, and power trading, so that utilities compete on price and service over a single, rationalized infrastructure.
- Negotiate agreements with Nepal to develop 42,000 megawatts of accessible surplus hydro power and connect to a regional electricity grid serving Bangladesh, Bhutan, India, and Nepal.
- Improve billing and collection processes, operating efficiencies, and protections against electricity theft.
- End pricing structures under which industrial, commercial and large household users subsidize unmetered and discount pricing for farmers and the poor.
- End caps on retail energy prices that subsidize farmers and consumers at the expense of state utilities.

- End pricing rules that raise imported fuel prices to protect less efficient domestic producers.
- Bring more rural households onto the official grid to grow the revenue base and reduce pollution and health risks.

Weak Environmental Regulation

It should be noted that India's system of environmental regulation, while comprehensive, is relatively weak on the enforcement/penalty side and does not provide strong pressure on businesses and municipalities to undertake environmental mitigation.


India's Central Pollution Control Board (CPCB) sets policy and standards to be implemented and enforced by State Pollution Control Boards (SPCBs), which have inspection and documentation audit authority and can, in serious cases, close down a plant or cut off its water and power supplies to prevent operation.

The primary recourse for SPCBs is criminal prosecution, which is rarely used, both because court cases take so long and because offenders have been willing to pay the low maximum fines set by law. Civil penalties are limited to injunctive relief, although a court may award limited penalties or compensation. Another problem with current law is that no environmental impact assessment is required in advance of an industrial project being built.

The result, according to a 2007 World Bank report, is that the compliance rate across India for monitored industries is about 50%, and most small and medium-sized enterprises (SMEs) are not monitored. As there are no specialized standards or programs for SMEs, most would likely be found in non-compliance if they were monitored. Worse, corruption and bureaucracy at the local level has compromised the inspection process in many instances. In some cases, SPCBs have used lax enforcement as a marketing tool to attract new industrial projects. Of 250 plants surveyed in the World Bank study, 171 said they had taken environmental abatement steps, but in response to NGO or community complaints, not SPCB inspections.

Bay Area Connections

Bay Area companies, investors, universities and research laboratories have been at the forefront in helping India increase energy efficiency and output and accelerate the shift to renewable sources.

 San Ramon-based **Chevron Corp.** began selling refined petroleum products in India as Caltex in the 1930s. In 1957, Caltex commissioned the Visakh Refinery in Visakhapatnam, Andhra Pradesh, now operated by Hindustan Petroleum Corp. Ltd. In 1982, Chevron signed a five-year contract to drill exploratory wells off the Gujarat coast. The Chevron Ornite unit signed a fifty-fifty joint venture in 1989 with Indian Additives Ltd. to manufacture and market lubricant additives. Chevron Global Lubricants has been in India since 1993 and operates blending plants in Chennai and Mumbai. Chevron has also sold liquefied petroleum gas (LPG) in India since 1998

and operates an import terminal at Tuticorin and two bottling plants. The LPG is imported from the Middle East.

In 2006, Chevron invested \$300 million for a 5% stake in a \$6.1 billion, 580,000 barrels per day Reliance Petroleum export refinery project in Jamnagar—the world's largest refinery when commissioned in December 2008. Chevron had an option to raise its stake to 29%, but instead announced in February 2009 that it will sell its 5% back to Reliance and exit the project. Another Bay Area firm, Bechtel Corp., had the construction/engineering contract (see the *Architecture/Urban Planning/Infrastructure* section of this chapter).

Chevron currently employs 320 people in India, primarily in Delhi, Mumbai and Chennai, but also in 40 sales and marketing offices around the country.



Lawrence Berkeley National Laboratory (LBNL), in cooperation with the U.S. Agency for International Development (USAID), the U.S. Department of Energy (USEPA), the **California Energy Commission** (CEC) and California utilities, has been active in India for more than twenty years on a range of energy efficiency and conservation projects.

Under a memorandum of understanding (MoU) signed in December 2007 LBNL, the CEC and the **California Public Utilities Commission** (CPUC) are working with the Maharashtra Electricity Regulatory Commission (MERC) to assess supply, demand, and transmission losses, and to apply modern energy efficiency measures that are helping to reduce the Indian state's 5,000 megawatt electricity shortfall. Focal points include CFL and LED lighting, agricultural pumping, and zero net energy buildings. CEC commissioner Art Rosenfeld and CPUC commissioner Dian Grueneich have led to exchanges on Demand Side Management (DSM).

The MoU grew out of a 2004 energy assessment of Maharashtra State by Jayant Sathaye and Amol Phadke, scientists in LBNL's environmental energy analysis group. Maharashtra, with a population of 97 million, is home to India's financial sector and Bollywood, as well as to agriculture and small-scale industries such as textiles. Inefficient kilns, boilers, and motors, plus overuse of irrigation pumps by farmers receiving subsidized water and widespread theft from the power grid, have all taken a toll in the form of power disruptions. Energy demand is roughly 17,000 megawatts annually, while state electrical utility capacity is about 12,000 megawatts.

Uneven power supplies and the relatively high cost of grid electricity in impoverished areas has historically led to inefficient solutions. "In the 1970s, when there was a big increase in oil prices, consumption in developed countries dropped, but in India and elsewhere in the developing world it didn't drop—it kept rising," says Sathaye. "Oil companies wanted to know what was driving this; as it turned out, it was use of fuels such as kerosene and propane, not gasoline, by large numbers of subsistence consumers." Kerosene and propane remain in wide use today. Electricity consumption has increased with the use of air conditioning in middle class households and the use of televisions, refrigerators, ceiling fans, and light fixtures, even in slums. Often the electricity is pirated. Multiplied by many thousands of users in a small area, the result has been brownouts and voltage fluctuations.

Equally important have been the cost impacts of lost and wasted energy on government revenue. “We looked at the effects on tax revenue, in particular the loss of sales tax,” Sathaye recalls. “We found that the state government was losing enough money to cover 15-30% of its fiscal deficit at the time.” MERC has since raised electricity rates by 0.5%, producing an additional \$22 million annually that is set aside specifically to increase energy efficiency. One recent policy outgrowth: Mumbai has converted all of its traffic lights to LED.

With funding support from the U.S. State Department’s Asia-Pacific Partnership on Clean Development and Climate, LBNL is also working with MERC to explore: monitoring and pricing alternatives to better align power generation patterns with demand; energy-saving technologies such as solar water heaters, drip irrigation, efficient refrigeration and compact fluorescent lamps; and building standards and reduced energy consumption in public buildings. Under this program, Bay Area utility **Pacific Gas and Electric Company** is advising the Bureau of Energy Efficiency (BEE) on implementation of building standards and conservation programs.

Chief Maharashtra energy regulator Pramod Deo, who had responsibility for implementing the MoU on the Indian side, has since been appointed to head the Forum of Indian Regulators. A second CEC MoU was signed with the Forum in March 2009, with seven states signed up to launch efficiency programs.

CEC Commissioner Art Rosenfeld is helping two LBNL scientists, Hashem Akbari and Surabi Menon, promote their research on cool roof technology in India. In a 2008 paper, Akbari and Menon argue that the simple step of painting rooftops white reflects rather than traps heat and can cut energy use for cooling by 20%. California has mandated white flat roofs on commercial buildings since 2005.

LBNL is partnering with USAID on cool roof technology demonstration projects in some 30 Indian cities, replicating successes in Brazil in Mexico, to reduce air conditioning energy use in hot weather. The laboratory participates in the third phase of the Energy Conservation and Commercialization Program (ECO-III), a joint effort of USAID and International Resources Group to further commercialization of energy efficiency technologies.

Finally, LBNL’s building technologies department, with support from companies such as Hewlett-Packard and Network Appliance, is helping India’s IT and medical sectors cope with rising energy demand from data centers and clean rooms that use large amounts of energy to power operations and cooling. Server farms have become a particular concern, given the rapid growth and global reach of the IT industry.

“Indian tech parks are basically gated communities,” says applications team leader Dale Sartor. “You go through the gate and all of a sudden you’re transported from the India scene outside into Silicon Valley. Reliability is critical; you have redundancy built into everything, with two sets of diesel generators backing everything up.” Cooling is also important, as servers run longer and hotter. Most Indian data centers continue to use cooling tower technology that continuously chills and circulates water through the facility via conventional refrigeration and pumps, as opposed to less energy-intensive air chilling or use of continuous monitoring with temperature

sensors to adjust cooling. And servers generally run on high-wattage AC current rather than more efficient DC.

Moreover, “there’s no good forum for information sharing among facilities managers and IT managers in India,” Sartor explains. This contrasts with the multinationals from Silicon Valley, which are in contact with each other and whose managers are in contact with each other and can learn from their latest building. That experience is now being transferred from Silicon Valley to Bangalore. To address the gap, LBNL sponsored a workshop with Indian IT companies including Wipro, which feel themselves at a disadvantage to multinationals because they don’t have as much access to information about lessons learned.” At the same time, he points out, many multinationals partner or contract with Indian IT companies on R&D and product development and are themselves eager to address electricity reliability problems while lowering costs. LBNL is working with industry on shifting facilities to a DC standard and on techniques such as virtualization, sleep mode, and automatic shutoff to make server farms, clean rooms, and other industrial processes operate more efficiently.

LBNL’s India connection has recently expanded to Washington with the appointment in 2009 of Arun Majumdar, director of LBNL’s Environmental Energies Technology Division, as director of ARPA-e, the U.S. Department of Energy’s new program to invest in high-risk high-return energy research to increase energy efficiency, reduce dependence on imported energy, and address global warming.

In 2008, Majumdar played a leading role in launching the Berkeley-India Joint leadership on Energy and the Environment (BIJLEE) program, designed to bring together researchers from UC Berkeley, LBNL, and Indian universities and research institutions. The BIJLEE program formalizes and expands India-related research that has been ongoing for 20 years (with funding from a wide array of U.S. and Indian federal, state, and private entities) with a focus on three areas of R&D: demand-side management (DSM) in electric utilities, energy efficient buildings, and technologies such as nano-structured batteries for electric storage. Major partners on the Indian side include the Ministry of Science and Technology, the Indian Institute of Science, and the Council of Scientific and Industrial Research (CSIR). Purnendu Chatterjee, chairman of the investment firm Chatterjee Group, is a major corporate supporter and Berkeley alumnus.



Based in Washington D.C., **Solar Electric Light Fund** (SELF) was started in 1990 by Neville Williams, a former journalist who worked for the Department of Energy during the Carter Administration. Initial funding came from the Rockefeller Brothers Fund. SELF’s California connections are strong, however: board members include actors Ed Begley, Jr. and Larry Hagman, San Francisco attorney and CEO of commercial property firm Swig Development Co. Steven Swig, and his wife, clothing designer Mary Green Swig.

SELF’s mission has been to bring affordable, distributed solar power—in the form of small-scale home and building systems plus microfinancing through regional banks—to rural villages in developing countries in Africa, Asia, and Latin America, as well as to New Orleans and the Navajo Nation in the U.S.

In India, SELF created a stand-alone company in 1995, the Solar Electric Light Co. (SELCO), to market Tata-BP solar modules and batteries in a kit that also includes SELCO's own brand of fluorescent lights, switches, and outlets. Each solar home system (SHS) provides from 22–50 watts of power, enough to run six compact fluorescent lights, a radio, a portable television, and a small fan for several hours each day, either as a substitute or a backup for grid power. Working initially with Syndicate Bank, and now with other rural banks, SELCO arranges microloans to stretch the \$500 SHS cost into a 10% down payment and monthly or bimonthly payments of \$10–20. SELCO has also accessed financing through the Indian Renewable Energy Development Agency (IREDA)'s PV Lending Program, a partnership with the World Bank.

To date, SELCO has installed more than 75,000 systems in Karnataka, Andhra Pradesh and Gujarat, delivering independent electricity to some 300,000 people. (Those figures include an SHS installation at the Gaden Jangtse Buddhist monastery in Karnataka, which houses 3,000 Tibetan refugee monks. The monastery's system was donated by Steven and Mary Swig and replaces kerosene lamps in the prayer hall and the Dalai Lama's private quarters).

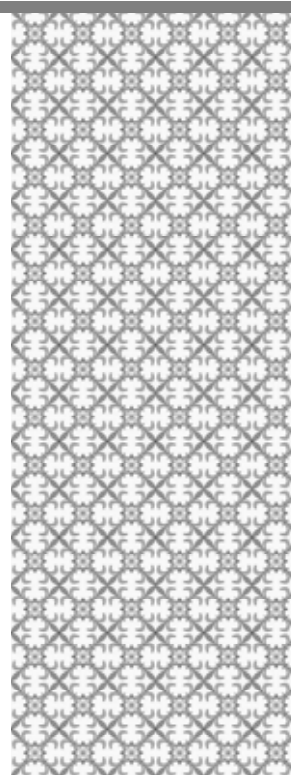
With a workforce of 180 and a network of 25 energy service centers, SELCO has achieved profitability on \$3 million in annual sales. Solar units have begun to displace dirtier backup diesel generator and inverter technologies where grid power is unreliable, and more reliable power has enabled the growth of more small (often home-based) businesses in addition to improving access to education and the outside world for remote rural villagers.

The 3-Lakh Electric Car

Clean technology investment in India has captured the imagination of venture and private equity firms worldwide. An estimated \$430 million was invested in 2006–07 alone. But the Reva electric car predates the current cleantech trends in its California-India connections.

The Reva is a two-passenger electric city car, with a top speed of 40 miles per hour and a range of about 50 miles per charge. (A new model introduced in 2007 pushes 50 mph, has 40% more torque and regenerative braking, and accelerates from zero to 25 mph in 7 seconds). At 2.99–3.78 lakh (about \$6,000–\$7,500) depending on the model, it is the least expensive vehicle in its class in the world and the only Indian car certified to be sold in the EU. With 800 cars on the road in London—where it is called the G-Wiz—the Reva is the UK's best-selling electric car. It is also being test-marketed in Italy, Malta, Sri Lanka, Cyprus, Greece, Japan, the U.S., Norway, and Spain. Since 2001, some 3,000 units have been sold worldwide.

The Reva Electric Car Company (RECC) is a partnership conceived in 1994 and formalized in 1998 between Bangalore auto-

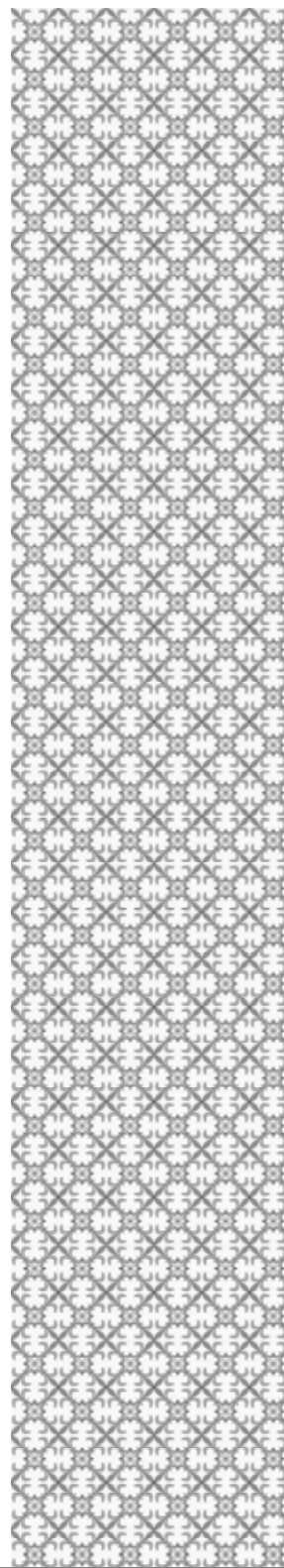


motive components and subassemblies manufacturer Maini Group and AEV LLC of Irwindale, California, a holder of thermoelectric power generation and other electric vehicle-related patents. A key figure in the RECC story is deputy chairman and CTO Chetan Kumar Maini, who holds degrees in mechanical engineering from the University of Michigan and Stanford.

RECC began with an initial \$20 million from Maini, AEV, ICICI Bank, the Government of India Technology Development Board, the Karnataka State Finance Corp., and the World Bank's International Finance Corp. From 1994–2003, it developed six generations of the Reva at a greenfield manufacturing plant at the Bommasandhra Industrial Estate in Bangalore. The first commercial Reva rolled off the factory line in May 2001. Initial power generation technology came from AEV, but Maini designed over 1,000 parts and made improvements in drive train and battery technology, making the Reva 95% indigenous to India.

The original Reva plant could produce 6,000 cars a year. Nearly all of the early financing went into prototype design, leaving an ambitious seven-city dealer network with little marketing support. A 1-lakh (\$2,000) per car government subsidy that RECC counted on was eliminated in 2001, and \$15 million in private equity funding envisioned in the initial business plan failed to materialize. By 2006, although European sales were showing promise, Reva had scaled back sales to Bangalore and Ahmedabad and had stopped advertising.

Reva was revived in December 2006 with a \$20 million capital infusion from Silicon Valley venture firm **Draper Fisher Jurvetson** (DFJ) and the Global Environment Fund, a VC investor in clean-tech and emerging markets. DFJ managing director Tim Draper and GEF president H. Jeffrey Leonard have taken seats on RECC's board. In 2008, sales expanded into Delhi, where the municipal government has begun offering incentive subsidies on the base price, the tax and license charges, and the VAT for electric vehicles. The Bangalore plant is being expanded to an installed capacity of 30,000 cars. Five new prototype models are ready to go into production, and RECC is exploring synergies with three other DFJ-funded companies: energy storage device company Deeya Energy, PV cell maker Konarka Technologies, and Silicon Valley electric sports car manufacturer Tesla Motors.



A Clean Tech Black Box

While Dr. K. R. Sridhar was director of the University of Arizona's Space Technology Laboratory from 1996–2001, he developed an electrolysis process for NASA that would use solar-generated electricity to separate oxygen, water, and methane from the Martian atmosphere. The process was to be used in an experiment to grow plants in an enclosed tent on the surface of Mars. NASA canceled the project, but Sridhar, a mechanical engineer with degrees from the University of Madras and the University of Illinois, moved to Silicon Valley to pursue a different kind of application for the technology—clean energy.



The website for **Bloom Energy** in Sunnyvale is a single page with flash images, the cryptic slogan “Be the Solution,” and no other information. The company, launched as **Ion America** in 2004, has raised \$165 million in four rounds of funding, including venture funding from New Enterprise Associates (NEA), Cypress Semiconductor, and Kleiner Perkins Caufield & Byers (KPCB), plus at least \$2.5 million from the U.S. Department of Energy. It is reportedly the venture that initially launched KPCB partner Vinod Khosla's interest in clean technology.

Bloom Energy already has R&D facilities in Chennai and Khosla, and at the February 2008 Cleantech Forum in San Francisco, the company announced a “massive” facility planned for Mumbai to take advantage of Indian engineering talent. While there is a high degree of secrecy about the project, it is believed that Sridhar has reversed the process he developed for NASA, so that natural gas is heated and reformed into carbon monoxide and hydrogen, with a portion of that exhaust mixture oxidized and run through a solid oxide fuel cell (SOFC) stack to create electricity, and a portion of the exhaust hydrogen separated and purified.

The ultimate deliverable is believed to be a scaleable fuel cell unit that can be deployed at the municipal grid, commercial building, or household level—depending on the size of the stack—generating both electricity and a supply of hydrogen suitable to power automobiles or for industrial uses. Powered by natural gas or propane initially, the unit emits only small quantities of carbon dioxide. Run on biodiesel, emissions could fall to zero. Because the reverse electrolysis is a chemical process with no combustion, it uses relatively little fuel up front. The fuel cell stack's ceramic core offers a cost advantage over cells using a platinum core. That edge could open an important market powering data center cooling systems.

Bloom successfully completed a 1-kilowatt prototype at the University of Tennessee-Chattanooga in 2005 and has since field-tested a 5-kilowatt demonstration project at the San Jose campus of Cypress Semiconductor. A \$2.76 million demonstration project agreement signed with Santa Clara County in September 2007, to power the county's 911 communications facility, is now in the construction phase. The project has 50% funding from a U.S. Department of Energy grant, with the county paying the remainder out of earmarked energy retrofit funds.

Bloom is said to be pursuing a two-track strategy—scaling up prototypes to the 100-kilowatt level for use in centralized power plants, and also reducing the size and heat output of the 1-

kilowatt and 5-kilowatt models for a distributed energy solution with potential throughout rural India and other emerging markets.



India is also emerging as a strong play for solar power. Reyad Fazzani, president of San Francisco-based **BP Solar**, chairs a 20-year joint venture with the Tata Group that produces solar cells for Indian and global markets. With manufacturing in Bangalore, the joint venture is India's largest manufacturer of solar cells, and California is its largest market.



Vinod Khosla of Khosla Ventures chairs the advisory board of Cleantech India, the India arm of the **Cleantech Group** of some 8,000 investors managing \$3.5 billion in assets, with Indian Venture Capital Association executive director Jaswinder Kaur in Delhi serving as Cleantech's India country director. Among the other Cleantech India founding partners are Google, NEA, BP Alternative Energy, IDFC Private Equity, TeleSoft Partners, Sun Group, Kenda Capital and Ernst & Young. To date, the Cleantech Group has organized two major conferences in India, and is partnered with Cisco to manage its global Connected Urban Development Alliance (see the discussion of Cisco in the *Computing/Networking/Internet* section of this chapter).



Infrastructure World LLC, a South San Francisco firm established by former Bechtel Corp. executives in 1998, provides engineering-procurement-construction (EPC) advisory services to help structure projects and raise private financing. The company recently launched a Clean Technology Ventures arm, partly in response to interest from major Indian industrial conglomerates looking to add clean technology to their portfolios.

Infrastructure World principal Barbara Treat, a former principal vice president at Bechtel and research director at Harvard University's Energy and Environmental Policy Center, says Indian partners with established infrastructure and manufacturing capabilities—but that due to the current economic downturn are unable for the moment to move forward in India—are interested in diversifying into fields related to their core competencies. “They want to refocus their efforts in the near term, ‘green up’ their portfolios with promising U.S. technologies, and redeploy their funds to the U.S., where projects can still get started.” Then, when financing is back in place in India, they can transplant the new technologies and private project financing models to India.

Treat says Clean Technology Ventures activities are wholly focused on the U.S. and India, in the following sectors: concentrated solar thermal (CST), voltaics, biofuels, geothermal, hydropower, water/wastewater treatment, and smart building/demand-side management.

Around 20% of power projects in India are now privately financed, Treat says, and nearly all have been or are being built by Indian companies—not because foreign companies are prohibited, but because the lack of government incentives, an opaque bureaucratic approval process, and interest group politics necessitate an Indian partner, at least for traditional projects.

For the moment, CST holds the most promise, given land availability, regulatory, grid, pricing, and other constraints in India. Only 2.1 megawatts of solar capacity is deployed nationwide, none of it CST, suggesting large upside potential. Infrastructure World and its Indian partners are studying 50–200 megawatt projects, typically under a “build-own-operate” model with a long-

term, stable payout comparable to that for investor-owned utilities. Geothermal and hydropower also have clear potential.

An important component in transplanting pilot U.S. projects into India will be tailoring their operational structure to the Indian market. For example, Treat says it may make sense to address distribution issues by pairing “green” energy projects with existing power plants or locating solar cells on mobile phone towers. Whatever the solutions growing out of Infrastructure World’s Indian partnerships, they are likely to have interesting cross-border applications down the road.

Promoting Conservation



It is only fitting that a Bay Area firm started by two Indian entrepreneurs, **Intergy Corp.**, would complete the energy/environmental circle by providing simple, often IT-based solutions for energy and water conservation and efficiency in California. In 2003, to launch Intergy, Ashish Goel, an IIT-Bombay graduate in chemistry with a master’s degree in environmental engineering from Clemson University, teamed with Alok Jay Bhalla, who holds a mechanical engineering degree from Punjab Engineering College, an MBA from San Jose State University, and a certificate in project management and financial analysis from UC Berkeley.

Intergy designs and implements energy efficiency solutions for municipalities, utilities, health care and educational institutions, and businesses—from energy audits to program design to benchmark measurement—and also develops IT, outsourcing, and web-based solutions in support of those programs. To the extent that water conservation and management principles are similar to—and at times dovetail with—energy conservation and management, Intergy works in comparable ways with California water utilities and users.

The company has developed niche expertise and exploited market opportunities that lie in the interface among utilities, regulators, and consumers. New technologies enable utilities to more precisely monitor and forecast usage patterns and to adjust supplies automatically. Business and institutional customers have growing options to produce their own power through cogeneration or renewable sources; power their own facilities more efficiently; and, in some cases, sell surplus power back to the grid. Among Intergy’s projects:

- energy-saving retrofits of lighting, ventilation, refrigerators and appliances at more than 2,200 California preschools;
- “Home Green Kiosks” set up at local banks, home and garden centers, and other locations to offer energy-saving advice to homeowners applying for home equity credit lines or planning to remodel;
- utility-supported programs in Southern California that reward homebuilders and property management companies for installing energy-efficient lighting and air conditioning systems;
- a program to replace commercial washing machines in laundries, hotels, hospitals, and other businesses and institutions, to save energy and reduce water use;

- audits and installation of automated energy management systems in hotels to monitor and regulate lighting and air conditioning room by room during the day; and
- IT systems and software to administer the three major California electric utilities' rebate programs for replacement of outdated air conditioners and motors.

In 2006, Intergy launched the Water Saver pilot program for the San Francisco Public Utility Commission (SFPUC), a performance-based incentive program targeted to high-volume non-residential users. Under this program, St. Mary's Hospital saved 628,000 gallons of water annually by installing thermostatic control valves to reduce the need for replacement water in its eight sterilizer units.



In June 2008 Willdan Group, Inc., a Southern California provider of outsourced engineering and other services to states and municipalities, acquired Intergy and rebranded it as **Willdan Energy Solutions**.

Connecting the Green Dots



Jagdish Amin, a University of Mumbai graduate, founded the San Francisco software development firm **37 Degrees** in 1999. With offices in Switzerland and India, the company serves the media, software, and beverage sectors, and counts among its clients Hewlett-Packard and Diageo.



In 2009, Amin and Harvard-educated biologist Dr. David Wheat launched **HaraBara** (Hindi for "full of greenery"), an online portal that they hope will build a community of technology manufacturers, B2B service providers, investors, and other talent resources that will help businesses worldwide develop and implement green strategies. The goal is to reach a critical mass of 1,000 member companies and organizations to provide expertise and share best practices on all aspects of green business across the U.S., China, India, and possibly Brazil.

HaraBara is funded primarily by angel investors and in-kind support from partners; the plan is to generate member business subscription revenues. HaraBara members so far include HSBC, Williams-Sonoma, and Kotak-Mahindra. The HaraBara Lexsite online library provides access to the database of Indian environmental laws and regulations.



The US-India dialogue on energy use and sustainability extends from business into the civic sector. The San Francisco-based **Sierra Club** is working with the Self-Employed Women's Association (SEWA) and the Climate Project India to establish a Green Livelihoods Centre in Mumbai, to promote collaboration between Indian organizations working on sustainability. One of the first projects will be to support the development of a green jobs strategy that links a grass roots focus on jobs with India's growing need for technologies and policies to address climate change.

G: Computing/Networking/Internet

Key Findings:

- Most personal computing is done in kiosks and Internet cafes; much Internet access is via mobile phone.
- India's wireless market adds 10 million new customers per month.
- Basic "thin-client" netbooks bring students and rural areas into the 21st century.
- Cloud computing creates low-cost business opportunities for Indian entrepreneurs.
- India is being used as a development platform for products targeting both its domestic market and other emerging economies.
- Work done in India is increasingly sophisticated and cost arbitrage is less important.
- India captive centers free Bay Area firms to focus on innovation at home.

As described earlier (see *Software/IT Services/Business Process Outsourcing* section of this chapter), there is a lesser-known hardware side to India's tech story. HCL Technologies had its beginnings building calculators and then Unix-based minicomputers as Hindustan Computers, Ltd. Satyam Computer Services began in 1987 as a low-cost personal computer manufacturer and network/systems developer. Wipro's initial venture into tech involved PCs and workstations as part of its total solutions packages.

Basic Unix, Windows and Linux PCs have been a staple of large businesses (banking, construction, telecom, health care) and government in India. Until fairly recently, however, the PC remained out of reach for the average Indian consumer, except at work and at Internet cafes and public kiosks.



In 2007, according to Lehman Brothers, India had 24 PC users per 1,000 people, with annual sales estimated at 6 million units. By contrast, India adds at least that many mobile phone users in a month. When a Microsoft researcher informally surveyed 300 small businesses—cobblers, locksmiths, rice dealers, copy shops—he found that only 13% had a computer and only 23% had ever used one. A World Bank survey of 2,000 retailers showed that only 19% used computers. In fiscal 2006–07, Indians bought only \$1.6 billion worth of software, in part because an estimated 72% of software in use is pirated.

New low-cost business models for getting computing power into the hands of ordinary Indians have begun to surface, however. The MIT Media Lab's One Laptop Per Child (OLPC) initiative and Intel's Classmate PC (see the *Semiconductors* section of this chapter) are getting simple, inexpensive, heat- and dust-resistant laptops and wireless broadband into village schools. The 2004 reductions in tariffs on imported computers have brought global competitors into the market and have helped bring down prices; HP, Acer, and Lenovo, along with HCL and Wipro in partnership with Intel, are all offering or planning to offer PCs costing under \$300.

Novatium, an Indian company formed in 2003 by Mumbai entrepreneur Rajesh Jain and IIT-Chennai professor Ashok Jhunjhunwala, offers a \$50 thin-client computer (\$125 with a new monitor) that runs on a mobile phone chip set and server-based software for \$10 a month.

The Future is Calling

In the early 1990s, India's two state-owned wire line phone companies (under the Department of Telecommunications) had a total of 8 million lines and a waiting list of 2.5 million customers. A new National Telecom Policy adopted in 1999 opened the market to private (Reliance Infocomm, Tata Indicom) and foreign (Hutchison-Essar, Bharti Airtel Tele-Ventures, Escotel, Idea Cellular, BPL Mobile, Spice Communications) providers, leading to 38 million landlines and 6.7 million mobile customers by 2002.

At the end of January 2009, the Telecom Regulatory Authority of India (TRAI) reported 37.75 million wireline subscribers—roughly the same as in 2002—with some 11 million of those lines in rural areas. The numbers can be deceptive, however, since most rural lines are village public telephones (VPTs) and located in public call offices (PCOs), each serving many users.



The wireless phone market, meanwhile, has grown dramatically: the number of mobile subscribers was 362.3 million at the end of January 2009. India has been adding close to 10 million subscribers a month. Still, the market penetration rate remains below 35%. Huge demand is coming from rural users, typically earning less than \$1,000 a year, who have not been affected by falling property and share prices or tight credit.

It is estimated that 100 million of the country's next 250 million subscribers will come from rural areas. Phones cost in the \$60 range and prices are falling. Growing numbers of rural customers buy their phones through microfinance and pay the loans off by renting time to fellow villagers. Basic services run from \$2.50–\$12.50 per month, and many phone users have found creative ways to keep calls short to save money (e.g., auto rickshaw drivers give out their phone numbers and customers call but hang up before the driver answers; the driver checks missed calls and makes pickups).

The Internet and Mobile Association of India put Internet use at 45.3 million people in September 2008, up from 36 million a year earlier. Only 3.3 million users are in rural areas, and only 5.65 million are broadband users. It's not surprising, then, that a race is on to grow the Internet market by extending broadband Internet technology to the mobile phone and the PDA screen.

Short message service (SMS) text services have already sprouted on sites for news, email, travel reservations, real estate, job searches, sports and concert tickets, online lotto, and matrimony. Global search portals have established partnerships with Indian carriers—Google with Bharti Airtel, Microsoft's MSN with Vodaphone, and Yahoo! with Bharat Sanchar Nigam Ltd. (BNSL), BPL Mobile Communications Ltd., and Aircel.

Nokia, Motorola, Samsung, and other manufacturers have established product development and marketing presences in India, focusing on low-cost phones for the Indian market. Handset prices fell by half over 2005–07, according to Gartner Research, and 90% of phones sold in India now operate on the General Packet Radio Service (GPRS) system that enables wireless Internet access.

Revenues have been declining since 2006, due to competition and saturation in major urban centers—90% in Delhi and Chennai, 70% in Mumbai—along with failure to grow the rural market segment quickly enough. But features are helping to improve margins. The market for ringtones in India, for example, is about \$45 million annually, accounting for nearly half of non-voice revenue.

Government has been slow to respond to soaring demand with adequate spectrum. Large incumbent operators on the GSM wireless standard bought early licenses at low prices after the National Telecom Policy took effect and now say they need more capacity. At the same time, relatively new entrants on the CDMA standard, like Reliance, have also bought licenses and see spectrum grants as a zero sum game. One answer the government is considering involves charging the military, the railways, and the space program market rates for spectrum they underutilize, encouraging them to free some of it up. Smart antennae and towers built closer together could also maximize spectrum capacity. These issues, in turn, push any decisions about awarding 3G licenses further out into the future.

In August 2008, the Telecom Regulatory Authority of India allowed phone subscribers to choose any long distance service without changing local phone providers and allowed Internet providers to offer PC voice-over-Internet protocol (VOIP) calls to mobile phones. (Previously, VOIP providers had been prohibited from connecting to domestic networks and using equipment that would compete with landline services.)

Bay Area Connections.

Bay Area firms are an integral part of the computing, network and Internet environment in India, having been present at the creation of India's computer and software industries in the 1980s and having provided much of India's telecom and Internet network infrastructure. Today, a new race is on to create new services and advertising opportunities over a new kind of Internet, via mobile phones reaching deeper into the country's interior.



As previously mentioned (see *HCL Technologies: India's Homegrown Hewlett-Packard Diversifies* in the *Software/IT Services/Business Process Outsourcing* section of this chapter), **Hewlett-Packard** was an early arrival among transnational tech firms in India. An early focus on local distribution in 1988–89, was followed by more than ten years of intensive growth. HP partnered with Hindustan Computers Ltd. (HCL) from 1991-96, outsourcing R&D and offering its peripherals with HCL computers as part of jointly developed systems integration and networking solutions for Indian businesses. Today HP has two manufacturing facilities and is the largest PC manufacturer in India. The company also produces low-end servers and is considering making a laptop for the Indian market. All of HP's production in India is for the domestic market and not for export.

HP was the second U.S. IT firm to establish a BPO facility in Bangalore (after Texas Instruments). In August 2000, it began centralizing its internal global accounting and transaction processing (vendor payables, fixed assets tracking, freight cost management, order processing, etc.) in Bangalore under a BPO captive, Global e-Business Operations Pvt. Ltd. This necessitated not only recruiting business graduates, but also language experts. Over time, Global e-Business Operations was hired by outside firms such as Procter & Gamble, Gillette, Nestlé, and Reed Elsevier to provide similar services.

The India unit currently handles more than 70 percent of HP's back office activity (including \$40 billion in global payments), has more than 6,500 employees at four centers in Bangalore and Chennai, and plans to grow that total to 7,800. Ultimately, HP sees Global e-Business Operations as a profit center, with a network of centers worldwide (it now has 11 total) and with half of its business internal and half coming from external contracts. HP maintains a call center for U.S. customers separately from its BPO operation, with 500 direct and 350 contract employees.

The company's venture into software applications started with its 2002 acquisition of Compaq, which gave HP access to Compaq's significant India presence, including Digital GlobalSoft, a software development and IT services joint venture employing more than 4,600 people, in which Compaq held a 50.6% stake. HP acquired the remainder of the company's publicly traded shares in 2003 and renamed it Hewlett-Packard GlobalSoft. Today the unit has more than 4,800 employees. Among its software offerings are Digital InfoLife, a program that gives users simultane-

ous, secure access to mission critical data, and TradeEz, a platform to conduct secure standards-based electronic transactions over the Internet.

Today HP is the largest player in India's domestic IT market. Hewlett-Packard India's director of strategic development P. Ravindranath notes that even as U.S. companies are outsourcing to India, Indian companies are outsourcing to U.S. multinationals. HP, for example, is currently handling all procurement for the State Bank of Karnataka, as its contract service provider.

HP Labs Takes on the Future

Some of HP's most cutting-edge work worldwide, and most notably in India, comes from its basic research, product development, and applied research arm HP Labs—a network of 23 laboratories in 7 countries, with an India presence based in Bangalore. HP Labs India, established in 2002, has focused primarily on IT for emerging markets. Nearly all of HP's research in Bangalore relates to global markets, as part of an extended team with researchers in the U.S. and other global centers. More than 2,500 workers there—roughly 25% of HP's global R&D staff—are engaged in research on high-end servers, software related to storage, imaging, and printing.

Prith Banerjee was recruited in August 2007, from his position as dean of the University of Illinois at Chicago College of Engineering, to become senior vice president of research and director of HP Labs. He has since presided over a restructuring of HP Labs that was unveiled in March 2008. Banerjee argues that the unit's 23 labs in 7 worldwide locations had lost much of their effectiveness because they were unfocused, with as many as 150 small projects pending, and because the research was heavily weighted toward long-term development of internal intellectual property for HP only, with little outside collaboration or thought of getting products to market quickly.

His new strategic plan emphasizes fewer (20–30) larger collaborative projects with higher financial and social impacts; a greater flow of technology transfer from the labs to business; and “open innovation” partnerships with universities, graduate researchers, entrepreneurs, and start-ups, for advancing applications and solutions that may involve sharing of IP over time.

“We've developed a template for IP agreements that are very well thought out and are not totally HP-centric,” Banerjee explains. “Over the years we've learned what works and what doesn't. We're not trying to be greedy and own all of the IP.” That has meant reevaluating relationships with the IITs and other universities in India, scrapping some where there is duplication, but expanding others to a broader vision of meeting localized needs as well as furthering HP's long-term global research goals. In some cases, that means sharing IP; in others, it means one or both parties may license the other's technology.

In India, much of HP Lab's focus is on the technology requirements of emerging markets and how to reduce costs to meet growing demand. Banerjee notes that access to broadband Internet services is still limited, so the focus will likely be in printing technology, interfaces, and mobile devices. Examples include:

- technology to deliver downloadable and printable content—distance learning, government information, telemedicine content—across broadcast television networks;

- optical character recognition scanning, allowing machine readability and secure verification of paper documents; and
- touch screen, pen-based, voice activation, and intuitive keyboard solutions that address the barrier of 22 principal languages spoken throughout the country.

HP Labs India has joint PhD fellowships and has sponsored research students and projects at the IITs in Mumbai, Bangalore, and Hyderabad, and at IISc Bangalore and Birla Institute of Technology and Science, Pilani.



Of U.S. companies, **Cisco Systems** has been one of the most aggressive in building an India presence geared to global markets. To that end, Cisco announced in 2007 the establishment of its “second global headquarters” in Bangalore, headed by senior executive Wim Elfrink, who has since moved to India. The core of the strategy is to accelerate business growth by positioning the company close to the action in the rapidly developing markets of Asia and the Middle East.

With growth in emerging markets eclipsing growth rates in more developed economies, Cisco’s presence in India is targeted on both India’s domestic market and its goal to position Cisco as a market leader in developing economies. India is also playing a central role in Cisco’s broader global strategy. As Elfrink describes it, lower cost is not a sustainable advantage, which in the end will only come from talent, innovation and the ability to add value. This is leading to a shift in the linear value chain to a “collaborative business network model,” in which India’s role shifts from vendor to partner. The difference between vendor and partner is that a partner co-creates value: “It’s how you globalize brains.”

Cisco established its wholly-owned India subsidiary in 1995, primarily to recruit, train and certify value-added resellers (VARs) for its routers, switches and other enterprise networking products. Presently headed by Naresh Wadhwa, the India subsidiary is part of Cisco’s Asia-Pacific region, which accounted for 10% of company revenues in 2007. Cisco has 7 sales offices in New Delhi, Mumbai, Bangalore, Chennai, Pune, Hyderabad, and Kolkata, and joint development centers with Wipro, Infosys, HCL, Satyam, and Zensar Technologies.

Cisco’s VAR network includes 900 partners in 100 cities, and it also uses two nationwide distributors, Ingram Micro and Redington. Its broader network includes 10 system integrators, including IBM, HP, TCS, Wipro, and Cable & Wireless, and 13 gold and silver certified partners. Cisco operates 9 logistics centers throughout India, part of a customer support system that offers next business day replacement of equipment. Its India workforce totals some 4,000 people, including R&D and business/sales support.

The Cisco Networking Academy Program, launched in 1997 globally and brought to India in 2001, has 152 academies in 23 Indian states, offering specialized college-level curricula in computer networking to some 9,000 participating students. In November 2008, the company launched a joint development program with the Small Industries Development Bank of India (SIDBI) and the Science and Technology Entrepreneurs Park (STEP) to encourage development in India’s information and communications technology (ICT) sector. The new program will

provide finance, loan subsidies, mentorship, and training for qualified entrepreneurs and small businesses across India that are run by current or former Cisco Networking Academy students.

In 2005, Cisco committed \$1.1 billion in new India investment over three years. Part of that investment funded the new \$50 million, 14-acre Cisco Globalization Center East campus in Bangalore, integrating R&D, IT, sales, and customer support. The center, completed in 2007, will help recruit new talent and maintain Cisco's current low attrition rate.

Cisco has also made \$100 million in early stage venture investments, in companies such as mobile game developer Indiagames, media/advertising/sports rights firm Nimbus Communications, and telecom software company Bharti Telesoft. India customers range from the Taj Group of Hotels and retailer Future Group, to Indian Oil Corp and ICICI Bank, to the National Highway Authority and Parliament's Lok Sabha Library, to the Reliance and Bharti Groups.

Economies of Scale

Cisco vice president for globalization Chris White says that with 4,000 Indian employees currently, the company's investment in India is on track, and the India workforce should reach 10,000 by 2013. Cisco has a publicly stated goal for the top 20% of its executive leadership to reside in India over time. Why? "Developing country GDPs are now clipping along very nicely, rather than spiking," White says. "India has a bad year when growth drops from 9.8% to 8.9%. Is there a concept here to support our next \$30 billion of business?" India's geographical location—at the center of a five-hour time zone that includes the Gulf States, Africa, and Asia—is also part of the advantage.

White insists that for Cisco, India is "a scale play on engineering, not manufacturing. We use India as a platform to fuel growth, not just to take advantage of cost arbitration or even tap talent." As an example, he cites retailer Future Group, which operates the Pantaloon Retail, Big Bazaar and Food Bazaar chains across India. Cisco is developing a radio frequency identification (RFID)-based flat network architecture to be tested at Big Bazaar's three Bangalore outlets. The chain has a total of 92 stores across India; many have grocery sections, including fresh produce, and the metro stores feature gaming and children's play areas.

Eventually, the technology will be extended to all Future Group retail formats, attaching RFID tags to 1 million stockkeeping units (SKUs)—individual items or cartons—of \$10 or more in value. RFID tags contain detailed data on the tagged item and the shipment in which it is included. The tags are used for real-time tracking that provides full visibility into the retailer's supply chain, allowing stores to manage inventory, monitor customer purchases, and improve efficiency in scheduling and routing shipments. This comes in especially handy for perishable goods such as produce, which are often lost or delayed in India, leading to high spoilage rates.

More importantly, however, Future Group estimates that it currently scans 3 million retail items six times daily as they move from field or factory to store shelf—18 million scans per day. By 2010–11, planned store growth will require 30 million scans daily, more than will be manually possible by people; processes will have to be automated. All large store chains face the same

problems and over time, pressure will reach down to small and mid-sized retailers to keep pace in order to compete on efficiency and price.

“If you look at 95% of the retail business in India, it’s really mom and pop stores,” White explains. “We have an opportunity in India to say, ‘Here is the retail store of the future and we just built 10,000 of them.’ Imagine trying to do that in the U.S.; we wouldn’t get to that scale because of the installed base of stores already here.”

The Fourth Utility

In areas like healthcare, education, and security, White sees the network as a fourth utility, overcoming physical distance and enabling greater collaboration. In broader terms, Cisco vice president for advanced services Parvesh Seti told a December 2007 conference on globalization of services that the company is making a shift in India from fulfillment—delivering and installing hardware ordered for a specific need defined by the customer—to demand creation, where Cisco offers integrated hardware/services solutions to meet needs mutually defined by it and the customer. Toward that end, Cisco is pursuing build-operate-transfer and remote infrastructure management projects in areas like electrical power grids and smart road or transit systems.

The company has working partnerships with all five of India’s major IT companies, with the focus on innovation—not just outsourcing. In October 2007, Cisco created a partnership with Satyam to take a 911 emergency response system developed for Hyderabad national, establishing intelligent routing of ambulances and offering information on non-emergency health services. In November 2007, it launched a partnership with Wipro to deliver advanced IT services leveraging Wipro’s expertise in infrastructure and Cisco’s in networking. As part of that partnership, the company established a center at Wipro’s campus in Bangalore to create and launch new services to address the Indian, Middle East, and African markets.

In September 2008, Cisco expanded the partnership with the announcement of a \$1 billion alliance to assist with remote management and leverage its global applications expertise. The company has also partnered with Tata-owned Internet service provider Videsh Sanchar Nigam Ltd. (VNSL) to develop bundled Internet phone, video on demand, videoconferencing, and other services for Tata Indicom Broadband Services.

Cisco’s efforts to connect its India operations to its global voice-over-Internet protocol (VoIP) network opened up unexpected market opportunities in telecom services, beginning in 2005. As mentioned earlier, Indian regulation prohibits interconnection between VoIP and the public switched telephone network (PSTN). First, Cisco replaced its standard PBX systems with Internet phones and its CallManager call processing technology, and then it linked corporate sites over its data network for a purely internal VoIP system. Next, it negotiated a waiver from the Telecom Regulatory Authority of India that allowed employees to join networked VoIP conference calls from home because of the time differences involved. Voicemail was added, based on an argument that stored and forwarded messages were distinct from real-time conversation covered under the regulation. Finally, CallManager was modified to automatically route calls as required to and from VoIP and the PSTN.

BPOs flocked to the new solution, as did large enterprises with data infrastructure in place, such as New India Assurance Co. and the National Highways Authority of India. IP phone prices have come down from an initial \$350 per unit to around \$100, and the savings on calls within the so-called “closed user groups” allowed by law have been considerable, while enhanced broadband services have increased, exceeding the offerings of most PSTN providers.

White sees opportunities for applying the India BPO model to more sophisticated processes. “Could you use things like call centers—clusters of resources—for more intelligent things?” he asks. “That engineer talking to the CIO in Manhattan—who cares where he sits?” Toward that end, he says, Cisco has been more willing to collaborate with Indian vendors moving up the value chain.

But he acknowledges that the concept has inherent limitations: “There’s a quantity versus quality game. You can scale outsourcing by processes, but can you scale innovation? You can throw 10,000 more people at a problem, but that doesn’t necessarily mean you’re getting 10,000 more ideas.” Thus San Jose will likely retain its central role in Cisco’s R&D and strategic planning for some time, even as global activities become more localized. “The world has flattened,” White says, “but it’s not lopsided yet. The U.S. and its market will continue to drive innovation, even relative to the BRICs (Brazil, Russia, India and China).”

Cisco’s latest move is into sustainable urban development. Connected Urban Development (www.ConnectedUrbanDevelopment.org), was launched at the Clinton Global Initiative with a \$15 million pledge, with the idea of building technology into the foundation of new and expanding cities from the ground up. One focus is “ecomapping”, a system that helps cities map and compare their transportation, energy, waste, and CO₂ footprints. At present, the Connected Urban Development initiative includes seven global cities, including San Francisco, and is largely driven from Cisco’s globalization center in Bangalore. The concept, which will eventually be spun off as an independent platform, reflects Cisco’s vision of the role that technology can play in supporting sustainable urban growth in critical areas such as energy and smart grid—a vision that contains the seed of an eventual business model. Earlier this year the company announced the CUD Alliance—a partnership with the Climate Group (see the *Energy/Environment/Clean Technology* section of this chapter)—to expand the participation of businesses, cities, and non-governmental organizations in a global strategy for the role of IT in sustainable cities.



Venkat Panchapakesan joined Sunnyvale Internet portal and search firm **Yahoo!** in 1998 as vice president for engineering. Early on, Panchapakesan was tasked with establishing an India presence, including setting up an R&D center. “The focus was not cost savings,” he says. “In order to serve markets globally, you need to tap global talent.” While Yahoo! always viewed India as a potential market, there have been limitations. “People use the Internet a lot,” he explains, “but the price of a personal computer is a factor; so is the access cost for DSL.”

An interim step for the company was Yahoo! India—an English-language portal and directory of India-related websites launched in June 2000, offering news, stock quotes, cricket scores, and Bollywood gossip, along with email, instant messaging, chat, and online clubs.

The R&D center opened in Bangalore in 2003, with Panchapakesan as CEO, to develop new technologies and global product platforms for Yahoo!. Today the center employs more than 1,000 engineers, programmers and other employees in four basic groups:

- product engineering (global platforms and applications);
- technology research (high-value technologies that improve or change user behavior);
- market innovation (value propositions for technologies in user and business analysis); and
- content and end-user management services (engineering and business services).

Several factors have brought India front and center in Yahoo!'s global strategic planning in recent years. India has evolved into Yahoo!'s base for development of products and services for emerging markets. Over 2006–07 it rolled out successful search and portal features, developed from inception in India and geared primarily toward mobile phone users. Some examples:

- screen reader software to make Yahoo! Mail accessible for visually impaired readers, given the prevalence of untreated cataracts and glaucoma in rural areas;
- seven local Indian language portals (including Hindi, and a tie-in with Hindi publishers Jagran Group for news and current affairs content) which will add significant numbers of new Yahoo! users to the current 30 million now accessing the English-language site;
- Yahoo! India Our City user-generated “mashup” portals providing views of 20 Indian cities from the perspective of locals, including news, weather, photos, event listings, blogs, and other shared information;
- Yahoo! India Maps, offering online street and satellite maps of 170 cities, 4,800 towns, and 220,000 rural villages across India, in partnership with CE Infosystems; and
- Yahoo! Avatars personalized animated representations of users for virtual social networking.

In April 2007, Yahoo! opened an expanded, 220,000-square foot, five-story R&D center in Bangalore, with capacity for a workforce of 1,600. In March 2008, it launched Yahoo! Labs Bangalore, a center of excellence and advanced research facility whose mission is to globally recruit an initial team of 100 scientists and engineers to work on next-generation search and multimedia retrieval technologies. The sixth such lab for Yahoo! worldwide, and the first in Asia, is under the corporate direction of Yahoo! senior vice president and head of research Dr. Prabhakar Raghavan, an IIT-Chennai graduate who received his PhD in computer science from UC Berkeley and is a consulting professor at Stanford.

Shortly after the Yahoo! Labs announcement, the company unveiled a new collaboration with the Tata Group's Computational Research Laboratories (CRL) to do advanced research on cloud computing. CRL's EKA supercomputer, the world's fourth fastest, is the only such computer that is privately owned and available for commercial use.

Finally, in July 2007, Yahoo! acquired a minimum 35% stake in Gugaon online advertising buyer Tyroo Pvt. Media Ltd., which specializes in designing and placing online ads on behalf of small businesses.

Open source technology plays an important role in Yahoo!'s future, as the company increasingly merges mail, text messaging, image-sharing, and social networking applications in a single customized experience. Yahoo! hosts an annual public Hack Day for student and outside developers in Bangalore at the Taj Residency Hotel, where it offers its traditional pizza and soda, opens up selected application programming interfaces (APIs) in the Yahoo! Development Network, and gives participants 24 hours to come up with new applications. The event traditionally attracts over a hundred developers and has led to prizes for projects such as:

- a collaborative browsing application that allows two users to surf websites in parallel;
- desktop wallpaper developed from Flickr photo images;
- a mapping tool using traffic APIs to find how likely it is to arrive somewhere on time; and
- YaHealer, a tool enabling doctors to annotate a brain scan simultaneously and talk via chat.

Part of Yahoo!'s global recruitment strategy for India, and especially for the new lab, is to tap into the growing desire among overseas Indians to return home and take advantage of increased opportunities. Despite the recent global economic slowdown, Venkat Panchapakesan says interest remains strong. As market growth resumes, however, he expects quality talent on a global scale to become increasingly scarce and costly. Furthermore, he points out that skill needs are different for industrialized and developing countries. "For an Internet company, the market in the U.S. is very mature and in a very different phase of growth," he points out. "Over the next two to three years, India is likely to be more about emerging markets; the U.S. will be more engaged with broadband and device convergence."

And in the U.S., Silicon Valley will continue to play a unique role, providing innovation, management expertise, and capital. "When I talk to friends in India, they tell me that for the big companies the Valley is not as important as a center," he says. "But for startups, that connection back to the Valley is still important; the brand name carries a lot of weight."



For a number of reasons, **Apple Inc.**'s India market penetration in the past decade has been uneven. It has long been highly protective of its IP; its market share has remained small, due to relatively high price points (made even higher by customs duties) and a focus on niche markets such as publishing and education; and most Indian programmers work in the Windows and Unix formats anyway.

Apple set up a sales and support unit, Apple India, in the mid-1990s, followed by a software subsidiary, Apple Development India, opened in January 1996 in Bangalore. Apple Development was established to create solutions tailored to the Indian market, such as the Indian Language Kit, a set of TrueType fonts for adding Hindi, Sanskrit, Gujarati, Marathi, Punjabi, and Nepalese text to documents, and software to work with Devanagari, Gurmukhi, and Gujarati scripts in applications on a Macintosh computer.

In 1997, two of Apple's main Indian resellers, Wipro Infotech and Tangerine, severed ties with the firm as it hit a low point in sales and market share. Apple ended its relationship with a third, Odin Computers. It turned to three others—Godrej Pacific, Summit Data and Ingram Micro unit Electronic Resources India Ltd.—to reposition sales of the new iMac and desktop publishing product lines. The iMac's catchy design, affordable price, and Internet capability boosted sales in both the consumer and school markets.



The iPod and iTunes were introduced in India in 2004. The media processor chip for the Mini model was designed in India by the R&D captive of a San Jose company, **PortalPlayer**. Later models have used Samsung chips. Apple teamed in 2004 with Padmalaya-Zica, the animation training division of Padmalaya Telefilms, to launch Apple training centers in Hyderabad, Mumbai, and Kolkata. The centers provide Apple certification in video special effects and editing on software such as Shake, Final Cut Pro, DVD Pro, and Maya.

While iPod ownership carries considerable status in India, Daily News & Analysis estimated in 2006 that 60–90% of India iPod sales were “gray market” goods—genuine Apple iPods smuggled from Singapore, Dubai, or Malaysia and sold on the street, not through authorized dealers. High taxes and duties (accounting for up to 40% of an iPod's retail cost), the gray market, rising BPO salaries and high attrition rates, and a dominant Windows PC market, reportedly led Apple in May 2006 to cancel plans for a captive customer support facility called Apple Services India that it had announced a month earlier. It maintained an outsourced call center with Indian BPO Transworks, however, and entered into a non-exclusive distributor relationship with HCL Infosystems to provide sales and support for desktop computers and iPods.

In June 2007, Apple resumed ties to Wipro Infotech, in a broader sales, distribution, and support deal covering all of Apple's products, including laptop computers and enterprise solutions. Wipro has created a special team to focus on the enterprise and small business markets. And in October 2007, Apple raised the stakes in India, announcing a partnership with Reliance Retail to open 10 stand-alone “iStore” retail outlets, with the first in Bangalore. By May 2008, Reliance had opened 4 stores and announced plans for a total of 60 by 2011.

Apple rolled out the iPhone in India in August 2008. Response was light, in part because Apple left the marketing to service providers Bharti Airtel and Vodaphone, and in part because of the \$720–\$840 price plus deposit. Unlike in the U.S., Apple is unable to offer a cheaper price subsidized by phone contracts, due to Airtel's and Vodaphone's low average revenues per user (in the \$7–8 range) and customer resistance to either locked phones or contracts. Furthermore, India does not yet have the network infrastructure to support the 3G iPhone. For this reason, Apple's short-term strategy has been to offer the iPhone as a status item to a relatively narrow market of more affluent Indians.



Online search engine and web portal **Google** began operations in India in 2004 with direct (online) sales for the India market. The company saw multiple opportunities: a large market that was growing exponentially, a chance to be closer to their customers, and an opportunity to access large pools of talent. The Mountain View company opened its first non-sales R&D center outside the U.S. in Bangalore the same year. It initially hired some 100

engineers to work on aspects of a next-generation search engine, including cutting-edge research in information retrieval, distributed systems, machine learning, data mining, theoretical computer science, statistics, search algorithms, scalability issues and user interfaces. At around the same time, Google opened a software testing, sales, and support center in Hyderabad.

The firm was under intense competitive pressure to maintain its technology lead in search over Yahoo! and Microsoft, and it needed access to quality talent. Arriving in India later than many tech companies, Google learned from others' mistakes in setting up a captive center. "When we set up three and a half years ago, the multinationals were already here and were hiring en masse," recalls vice president of online sales and operations David Fischer. "We learned that if cost savings heads your list of top five priorities, you'll achieve that while missing out on other opportunities."

Google India HR director Manoj Varghese notes that the company's India presence isn't about outsourcing or offshoring, but is part of a global enterprise that develops engineering for both global and local products. He sees continued exponential growth in the Indian market, saying, "In three to five years we might have more end users in India than in the U.S." Already, Google is India's leading search engine, and India constitutes Google's largest operation in Asia. Email, chat rooms, and information search are the most common Internet uses, and B2B activity is limited. But sales tied to Gmail, advertising, blogging, online purchasing, e-commerce sites, and job sites are growing rapidly. Consumers are also becoming more comfortable with using credit cards. Today's limitations in India's market are also opportunities: most connections are still dial-up and many Indians access the net at Internet cafes. As broadband grows, so will sales.

In early 2006, Google opened business offices in Delhi and Mumbai, hiring *Indiatimes.com* general manager and business head of e-commerce Ashish Kashyap to handle sales and operations. A key India market objective was to promote Google Adwords, a technology that matches text-based ads to user search queries. Early advertisers in India included Citibank, Monster India, Bharatmatrimony.com, MakeMyTrip, SpiceJet, Kingfisher Airlines, ICICI Bank, Shaadi.com, eBay India, and Birla Sunlife.

Fischer notes that building markets in India was initially a daunting process, given low personal computer ownership, the number of languages, difficulties setting up reliable online payment and fulfillment logistics, and the fact that people were uncomfortable buying products sight unseen. Some of Google's greatest successes have been surprises: videoconferencing, mobile text messaging launched in 2007, and the Orkut social networking site that was developed for the Brazil market and migrated on its own to India. "Orkut took off independent of any marketing," Fischer says. "It was one of those cases where you build things of use, put them out there, and see what happens."

He describes Google's global growth strategy as one of "value being created around an extended model of hiring smart people and turning them loose." In February 2007, the company invested in two early-stage venture funds in India, Seedfund and Erasmic, a first for Google at the time. It later invested in Ventureast Tenet Fund II, a seed-stage collaboration of the Tenet Group of IIT-Madras and Ventureast Fund Advisors to help startups and bridge the digital divide. Google also joined the Indian Angel Network, a professional organization to promote entrepreneurship.

Also in 2007, it introduced Google News in Hindi and a Hindi transliteration feature in its Blogger web publishing service that converts text typed on an English keyboard into phonetically equivalent Hindi script. Other expansions:

- Google Local Business Centre and Local Search, an online local yellow pages offering free restaurant, store, hotel, and other listings to businesses and providing easily accessible local information; and
- Google India Labs, one of seven such labs worldwide that showcase innovations developed at various centers and offer a platform for Indians to beta test new features and provide feedback.

And in mid-2007, Google signed a memorandum of understanding with the government of Andhra Pradesh to expand its Hyderabad center on 20 acres on the city outskirts at Kokapet. Over time the existing support facility has grown to include engineering and back office functions, with a workforce of nearly 1,100. The new center will have a capacity of 4,000 employees.

Like other U.S. technology companies, Google finds hiring managers to be a challenge. The company needs engineers with core skills (most with masters and PhDs), a product mindset (which is different from a service mindset), and the ability to work in a non-hierarchical environment. To meet these requirements, Google engineers are given the opportunity to earn an MS degree at Stanford, primarily through distance learning, and to travel frequently to the U.S. The interaction, Google finds, both builds skills and aids retention.



Juniper Networks was founded in 1996 by Pradeep Sindhu, an IIT-Kanpur graduate with master's and doctoral degrees in computer science from Carnegie-Mellon University. VC firm Kleiner Perkins Caufield & Byers provided \$200,000 in initial funding. Sindhu had previously worked as a principal scientist and distinguished engineer at Xerox's Palo Alto Research Center (PARC). His work on design tools for VLSI and high-speed interconnects for shared-memory multiprocessors led to commercial development of Sun Microsystems' first high-performance multiprocessor system family.

Juniper first opened a sales office in Delhi in July 2000, followed by Mumbai and Bangalore offices and a Delhi proof of concept center in 2001. Partners at the time included Nortel, Ericsson, and Indian IT provider Aparar Enterprise Solutions, among others. In 2003, Juniper opened a Bangalore technical center with a staff of 27 to provide software testing and development support for its growing India customer base. In August 2004, the firm expanded its training and certification program, certifying Hyderabad training firm Isilica Networks India as a partner. At the same time, Juniper folded a Hyderabad R&D center—part of its \$4 billion acquisition of Sunnyvale network security firm NetScreen Technologies—into its larger Bangalore facility. Combined India professional staff at the time was 125.

Early customers were state-owned telecom provider BNSL and international data carrier Data Access, followed by BSES Telecom, Dishnet DSL and HCL Infinet. More recently Juniper has signed government network deals with Indian Railways and with two Indian states, Himachal Pradesh and Bihar. It has partnered with Wipro Infotech to market and implement solutions that

accelerate WAN and data center performance nationwide; the first project involved upgrading the website of online securities trading firm Sharekhan in August 2007.

Juniper invested more than \$200 million in India over 2005–07 and has committed another \$400 million through 2012. The company sees big opportunities for working with existing Tier 1 telecom customers on rollout of their 3G wireless networks, including network performance acceleration and security.

Senior vice president for high-end security systems Michael Frendo, interviewed for this report in early 2008 before leaving Juniper, was instrumental in setting up the company's captive operations as he had previously done for Cisco Systems. The objective at the time, he said, "was getting more hands, freeing people here to work on the next thing. We began giving the Indian engineers relatively mature products and teaching them to work with those; we went from an outsource model to a captive model."

Even though Juniper keeps its core technology close to home in Silicon Valley, half of the company's India workforce of 1,250 in 2008 was composed of development engineers. "We're not moving things to India," Frendo explained, "we're creating things in India based on the skills and domain expertise the country offers."



Online auction site **eBay** made its big push into India with the \$50 million acquisition of Mumbai-based Internet marketplace Baazee.com in June 2004. Baazee delivered a million confirmed registered users to eBay through a familiar localized portal selling cameras, music, phones, consumer electronics, fashion, home furnishings, toys, and travel. In return, eBay provided Baazee with integrated global access for its Indian user base.

Today, eBay has doubled the number of regular users to about 2 million in 670 cities, with half of registered Indian sellers coming from small cities. The site has another 2.5 million unique visitors each month.

eBay fully integrated Baazee under the eBay name in 2005. Although it had acquired online payment, clearance, and settlement firm PayPal in 2002 for the global portal, for the India market, it kept Baazee's payment system PaisaPay, with its established banking relationships.

eBay's India volumes have grown steadily. In 2005–06 Asia-Pacific traffic grew by 75%, with an item from India sold every nine minutes. A third of the sales were to international buyers, mainly from the U.S., UK, Singapore, Mexico, Canada, and Pakistan—for apparel, leather goods, collectibles, musical instruments, handicrafts, and jewelry. Fixed-price rather than auction items increased in popularity. In August 2008, the company reported an item sold every minute on the eBay India website; the most popular product was jewelry, with an item selling every 7 minutes. Men aged 25–30 make up 75% of shoppers; men shop mostly for electronic gadgets, while women tend to shop for jewelry and apparel. Stamps, coins, and books are also among frequently sold items.

eBay Indian Motors, originally launched by Baazee in 2002, has emerged as a major online B2B secondary market for used trucks, buses, three-wheelers, and other commercial vehicles. By late

2007, more than 150,000 vehicles had been sold on the site, with much of the business coming from large corporate fleet owners, trucking and logistics firms, leasing companies, financial institutions, and large dealers selling to smaller dealers in outlying cities and rural areas, as well as to individual business owners.

More than 10,000 dealers across 250 Indian cities participate. Dealers typically access the service via cybercafes; most buy vehicles outside of their local communities and a growing number buy from neighboring states. In July 2008, the concept was expanded to include an online truck B2C classified advertising option that has some 700 vehicle listings. Ads are posted for 30 days and the site enables buyers and sellers to evaluate one another and negotiate price and terms.

“How-to” events hosted in smaller cities around the country in 2007—in the holy city of Varanasi, famous for its silks, ivory, perfumes, and sculptures, and in Jaipur, a center of gemstone production—have increased awareness of opportunities to sell globally. At the same time, eBay rolled out improvements to PaisaPay, including installment payments, online remittances to sellers and refunds to buyers, 7-day phone support, and online transaction tracking. Personalized blogs and web pages were introduced to reinforce community and encourage seller creativity in promoting products and attracting buyers.

eBay began test marketing display advertising from Nokia, Motorola, Dell, Reliance Communications, Canon, L’Oreal, and others in July 2008, and it opened its site to advertising the following November. It had a global partnership with Yahoo! to sell display ads, but in April 2008 added a local Indian partner, Komli Media. It has partnered with media and sports franchises to hold themed auctions of celebrity and team memorabilia, and in early 2008, it attracted 50,000 unique visitors and 500 bids with a series of 10 auctions entitled “Ten Things to Do Before You Die,” ranging from a helicopter ride to a Monaco Formula One Grand Prix travel package.

The economic slowdown beginning in mid-2008 has taken a toll: eBay announced in October 2008 the layoff of 1,000 of its 16,000 employees worldwide. In India, that meant outsourcing of customer service and payment operations to BPO VCustomer. Prospects for longer-term growth, however, remain strong.



Santa Clara network hardware, software, and systems provider **Sun Microsystems Inc.** set up a captive enterprise technical support center in Bangalore in 1998. With the tech bubble underway, demand from venture-funded Internet startups soared for Sun’s Unix-based servers and workstations. Pressed for 24/7 support, Sun had difficulty finding qualified engineers in the U.S. to work night and weekend shifts.

By late 1999, the Bangalore facility was expanded to include an engineering development center and a new division, Sun Federal, to market enterprise solutions to government. It had also set up a center of competence at IIT-Bangalore. By 2001, Sun had invested \$25 million in India and had committed to double that investment to \$50 million within one year—to give its Bangalore facility R&D responsibility for a complete stock of high-end servers for global markets, to open new offices in Chennai and Hyderabad, and to support educational programs.

Sun was an early proponent of open source software and client-server networks, as a counter to Microsoft-Intel dominance in the personal computing market. It launched a range of low-end servers and Sun Open Net Environment (SunONE) software in India, and it offered donated hardware, software and training to government agencies and universities in China and India, in an effort to create a critical mass of users and developers to jumpstart future business.

In 2002, Sun and Oracle jointly set up the iForce Developer Lab with 150 SunBlade workstations running the full range of Sun and Oracle software and Java platform development tools. The lab enables Indian software developers and vendors to test and certify products for small and mid-sized businesses. Sun partnered in 2004 with Cadence and very large scale integration (VLSI) engineering institute VEDA-IIT to launch a center of competency for R&D in VLSI engineering design automation and embedded system engineering in Hyderabad.

Sun had invested \$150 million in India by 2005, and also in 2005, it joined with the Centre for DNA Fingerprinting and Diagnostics (CDFD) consortium and the government of Andhra Pradesh to open a center of excellence in medical bioinformatics in Gandipet. The company also committed \$5 million in matching grants to degree-granting institutions for purchasing equipment.

As computer viruses, worms and denial-of-service (DoS) threats over the Internet made headlines in 2006, Sun joined the list of network firms to focus on IT security, setting up regional control centers in Scotland, the U.S., and Chennai, India, to monitor customer IT infrastructures and processes, spot threats and potential systems failures, and respond within 15 minutes across the world, 24 hours a day.

Sun, General Motors, Electronic Data Systems, and product lifecycle management software firm UGS Corp. collaborated with PES Institute of Technology (PESIT) in Bangalore in 2007, to provide computer hardware and automotive design and engineering tools worth \$155 million to PESIT students.

Sun has recently partnered with Visvesvaraya Technological University (VTU) in Karnataka to offer distance e-training and certification via the EDUSAT satellite television network across the 111 VTU colleges, taught by Sun India engineers in Bangalore and reaching students throughout rural Karnataka. On the commercial side, Sun provides the backbone for Tata Sky's digital direct-to-home pay television service and has partnered with Tech Mahindra to set up a next-generation Internet Protocol Television (IPTV) lab in Pune to develop video-based services and personalized video streams using the Sun Streaming System scalable video delivery platform.

In comparison to its India workforce of 1,200 (mostly Bangalore-based) in 2005, today Sun employs about 1,400, mostly in Bangalore and Chennai, but also in Delhi, Mumbai, Kolkata, Hyderabad, Pune, and Gujarat. Through partners Wipro Infotech, Comptek International, Aman Technologies, Accel Frontline Ltd., and Micropro Software Solutions, it has begun to reach into Tier 2 and 3 cities, including Bhopal, Ranchi, Indore, Jammu, Coimbatore, and Nagpur.

Sun's shift to India has coincided with tough global competition from IBM, HP, and others in the more mature U.S. and UK markets. By contrast, Sun's India revenues have increased by an average 35% annually through much of this decade, including 28% growth in fiscal 2007–08.

Sun includes in its customer base telecom providers BSNL and Reliance Infocomm, ICICI Bank, HDFC Bank, United India Insurance Co., National Stock Exchange of India, Punjab National Bank, pharmaceuticals retailers RPG and Apollo Pharma, Tata Teleservices, Future Group, and the government of Haryana State.

It is also actively pursuing the small and medium-sized business market. Alliances struck during 2008 offer web hosting and managed services to startups, through IT services provider NetMagic, and retail distribution and enterprise management software (billing, purchasing, inventory management, accounting, customer relations) from GoFrugal Technologies.

More than half of India's developer community—about 740,000—work on Sun platforms. Sun has 26 Java and 8 Solaris user groups in India.



San Jose-based **Brocade Communications Systems** began looking at the India market in 2002, after the tech bubble burst. The firm, which specializes in storage area network (SAN) and file area network (FAN) solutions to store, manage, and back up large data volumes, began talking with the IITs, IISc, government agencies, and the banking/finance, medical, and telecom sectors about setting up labs.

In 2003, it began outsourcing software development and testing work to Wipro and later established a similar relationship with HCL Technologies. It has sales and support offices in Gurgaon, Mumbai, and Bangalore and in August 2007 opened its own R&D center in Bangalore with about 30 engineers.

Brocade director of engineering operations Surya Turaga says the company's India outsourcing strategy has been a gradual one, with clear divisions of labor worldwide. "We approached it in terms of concentric circles, with core engineering at the center," he explains. "Working outward, you have the embedded design, then the applications, then testing and so on. We started peeling the onion from the outside in, asking 'What can we do through an offshore model?' Most of the time it was a question of having 10 engineers working locally on X, and realizing that now we need to do Y as well, but someone still has to keep doing X." Its India center and partner center help the company sustain its baseline business (the X), freeing engineers at home to focus on innovation.

Turaga says the core of Brocade's IP, its application-specific integrated circuit (ASIC) design, has been closely held within the company and is done in the U.S., while a development center in China focuses on hardware design. But he also acknowledges that it is in the company's interest to incrementally offer the India Center a bigger piece of the onion: "When we looked at the local environment we could see we were able to get good, skilled engineers and researchers; we were more successful than the stories had suggested. But if you don't give them interesting work, that's when you get into issues of attrition."

Turaga says the work performed in Bangalore is no different from that being done in the Bay Area—that Brocade sees it as just another location. No jobs have been displaced, and the company continues to grow in all its locations, including San Jose.

H: Biotech/Biopharma

Key Findings:

- India's biotech sector is growing, as both markets and R&D expand.
- Bay Area biotech firms use India for trials/testing/research.
- Indian biopharma is shifting from outsourced research to deeper partnerships.

India, already a powerhouse in the generic pharmaceuticals sector, is also emerging as a significant player in biotech and biopharma, the biotech industry's largest segment. There are approximately 350 biotech companies in India today, with revenues of \$2.5 billion and roughly 30,000 employees. With growth in the sector historically having averaged 35–40% per year (between 2002 and 2007), revenues are expected to reach \$5 billion by 2010. The Associated Chambers of Commerce and Industry of India (ASSOCHAM) predicts that the number of biotech firms in India will double to 600.

The sector is essentially distributed between biopharma, agricultural biotech (e.g., bio seeds), bio-IT (bioinformatics including data management), and industrial biotech. For now, India's pure-play biotech sector is nascent and principally based in Bangalore, which also serves as home to the National Institute for Biological Science, the Indian Institute of Science, and other research institutes. Most Indian entrepreneurs remain focused on IT, which is where the largest pool of investment dollars are available, but this may change over time as national and global health markets expand and fields such as genomics accelerate the global hunt for talent.

Biotech in India is rooted in the growing domestic market and in the country's strong base in pharmaceuticals. A June 2008 report by the Kauffman Foundation, "The Globalization of Innovation: Pharmaceuticals" tracks the global spread of the pharmaceuticals market. While the global market share of the top 10 pharmaceuticals firms peaked in 2005 at 42% before easing to 38% in 2007, the emerging markets share of global industry sales more than doubled between 2001 and 2006, from 13% to 27%. India's market share in 2007 was about 4%. A 2007 survey by PricewaterhouseCoopers (PwC) suggests that industry executives see the center of gravity of the global pharmaceuticals market shifting from Europe and North America to Asia. Asian markets, including India, are therefore seen as critical to capturing global market share.

Global outsourcing is now extending beyond manufacturing to biotech, as mass communication, low-cost computing and the quest for global talent have led to:

- licensing of component products and research, or complete drugs, from India;
- research partnerships between global majors and Indian firms (discovery research), with cost and risk sharing as well as joint ownership of intellectual property;
- the emergence of contract research organizations (CROs) that conduct research and clinical trials for specific stages of drug discovery, development, or testing;

- a growing use of India by biotech firms for R&D and drug development functions; and
- growing generic drug and active pharmaceutical ingredient (API) markets, as global products come off patent.

Reflecting these trends, Bay Area biotech companies are using Indian resources to develop computational software and for contract-based trials and testing. The cost and value effectiveness of doing these things in India is allowing smaller Bay Area biotech firms—which need to rely on limited venture or other investment until products become commercially viable and obtain FDA approval—to extend their funds and increase their chances of survival and eventual success. Larger Bay Area biotechs are meanwhile deepening their R&D ties.

India's pharmaceuticals industry has a history that predates IT. In the 1970s, to encourage Indian companies to produce for the domestic market, Prime Minister Indira Gandhi's government changed patent law in way that conflicted with global patent standards. As the industry grew, so did its outward orientation, with expanding exports to Asia and the Middle East. With its accession to the WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 2005, India formally recognized product patents. The change resolved the longstanding issue of widespread patent infringement and required Indian companies to produce generics only when drugs go off-patent.

This stimulated a surge in contract research work in India, as well as clinical trial activity by multinational corporations who now had fewer concerns that intellectual property might be stolen. The Indian clinical trials market is expected to reach \$1 billion by 2010. Contract manufacturing, estimated at \$350 million in 2007, is also expected to reach \$1 billion by 2010. In the future, India's biopharma companies will likely follow the course taken by their counterparts in information technology—moving from outsourced contract work to full partnerships and increased risk-taking with global partners.

Much of India's drug production is for export. According to global data source Trade Information Systems, Indian pharmaceutical exports for 2008 were estimated at \$10 billion, up from \$1.9 billion in 1999. Supporting this production are eighty-five product active product ingredient (API) and formulation plants in India, the largest number in any country outside the U.S., producing drugs on a very large scale for the U.S. and other developed markets. While standards at these facilities are uniformly high, the industry hit a speed bump in September 2008 when the FDA banned the sale in the U.S. of products from two facilities operated by Ranbaxy Laboratories, based on deficiencies in their manufacturing processes.

Building on this historic base in generics and adding research capacity, Indian companies are starting to grow through acquisitions and strategic partnerships in Western markets. India's advance into drug development and discovery research is part of this global reach. According to PwC, the key considerations behind the outsourcing decisions of multinational corporations are lower-cost manufacturing, lower-cost research, cost-sharing, leveraging in-house with external capacity, accessing expertise, and the ability to better focus on core internal strengths. The trend is toward two-way partnerships, with Indian partners taking more responsibility. Today there are

at least 11 large new Indian drug companies engaged in sophisticated drug development and discovery research. Most scientists in these companies were trained and educated in the U.S., particularly in Silicon Valley, and most Indian entrepreneurs in the life sciences come from either the Bay Area or New Jersey.

Many of the leading pharmaceutical companies in United States and Europe now conduct clinical trials in India, which offers several compelling advantages: 40–60% of the cost in developed countries, skilled medical professionals, a large pool of “drug naïve” patients or volunteer test subjects who have not been subjected to previous treatments, a shorter recruitment cycle for engaging clinical trial subjects, and quality IT infrastructure. Clinical data management is also growing, due in part to India’s quality IT infrastructure and workforce.

Despite progress, intellectual property protection remains a concern. India’s 2005 reforms extended to drug substances protection previously applied only to the drug manufacturing process. But Indian courts have been emphatic in rejecting so-called “incremental innovations” that serve to extend patent life. At the same time, a vibrant generics and compounds industry is constantly looking for opportunities in patent lapses and loopholes—from a profit standpoint, but also from a perspective (often shared by government) that developing countries should not be denied access to new treatments because of price.



San Carlos-based **Reamatrix**, a diagnostic development and reagent services company with funding from Sequoia Capital, and **Gangagen**, a Palo Alto company producing products for the prevention and treatment of bacterial infections, both have India bases in Bangalore. **Agilent** also maintains a research center there.



Emeryville vaccine developer **Chiron Corp.**—now part of global major Novartis—secured a 51% stake in a 2003 joint venture with Aventis Pharma to manufacture rabies vaccines, it and announced plans to use India as a regional hub to supply them in other markets. In 2004, it formed a strategic alliance with Panacea Biotec in Mumbai to develop breakthrough vaccines for India, most notably Pentavalent, a single vaccine for diphtheria, tetanus, whooping cough, Hepatitis-B, and H. Influenza type b.

The Confederation of Indian Industry (CII), sensing potential, sent a 30-member delegation to the industry’s BIO Convention in San Francisco in June 2004. The group presented at the event, and later met with Genentech, Genencor, Chiron, Exelexis, Gilead Sciences, and Nektar Therapeutics, as well as venture investors.




In September 2006, **Gilead Sciences** signed a deal with eight Indian generics companies—among them Aurobindo Pharma, Medchem International, Matrix Laboratories, and Ranbaxy Laboratories—licensing the rights to make, combine, and set market pricing as they see fit for two HIV drugs, Emtriva and Viread, with Gilead receiving a 5 percent royalty.




Nektar Therapeutics, a San Carlos firm specializing in respiratory and pulmonary pharmaceutical delivery systems—it is best known for Exubera, an inhaled diabetes treatment it developed with Pfizer—announced in May 2007 its plan to build an R&D center near Hyderabad on 15 acres provided by the Andhra Pradesh government. Nektar CEO


Howard Robin and COO Bharatt Chowrira were both previously with RNA-based therapy developer Sirna Therapeutics in San Francisco, which was acquired by Merck in 2006; both were involved there in establishing collaboration agreements between Merck and Indian pharmaceutical firms like Nicholas Piramal and Ranbaxy Laboratories.

 Most investment to date, however, remains on the VC side. Dr. Nandini Tandon, venture partner with **Lumira Capital** in Mountain View—an early stage investor affiliated with Toronto institutional investment firm MDS Capital—opened the firm’s Bay Area offices in 2002. Previously she had been with RBC Capital Partners, and before that had held senior business development positions with Hayward protein analysis platform company Zyomyx and Sunnyvale gene research firm Hyseq. She also chairs TiE’s life sciences group.

“It’s very exciting to see what’s happening in India and China,” Dr. Tandon says. “There’s a great awareness of the potential that exists in the health care field, especially in terms of new technology. Companies are standing on the shoulders of the IT sector; they’re putting the processes in place to go forward.” She sees particular upside in the medical and health services space—prosthetics, diagnostics, delivery systems, and imaging—as opposed to drugs and other therapeutic treatments. Tandon expects Lumira’s portfolio over time to shift from 80% therapeutics and 20% medical services to a 70:30 ratio favoring services, reflecting the growth of emerging economies in importance both as markets and as product development centers.

 Lumira sees opportunity in India, but prefers to leverage its exposure by teaming with other venture capitalists. Dr. Tandon notes that “right now there is not enough of a critical mass to create a syndicate,” but expects to see one in the next few years as more life sciences venture capitalists begin to pursue growth opportunities there. Two companies in Lumira’s portfolio with potential India applications are Hayward-based **Guava Technologies**, whose cell sorting and analysis technology permits more experiments with fewer cells at the bench level without requiring large volumes of water, and **U-Systems, Inc.**, a San Jose maker of low-cost ultrasound systems for diagnosing breast cancer, that are competitive with an MRI and focus on scanning dense tissue common in Asian women.

Dr. Tandon believes Silicon Valley will continue to lead the way in delivering life sciences solutions to emerging markets, including India. “It’s still too early for Indian companies,” she says. “A company is run by its management, so what we are investing in is management. The culture in Silicon Valley has spawned people who have done this very well. I don’t see that elsewhere, including India.” However, she sees cross-border companies developing in India over time: “The companies that are going to succeed are the ones with ideas in India and experience from here.”

 San Francisco-based life sciences VC firm **Burrill & Company** is creating a \$200–250 million VC/PE India fund that will invest in innovation-based health care and health care delivery businesses within India, as well as businesses outside India that have India as an integral component of their business strategy.

Dr. Tania Fernandez, India director at Burrill, says health care is one of India’s largest sectors both in terms of revenue and employment, and the sector is expanding rapidly. Its value is more

than \$34 billion today and is expected to touch \$40 billion by 2012, with the private sector accounting for more than 80% of total health care spending in India. The country's life sciences sector is in the process of more than doubling, from a \$2 billion sector in 2007 to \$5 billion in 2010. Of that, biopharma—including vaccines—continues to be the main revenue generator and makes up about 70% of the biotech industry's revenue; bioservices and bioinformatics make up 15% and 12% respectively, while bioagro and bioindustrial account for 4% and 2% respectively.

Apart from health care and innovative models of health care delivery, Fernandez sees opportunities in biopharma in particular. Growth in this sector, she says, is driven both by domestic consumption and by exports: the domestic pharma market has continued to experience healthy growth and the demand for generic medicines is on the rise in international markets. Fernandez also sees India as uniquely positioned in the global vaccines market; it is the world's largest producer, accounting for a third of global vaccine sales. Bioagro, though a smaller contributor to the industry's revenues, has shown impressive growth.

Dr. Fernandez views portfolio expansion into India as a strategic venture. There has been an increasing appetite among Bay Area companies to go to India, as the biotech industry there has moved up in sophistication and as consumer markets are driven by a rising 300 million-plus middle class with growing incomes and purchasing power. Out-licensing from the U.S. of proven technologies that can be customized for Indian markets is another area of interest.

Dr. Fernandez describes most of the innovation in India as process innovation and innovation in business models. Creative innovation still continues to come from Silicon Valley, either from companies directly or from people that have assimilated Silicon Valley management culture. "Indian culture still doesn't tolerate high levels of risk and still needs to work on building sustainability into their businesses," she says, "but people coming from the Bay Area are bringing back with them a more risk-tolerant perspective." Investment from Indian companies in the Bay Area through strategic alliances and partnerships is also a strong possibility over time, particularly among biopharma and medical device companies looking for front-end marketing and distribution in the U.S.



Evolve India Life Sciences Fund (EILSF), the first life sciences fund focusing exclusively on India, has raised \$90 million. Its first two investments are in Health Care Global, an India-wide network of oncology clinics with a hub in Bangalore, and Gland Pharmaceuticals, a company producing injectable generics in pre-filled syringes for the U.S., European, Asian, and Indian markets.

A third EILSF investment was announced in September 2007 in Sutures India, a regional manufacturer of surgical sutures and India's second largest producer, with a national distribution network and exports to more than 50 countries. The investment will enable EILSF to tap directly into the estimated \$250 million market in India, Brazil, and Russia, as well as a global market estimated at \$3–4 billion annually.

Dr. Anula Jayasuriya, the fund's co-founder and managing director, is also the president of EPPIC, a Bay Area association of life sciences professionals who share an interest in globalization, with a particular emphasis on India (see *Bay Area Entrepreneurs Flex Their Muscle* in Chapter 3).



7

M&A, Venture Capital, and Private Equity: A Thriving Investment Climate

“The focus in India today is to create the “disruptive business model” as opposed to America where the focus is on “disruptive innovation”.

Vinod Dham, NEA Indo-U.S. Ventures

Key Findings:

- Foreign direct investment (FDI) liberalization has lured private equity, and deal size has doubled since 2005.
- Non-hostile “influential” strategic stakes in companies are favored over mergers and acquisitions (M&A).
- Investment has spread from IT/BPO to business and consumer services.
- Seed venture capital (VC) prospects grow as returnees with management expertise launch startups.
- Insurance and pension funds look to property—REITS and project developers that own land.
- Tight credit and capital outflows have slowed development.
- Venture firms invest directly or through dedicated India funds, and consumer markets are a target.
- Outbound FDI is growing, as Indian firms seek vertical integration and global scale.

While the environment for two-way India investment has become less hospitable in the wake of the global downturn, India remains a favored long-term play in a range of industries, and its companies are no less focused on developing global scale and reach. As numerous experts interviewed for this report have said, a bad year for India is 6–8% GDP growth.

Over 1991–99, Indian government policy on foreign direct investment (FDI) underwent a tectonic shift. Where it had broadly prohibited FDI except for specific, exempted areas, gradually more kinds of investment were moved to the automatic approval list until, in 1999, the government took a new position that freely allowed FDI except in specific sectors felt to be sensitive.

Private equity and venture capital investment in India began in earnest in 1996–97 with expansion of the IT, telecom and Internet sectors. Combined venture/private equity investment totaled \$20 million in 1996, increasing four-fold in the following year to \$80 million. Simultaneous with the global tech boom, a high point was reached in 2000, with 280 deals valued at \$1.16 billion. Most of this activity was in the IT services/software sector and was related to Y2K business.

With the tech crash in the U.S., deals fell in number to 110 in 2001; the number of early-stage deals declined to 36 from 142 (although average deal size doubled from \$4.14 million to \$8.52 million); and the number of late-stage and private equity deals fell from 138 to 74. Investments in Internet companies declined from \$576 million to \$49 million. Investment reached a low point in 2003 but since 2004, deal activity has returned in full force.

Inward Foreign Investment in India, 2004-08 (\$ billions, U.S.)

	2004–05	2005–06	2006–07	2007–08
FDI	3.75	5.5	15.7	24.5 (+56%)
PE/VC*	1.65	2.2	7.47	14.23
(# of deals)	(71)	(146)	(302)	(387)
Venture Capital*	n/a	.268	.508	.543
(# of deals)		(44)	(94)	(98)
Key Sectors:	Mobile/Web Services; IT/BPO; Business and Financial Services; Health Care/Life Sciences; Media/Entertainment; Real Estate/Infrastructure; Manufacturing; Cleantech.			

Source: Ministry of Commerce and Industry; U.S.-India Venture Capital Association/Venture Intelligence.

* Totals are for calendar years 2004 through 2007.

In the first five months of fiscal 2008-09 (April-August), FDI in India totaled \$14.8 billion, suggesting a possible slowdown and raising the question of whether India was still likely to meet the government’s forecast of \$35 billion in FDI for the fiscal year. Still, India’s investment environment remains dynamic. A report released in September 2008 by the United Nations Conference on Trade and Development (UNCTAD) continued to list India among the most attractive FDI markets. A June 2008 survey by Ernst & Young placed India fourth in terms of attractiveness as an alternative business location—after China, Central Europe, and Western Europe, and ahead of the U.S. and Russia.

Venture Capital Arrives

Among its advantages for Western multinationals, India is English-speaking; its legal system is well-established and based on the British system, with well-trained judges and lawyers and, while less than efficient, is relatively free of corruption; and corporate governance and accounting practices are relatively transparent.

Several trends have become apparent as the Indian investment landscape has continued to evolve:

- As Indian market sectors are opened to FDI and ownership ceilings are raised or lifted entirely, average deal size has increased.
- VC investors are seeing new opportunities for seed and early-stage investment in returnee and domestic startups—particularly as larger private equity players enter the market and focus on mezzanine, late-stage turnaround, and private investment in public equity (PIPE) financing.
- Investment has diversified, from mainly IT/BPO and related services into the mobile telecom, media, manufacturing, retailing, automotive, aviation, health care, pharmaceutical, real estate/infrastructure, travel, and financial services sectors.
- Investors are increasingly focused on building longer-term, “influential” minority stakes in firms, typically negotiated up front with management, versus investment geared toward an IPO, M&A, or some other shorter-term exit strategy.

In fiscal 2004–05, the National Association of Software and Service Companies (NASSCOM) identified 46 venture capital/private equity deals valued at \$1.3 billion. Ninety percent of the investment was with existing, mostly profitable, firms such as optical storage firm Moser Baer, life insurance/health care provider Max India, television network UTV, and the \$500 million private equity buyout, by Oak Hill Capital Partners and General Atlantic, of GE Capital International Services (GECIS). Investment in biotech was relatively low, at \$70 million over nine firms.

By 2007–08, according to the U.S.-India Venture Capital Association (now the Global India Venture Capital Association) and Venture Intelligence, the largest single investment (in Bharti Infratel) had grown to \$1 billion; private equity firms had invested \$10 billion or more in 249 companies and 31% of deals were in the \$10–25 million category; and on the VC side, only 23% of all deals were less than \$2 million. Only 16 of 65 private equity exits—and only 2 of 24 VC exits—were through IPOs. IT and IT-enabled services remained the leading sector by volume—half to two-thirds, by various estimates—but business and financial services led by total value. Average deal size was now around \$45 million, up from \$21 million in 2005.

Venture investment in India fell sharply in the first half of 2009 (27 deals with a value of \$117 million versus 67 deals worth \$413 million in the first half of 2008), reflecting instability in global financial markets. Deal flow is expected to recover, however, as emerging markets attract increasing attention and the global economy strengthens.

The Floodgates Open

A watershed exit in March 2005 changed the Indian investment landscape, leading to a flood of new capital raised and deployed by large institutional players. Over 1999–2001, Warburg Pincus had acquired for some \$300 million an 18.5% position in Bharti Tele-Ventures, India’s largest publicly traded mobile telephone company. With hands-on involvement from Warburg, Bharti

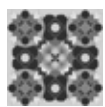
grew its subscriber base over 1999–2005 from 104,000 to 14 million, and its market capitalization from \$100 million to \$15 billion.

Warburg's stake in the company, in the meantime, had grown to about \$1.26 billion, and it decided to sell a block worth \$560 million on the Mumbai Stock Exchange. The question was how easily the market could absorb such a large block trade, the largest in the Exchange's history. The trade was completed in 28 minutes, and Warburg had repatriated its earnings within 48 hours.

From that point, large private equity deals proliferated, among them:

- U.S. generic drugs maker Mylan Laboratories bought a 51.5% stake in Hyderabad-based contract drugs research and manufacturing firm Matrix Laboratories in August 2006 for \$736 million, providing an exit for TPG Newbridge and Singapore sovereign fund Temasek Holdings which together held 39% of the company.
- In April 2006, TPG Newbridge invested \$100 million in Shriram Transport Finance Company, a lender in the small truck and commercial vehicle market.
- Providence Equity Partners paid \$400 million for 16% of Indian wireless provider Idea Cellular in October 2006.
- EDS, recently acquired by Hewlett-Packard, bought 52% of BPO firm Mphasis for \$380 million in June 2006, providing an exit for Baring Private Equity of Hong Kong, which sold its 23.38% stake for about \$170 million—14 times what it had paid initially.
- Vodafone spent \$11.1 billion in February 2007 to buy 67% of Hutchison Essar, winning out in an auction against a partnership of TPG, Blackstone Group, and Reliance Communications, and gaining a 16% market share in India.

Despite the size of these deals, a 2008 survey by accounting firm Grant Thornton found that roughly 80–90% of private equity deals in India since 2006 were under \$50 million each.



Early 2007 also saw several successful VC exits: **Walden International** and Global Technologies took IT services firm MindTree Consulting through a \$53 million IPO in February; and BPO firm FirstSource, formerly ICICI OneSource, floated 23% of its shares on two Indian stock exchanges, providing exits to WestBridge Capital Partners (now Sequoia Capital India), as well as to Temasek. M&A exits included software testing company RelQ, BPO firm Global Vantage, and radio channel Music Broadcast.

Combined inbound and outbound India merger and acquisition (M&A) deals totaled 553 in 2006, with a value of \$55 billion. Most notable was the \$28 billion in mostly debt-funded acquisitions by Indian firms pursuing vertical integration strategies and establishing global brands. Indian firms scooped up European and Canadian steel producers, British consulting firms, Indonesian coal mining concerns, and a German maker of wind power generating facilities, as well as British scotch distiller Whyte & Mackay.

Beginnings of a Bubble

Fiscal 2007–08 set a record for funds raised through initial public offerings (IPOs), follow-on public offerings (FPOs) and foreign currency convertible bonds (FCCBs), with more than \$13 billion raised by 91 issues, according to research firm Prime Database. That amount was more than double the total \$6.2 billion raised by 76 issues in 2006-07 (but was still less than half of the total IPO value in China). Major issues included real estate firm DLF's \$2.26 billion IPO and ICICI Bank's record \$4.68 billion FPO, along with India's largest IPO to date, from Ambani Group's Reliance Power, in January 2008. That offering was 10 times oversubscribed at the end of its first trading day and raised \$3 billion within a minute of opening.

In October 2007, the Securities and Exchange Board of India (SEBI) barred foreign institutional investors from holding more than 40% of their assets in participatory notes (PNs)—derivative instruments that enable hedge funds and other overseas investors to invest indirectly in Indian stock markets through foreign institutional investors (FIIs). It ordered FIIs to unwind their PN holdings above the 40% threshold over 18 months, and prohibited them from renewing or issuing new PNs. SEBI's action reflected Reserve Bank of India concerns that massive capital inflows were driving up the rupee and costing tens of thousands of export-related jobs, particularly in textiles. The government was also troubled by the lack of transparency into large hedge fund positions because of PNs.

Foreign investors purchased a record \$17.4 billion worth of Indian stocks in calendar year 2007—more than half of that (\$9 billion) in the last four months of the year. Fears of a bubble were confirmed in part by the Reliance IPO: Reliance Power, 50% owned by Reliance Energy, was an entity created to issue stock and raise funds for power plant development across India; at the time of the IPO, valuation was next to impossible because it had no operational power assets, faced uncertain land acquisition and other costs, and would likely not make a profit for at least another four years.

Over 2008, the Sensex as a whole lost more than 52% of its value, or 10,640 points, according to the Business Standard. Overseas investors dumping emerging market shares sold \$13.4 billion in Indian shares on net by year-end—a net loss of nearly \$31 billion from the 2007 record sales. Three large private IPOs were withdrawn in 2008 due to slowing interest, and planned IPOs relating to privatization of state-owned energy firms were also delayed. Since then, however, stock markets have rebounded as investors have poured \$12.7 billion into Indian stocks in the first nine months of 2009, more than making up for the \$12 billion withdrawn in 2008. Private equity and venture investment has also rebounded, though deals are generally smaller and the appetite for risk lower. Through July 2009, \$16.6 billion in foreign direct investment flowed into India.

Conflicting Signals

Wherever the Indian government has moved to relax investment rules sector by sector—raising ownership caps, easing lock-in requirements, reducing or eliminating tariffs on related inputs and equipment, cutting taxes—foreign investment has risen sharply.

One important example is real estate, where 2005 rule changes opened 100% of the construction industry to FDI, lowered tariffs on imported construction equipment and materials, and reduced the minimum project size eligible for foreign participation from 100 to 25 acres or 50,000 square meters. The new rules attracted investors and raised real estate's share of total FDI in India from 10.6% in 2004–05 to as much as 26% by 2006–07, according to ASSOCHAM.

In certain sectors, however, government response to investor interest has been slow and/or conflicted, attempting to balance the competing goals of furthering modernization without creating undue competitive disadvantage for domestic industry.

In January 2008, the government approved changes to the FDI rules that had been postponed six times over two years. The changes:

- raise allowed foreign ownership in oil refinery projects with state-owned firms to 49%;
- end the requirement that foreign ventures marketing or trading petroleum products surrender a 26% stake to Indian firms within five years;
- allow up to 49% foreign holdings in commodity exchanges and credit information companies.
- permit 100% FDI in titanium mining;
- allow foreign investors to own 74% of air cargo, non-scheduled, or charter airlines (although while foreign airlines may invest in air cargo operations, they may not invest in Indian passenger airlines);
- extend 100% foreign ownership to aircraft maintenance, repair, overhaul, and flight training operations, and raise ownership cap in ground-handling services from 49% to 74%; and
- exempt industrial parks from minimum size and portfolio investment restrictions in the construction development sector.

What was not included in the rule changes was at least as important: foreign investment in grocery retail remains restricted to wholesale “cash-and-carry” operations that supply small grocers and to specialized single-brand retail—such as a Levi Strauss, Starbucks, or Coach—in which 51% FDI is allowed. Modern “multi-brand” department store or big-box competition remains prohibited, due to intense political opposition, and makes up only 5% of a \$350 billion market.

Wal-Mart and Tesco have opened cash-and-carry outlets and have partnered with Bharti Enterprises and Tata Group, respectively, in developing hypermarkets for India. While maintaining a relatively low profile, these large retailers are developing an efficient back-end supply chain and inventory management infrastructure throughout the country. But even domestic firms threatening competition to the country's small grocers have felt serious resistance: in late 2007, the Uttar Pradesh government ordered Reliance Group to close 37 Reliance Fresh produce outlets after small retailers staged riots outside its stores. The central government has commissioned two studies before taking further action.

In the telecom sector, the government raised the FDI cap from 49% to 74% in early 2006, prohibited remote outsourcing of network maintenance and repair, and reserved senior management positions for Indian nationals.

Foreign venture capital firms, meanwhile, face uncertainty from India's confusing tax structure. A 2004 Supreme Court ruling clarified and upheld investors' ability to avoid double taxation by setting up entities in countries like Mauritius, Singapore, or Cyprus that have double tax avoidance agreements with India.

Domestic venture capitalists, which remain subject to India's 10–20% capital gains rate, have protested the discrepancy. The Finance Ministry has taken up their cause: a February 2007 budget speech by Finance Minister Chidambaram attracted considerable attention, calling double taxation avoidance an incentive and proposing that it be limited to nine sectors—biotechnology, IT for hardware and software, nanotechnology, seed R&D, certain R&D in the pharmaceutical sector, dairy, poultry, biofuels production, and hotels and convention center development.

Challenges to Mauritius' residency requirements have led Singapore to establish a competing structure that meets potential restrictions down the road. In addition, India does not recognize limited liability partnership (LLP) and limited liability corporation (LLC) structures, which clearly distinguish between a fund and its investors in terms of tax liability. And despite tax incentives to register as foreign venture capital investors (FVCIs), conflicting rulings leave open the question of whether dividend distributions and exit earnings from an Indian investment are to be treated as capital gains or business income subject to Indian income tax.

As a result of those and other uncertainties, only a small number of venture capitalists have registered as FVCIs; most venture investment remains domiciled offshore and enters India as FDI. That has directed the flow of capital into specific areas where FDI has been most encouraged, including real estate.

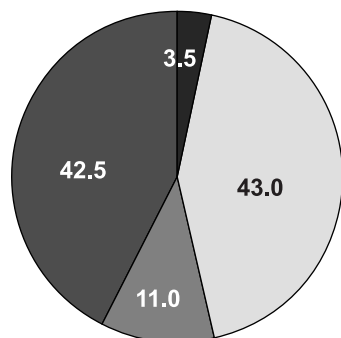
Investment Flows Both Ways

India, meanwhile, is seeing record outbound investment. During 2007–08, according to Reserve Bank of India data, Indian firms invested \$23.1 billion in more than 2,200 overseas ventures, including partnerships, joint ventures, and wholly-owned subsidiaries—a 53.2% increase over 2006–07. Major acquisitions have included Tata Motors' purchase of U.K.-based Jaguar and Land Rover from Ford Motor Company, Tata Steel's acquisition of the U.K. company Corus, and the purchase of British steelmaker Arcelor SA by Mittal Steel. ArcelorMittal, which is less than ten years old, now accounts for 10% of global steel production.

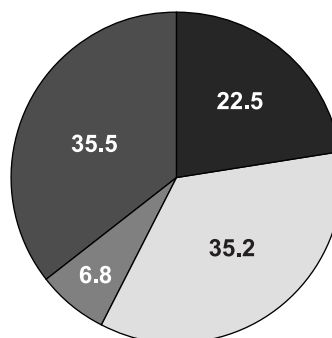
Outward investment is often channeled through tax-favorable jurisdictions, with about 65% moving via three locations: Singapore, the Netherlands and the British Virgin Islands. Mauritius, the United Arab Emirates, and Cyprus followed closely. Major destinations, according to a 2007 ASSOCHAM study, are mainly Europe, the U.S, and Africa. Nearly 82% of investment in 2007–08 was in equity, with the remainder in loans; 95% of outward FDI proposals were valued at \$5 million or more.

India's Outward Foreign Direct Investment, 2007–08

Distribution (% shares)

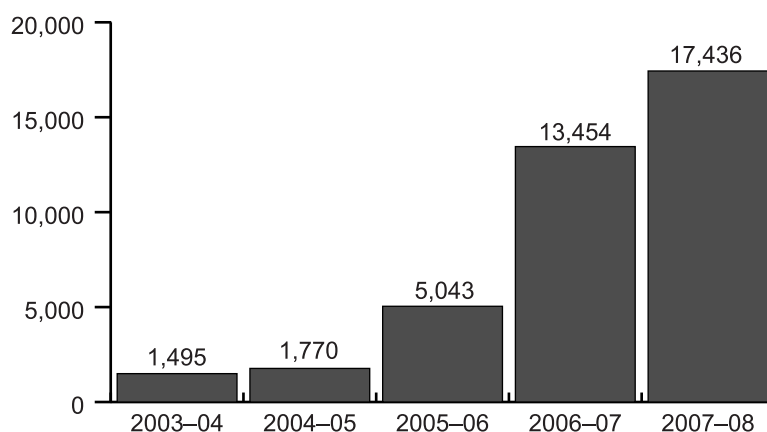


Direction (% shares)



Source: RBI / Domain-b.com

India's Actual FDI Outflows, 2003–2008 (\$ millions, U.S.)



Source: RBI / Domain-b.com

Manufacturing is currently the leading category, making up 43% of the total, and includes electronics, fertilizers, agricultural products, and gems and jewelry. The energy, pharmaceuticals, and automotive sectors also figured prominently in M&A activity. Non-financial services, accounting for 11% of the total, included telecom, software development, and medical services. Trade-related sectors included textiles, garments, chemicals and petroleum products.

M&A activity has also grown. Large firms pursuing scale and global reach through M&A have included Tata Group, Bharat Forge, Ranbaxy Laboratories, Oil and Natural Gas Corp. (ONGC), Infosys, Wipro, Essar, Reliance Group, Apollo Group of Hospitals, Bharti, Airtel, pharmaceutical and health care provider Nicholas Piramal Ltd., and Suzlon Energy. But smaller firms have also taken advantage of investment opportunities. In what promises to be essentially a reverse-outsourcing deal, in August 2009, Reliance Big Entertainment invested \$325 million for a 50% stake in Steven Spielberg's Dreamworks SKG, gaining a share of the profits and the right to distribute its products in India.

Of 86 M&A deals valued at more than \$35 billion in the U.S. during 2007, a third involved small and mid-sized Indian enterprises. Their combined value was up dramatically from \$15 billion worth of such deals in 2006 and \$4.3 billion in 2005. A March 2008 Ernst & Young study, commissioned by the Federation of Indian Chambers of Commerce and Industry (FICCI), suggested that direct investment in the U.S. by 46 Indian enterprises—72% of them small and mid-sized firms, and nearly half in the IT sector—created an estimated 65,000 jobs in 2007 alone.

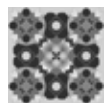
A weak dollar has heightened the appetite of Indian firms for U.S. acquisitions with an eye toward expanding markets, achieving global scale, acquiring management expertise and contacts, and accessing specific technologies, processes and talent quickly. Where India's domestic market may provide few opportunities to grow through acquisitions, M&A focused on the U.S., Europe and other Asian markets offers Indian companies the opportunity to acquire technologies, access new management pools, and increase their product lines.

Bay Area Connections

Throughout the previous sectoral analyses in this report—in financial and legal services, semiconductors, IT services, real estate, energy, computer networking, and the Internet—we have highlighted India investments undertaken by specific firms, in the context of their overall India presence. Here we attempt to provide a sense of cross-border venture capital, private equity, and M&A activity, in both directions.

An August 2006 Evalueserve study identified 23 VC and 21 private equity firms in the U.S.—many of them based in San Francisco and Silicon Valley—that had significant existing or planned India investments. Original research done for this report in 2007 identified 54 Bay Area firms with some level of cross-border, India-related investment in all categories.

Comprehensive statistical data on cross-border investment is not readily available, but it is possible to piece together from interviews and secondary research a flavor for investment trends as they relate to California and the Bay Area.



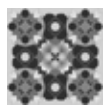
The **California Public Employees' Retirement System** (CalPERS) registered with SEBI as an FII in July 2004, committing \$100 million to the Indian equities market.

CalPERS' three emerging market fund managers made the decision to invest after India's successful April 2003 rollout of automated procedures to settle equity trades within two days of execution—a standard known as T+2 rolling settlement—down from three days in 2002 and 5 days in 2001. The pension plan's initial strategy focused on mid-cap stocks over a 3-10 year

timeframe. By mid-2007, it had a total investment of more than \$1 billion in 55 Indian stocks, up more than 260% from their \$277 million value when the shares were purchased.

As described earlier in this report (see the *Architecture/Urban Planning/Infrastructure* section in Chapter 6), CalPERS has also invested in Indian real estate, contributing \$100 million to IL&FS Investment Managers' India Realty Fund and \$50 million to Sun Apollo Ventures' India Real Estate Fund.

In 2007, CalPERS reallocated its India equity holdings, investing \$75 million in 100 additional companies—divided mainly among the petroleum, IT, logistics, financial and infrastructure sectors—as part of a strategy to focus on stocks outside the U.S., including in emerging markets. At the same time it changed its overall portfolio allocation away from stocks as an asset class. Among its top 2008 holdings were Chennai Petroleum Corp., Satyam Computer Services, Wipro, ABB (India), Indraprastha Gas, Axis Bank, and Cairn India.

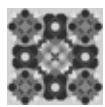


The **Franklin Templeton Group of Funds**, in San Mateo, has some \$6 billion locally invested in India through its own India mutual fund, according to chief investment officer Stephen Dover, and it has an equivalent amount invested with other India funds. Franklin Templeton began investing in emerging markets, including India, in 1982, but most of the serious growth has taken place in the past four years.

“There’s an enormous amount of potential in India,” says Dover, who travels there four times a year. “India is early in the takeoff stage, behind China and Southeast Asia. But unlike China, India is really a domestic consumption story; it’s not that dependent on export growth.” The key, he adds, is passing the per capita GDP threshold of \$1,000 annually, which will translate into discretionary consumption on a massive scale, given India’s high savings rate. He points to India’s large talent pool of scientists, technicians, and managers, and the more than 5,000 listed companies that have relatively strong corporate governance, healthy earnings, and a focus on return on equity. “There was not much FDI before,” he notes, “so they had to manage their cash well.”

Dover sees long-term potential in the diversification and globalization of publicly-owned Indian companies, which to date have paid out high premiums to private equity investors. But he also expects FDI to account for a smaller share of growth going forward. “We’ve gone from having Americans invest overseas to having Indian companies managed by Indians in India raising money from Indian investors.”

To support its operations, Franklin Templeton has worked with Indian IT partners since 1998, and it established a captive center of its own in 2003.

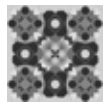


Gen. William Draper, became the first professional venture capitalist on the West Coast in 1958, after heading the team in charge of implementing post-war economic reconstruction of Germany and Japan under the Marshall Plan. His son, Bill Draper, formed Draper & Johnson Investment Co. in 1962 and then Sutter Hill Ventures in 1965. The younger Draper later went on to head the U.S. Export-Import bank in 1981 and the United Nations Development Program in 1986. Looking to apply his global experience to venture investing, he teamed with Robin Richards Donohoe, a Stanford Business School graduate knowledgeable in emerging markets financing, to form the first India VC fund, **Draper International**.

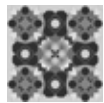
Draper International began with the two partners, eight advisors (including local Indian entrepreneurs), offices in Bangalore and Mumbai, and \$75 million. Its only institutional partner was General Atlantic. It made 24 investments during the late 1990s, most in the IT/software and Internet sectors, among them:

- Mumbai post-production studio CMM Ltd;
- credit risk analysis software firm e-Credit.com;
- fashion apparel designer Indus League Clothing;
- Torrent Networking, a provider of Internet routing solutions, acquired by Ericsson;
- Internet CRM developer NETA, acquired by Go.com and Disney;
- Internet security appliance firm Ramp Networks, acquired by Nokia; and
- Rediff Communications, a global Indian Internet portal.

Draper, a founding member of TiE Silicon Valley, says he found the firm's first deal while networking there. While it eventually wrote off four investments, Draper International returned 16 times the limited partners' investment. Draper and Richards went on to launch the domestic fund Draper Richards LP in 1996 and the Draper Richards Foundation for Social Entrepreneurship in 2001.



Bill Draper's son Tim heads another successful VC firm, **Draper Fisher Jurvetson** (DFJ), which became actively engaged in India in 2006. The firm's India portfolio—part of its core global fund rather than a dedicated India fund—includes eleven companies distributed between cleantech, Internet, technology-enabled services, advertising, and mobile commerce. One of the most notable is Reva Motors (see *The 3-Lakh Electric Car* in the *Energy/Environment/Clean Technology* section of Chapter 6). New investments are likely in logistics, distribution, and retail. More than half of the companies DFJ has invested in are led by returnees from the Bay Area. Most are located in India's top six urban centers, where much India's wealth and infrastructure is concentrated. Raj Atluru, who oversees DFJ's India investments, notes that while India isn't producing core technologies, its chief attraction is in innovative service plays.



While Draper International was the first venture firm to set up an India fund, **Silicon Valley Bank** (SVB) paved the way for the wave of venture investment in India that began in 2001. When the tech bubble in the U.S. burst, SVB concluded that companies would have to focus on capital efficiency and that India offered a promising platform for global value creation. It also recognized that corporate boards would need to support that shift, so in 2003, SVB led a delegation of twenty-three venture capitalists to India. It was also apparent that companies would need guidance once they arrived, so SVB started an Indian consulting business (prior to applying for a banking license) to help its U.S. clients and their investors research market opportunities and make introductions to potential partners, which in many cases led to operations on the ground in India.

To monetize its presence, SVB later established a \$54 million fund based in Bangalore to co-invest with its VC clients directly into Indian startups. It also obtained a license to establish a non-bank financial corporation, and in 2008 opened SVB India Finance, which makes loans but

can't accept deposits. The venture lending arm will provide debt capital to domestic venture-backed early-stage and mid-stage Indian companies. Ash Lilani, who leads SVB's India strategy, says India has the potential to be SVB's largest overseas market, and having a full banking license would allow it to replicate the SVB business model from Silicon Valley—commercial banking for technology companies and startups.



Sand Hill Road venture firm **Sequoia Capital** began an aggressive strategy in 2006 to invest in early stage and startup Indian firms. Today, Sequoia manages five India funds with a combined value of nearly \$1.8 billion and 60 investments. Its latest and largest fund, the \$725 million Sequoia Capital India Growth Fund II, closed in August 2008. The \$400 million India Growth Fund I closed in September 2006. A \$300 million early-stage fund closed in August 2007, and Sequoia manages two funds, with a combined \$350 million value, that were part of its May 2006 acquisition of Westbridge Capital Partners.

Westbridge was a cross-border firm with offices in San Francisco and Bangalore, launched in 2000 by four U.S.-educated entrepreneurs: Sumir Chadha, Sandeep Singhal, K.P. Balaraj, and Surendra Jain. At that time, Westbridge was an early entrant in the India market, with investments in some 16 companies such as e-learning company Brainvisa Technology, matrimonial website Shaadi.com, and telecom software provider Bharti Telesoft. The two funds have since generated \$100 million in exits. Westbridge was rebranded as Sequoia Capital India, with offices in Bangalore, Mumbai, and Menlo Park.

Sequoia's funds are not sector-specific but have evolved in their focus from offshore services, to Internet and wireless, and more recently to domestic growth companies. Subsequent investments have included ICICI OneSource, Idea Cellular, medical and biotech software firm Market Rx Inc. (acquired by Cognizant Technologies), online education provider TutorVista, search engine Guruji.com, coffeehouse chain Café Coffee Day, a Chinese fast food chain, pharma and biotech contract research company GVK Biosciences, car rental agency Carzonrent India, and rural lender SKS Microfinance.

Sequoia began with seed and early stage investment (\$500 thousand to \$7 million) in Internet and wireless companies that had already gotten off the ground with pre-seed financing, had sound business plans and management teams in place, and were dealing in disruptive, scalable technologies. The first fund enabled Sequoia to diversify into larger scale, later stage investments in BPO, Internet, discretionary consumer goods, and life sciences. By 2008, 30–40% of its investments were early stage and it was beginning to explore smaller investments in the \$100 thousand to \$1 million range.

Sequoia principal Shailendra Singh, a graduate of IIT-Bombay and Harvard Business School and a veteran of Bain & Co., approached Westbridge in 2000 as an entrepreneur looking for funding, and he joined the company in 2006. With close to a dozen U.S. India-dedicated funds now in the market, there is a need to stay focused, he says, as too much capital begins chasing too few deals, and shares become overvalued. He sees potential in “low-end disruption”: companies with technology that is not cutting-edge globally but is well suited for the growing markets of India and other emerging economies.

Moore's Law Applied to Venture Investing

Vinod Dham is known first and foremost in Silicon Valley and in India as “the father of the Pentium chip,” reflecting a 16-year career at Intel Corp. that began in 1979 and culminated in the design of the first PC microprocessor to become a household name. The Pentium (or X86) launched in the mid-1990s and ushered in the era of Internet access via the World Wide Web. Dham was also instrumental in flash technology development at Intel.

But Dham's career path entails a larger narrative and a common one in the Bay Area Indian community—the restless technology entrepreneur who finds himself at a plateau in the senior management of a major Silicon Valley firm and ultimately trades security for an opportunity to do cutting edge work in his field or to grow innovative new companies.

“The best thing I ever did in my life was to join Intel,” Dham says today. “The second best thing I ever did in my life was to leave Intel. In the Valley, there's always the urge to get involved with a startup, to step out of the shadow of the large corporation with all that money and infrastructure and go out on your own. Once you're a vice president in a large company, that's the optimum time to leave the company; if you stay a few more years and become an EVP or SVP, you're a company man, and you may not be able to roll up your sleeves and get down in the trenches. I felt that if I didn't go, I might always be looking back and wondering what might have happened.”

After leaving Intel in 1995, Dham served as COO of NextGen, a young company designing a potential successor chip to the Pentium; proposed a Pentium-compatible solution for the NextGen processor that would eventually result in acquisition of the company by Advanced Micro Devices; joined AMD as group vice president for its microprocessor business; and launched the K6 chip that would bring down PC prices by half.

Dham left AMD in November 1997 to become an entrepreneur again, and in April 1998, he became CEO of Silicon Spice, a developer of voice over Internet protocol (VoIP) signal processors funded by Kleiner Perkins Caufield & Byers, New Enterprise Associates (NEA), Cisco Systems, and others. Broadcom bought Silicon Spice in August 2000 for \$1.2 billion in stock. While at



Silicon Spice, Dham had developed a working relationship with NEA general partner Mark Perry. An investment by NEA, returns from the Broadcom acquisition, plus World Bank and other funding, led to formation of an incubator **NewPath Ventures LLC**, a \$56 million business headed by Dham with the idea of lowering costs by using Indian engineers for R&D.

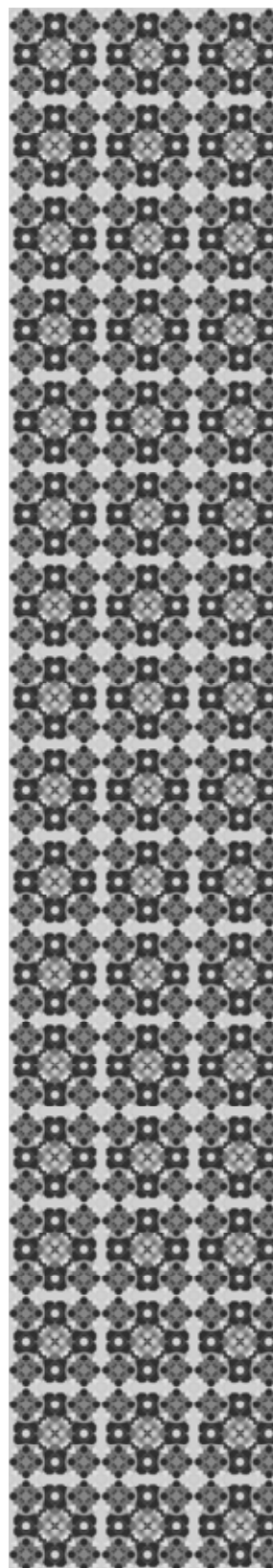
Over 2004–06 NewPath funded three cross-border IT ventures: Santa Clara-based **InSilica**, a fabless chip designer focused on imaging solutions for mobile devices; ASIC-based network security appliance developer **Nevis Networks** of Mountain View; and **Telsima**, a Santa Clara telecom network solutions provider. InSilica and Telsima each set up development centers in Bangalore, while Nevis set up its development center in Pune.

Today, Dham is managing director and founder of **NEA Indo-U.S. Ventures**, an early-stage and mid-stage VC fund with offices in Santa Clara and Bangalore, focused principally on the Indian consumer market and on developing relatively simple technology-enabled services solutions tailored to India's specific needs. NEA invested and co-branded with the Indo-U.S. Ventures fund to get exposure to India's emerging venture investing eco-system.

Among its portfolio of 16 investments:

- Attero Recycling, India's first electronic waste (cell phones, computers, TVs) reprocessing firm;
- Microqual, a maker of mobile telecommunications towers and electronic components;
- Obopay, a mobile payment provider that enables fund transfers via cell phone; and
- MedPlus, an Indian retail pharmacy chain with 600 small (2–3 person) kiosk-like outlets, that is expanding to include in-store diagnostic labs and health clinics

"India is leapfrogging in adoption of technology in an accelerated manner," Dham says. "It has been very far behind in the past and is now skipping a whole generation of technology to catch up." For example, while landline telephone penetration was limited to a mere 45 million households, cell phone usage in this decade alone has catapulted to over 300 million and is rapidly growing to 500 million subscribers. Dham contrasts India's progress to China's this way: "China's approach is top down—the government decides. From a business point of view, that's a more efficient model, since



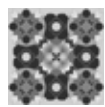
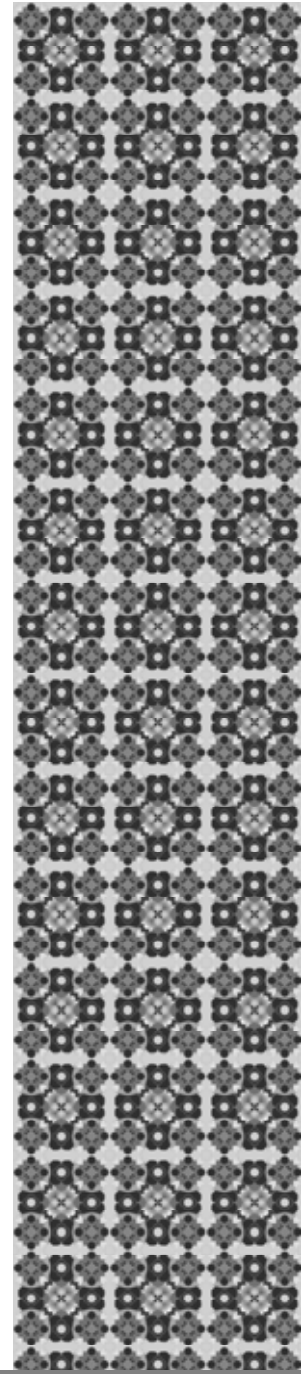
the decisions get made fast and you are dealing with less uncertainty. India, on the other hand, is a more chaotic bottom-up model—the entrepreneur is the change agent here, while the top is slow and bureaucratic, but that’s also a good thing, because even though the change is slow, it is deeply ingrained and hence more sustainable in the long run.”

He sees a natural synergy between India and Silicon Valley.

“When you see people going back and forth, it’s very healthy for both countries,” he explains. “For India, returnees from the Valley are bringing with them experience, culture, and values which proliferate throughout Indian management and companies. For the Indians coming to the U.S., there is an opportunity of lifetime—to get higher education, to gain world class experience, and to accomplish higher milestones professionally by working on innovative products and technologies.”

Dham notes that the spirit of creativity and innovation is so deeply embedded in the Bay Area that there’s no comparison with either India or China today. “But that’s fine,” Dham says, “since as an emerging nation, India brings the enormous advantage of its demographics and educated workforce to provide productivity improvements in the services industry. The focus in India today is to create disruptive business models, as opposed to in America where the focus is disruptive innovation.”

“Entrepreneurship is embedded in the DNA of Indians—they have been trading since time immemorial on the Silk route and have honed their survival by struggling every day to survive,” he says. “The simple act of catching a public bus on India’s roads itself requires advance preparation—since in India the bus never stops at the same spot at a regular time. You have to make necessary changes in real time to position yourself correctly to catch the bus, otherwise you will be left behind. In America, the infrastructure and systems are very efficient, and therefore it is much easier to accomplish much more with relatively less effort.”



Lightspeed Venture Partners was co-founded in the late 1990s by Ravi Mhatre, a Stanford graduate and veteran of Bessemer Ventures, Silicon Graphics, and Lehman Bros.’ technology investment group, and former Cisco Systems executive Barry Eggers, who set up several of Cisco’s largest distribution channels and directed its first wave of acquisitions and integrations.

Most of the firm's investments are still in the U.S.—particularly the Bay Area—but Lightspeed has invested since its inception in Israel, and it became involved relatively early in China. Lightspeed began exploring opportunities in India beginning in 2005. “We looked to invest in impact companies that were leaders in high-growth markets,” says Lightspeed managing director Jake Seid, who—along with Mhatre and Bejul Somaia—is one of three managing directors responsible for the firm's India investment. He points to India's profile of strong economic growth over time, high savings rate, liberalizing economy, and young demographic as key indicators of opportunity.

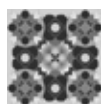
Seid sees patterns in India that mirror where China was 4–5 years ago. Both countries have companies with the potential to be world-class players and the opportunity to build on large domestic markets. While India still lags behind China on that curve, Seid believes it is a place where Lightspeed needs to be as a global firm. “We tend to take a walk-before-we-run approach,” he says. “Our first India deal was in 2006, and today we have two India-related investments, but we have other investments that highlight our strong U.S.-India connections.”

Lightspeed does not have a dedicated India fund, but it does have a four-person advisory team, based in Bangalore, supporting the investment team in Menlo Park. Its eighth fund closed in June 2008, raising \$800 million that will be invested largely in startup, early stage, and growth clean technology ventures in or related to China, India, and Israel. Its seventh fund closed in 2005, raising \$475 million. Lightspeed's two India investments at present are 4Interactive/AskLaila, a local city search site offering event, dining, shopping, and movie listings as well as other information for Bangalore, Mumbai, Delhi, Chennai, Kolkata, and Hyderabad, and TutorVista, an online tutoring and test preparation site.

In selecting companies to invest in, a management team with experience in the U.S. can be important, Seid points out, but where the company is primarily serving the Indian market, a familiarity with domestic market conditions carries more weight. In the end, the company looks to India less for innovation in technology—which is a Silicon Valley strong point—and more for innovation in business models and business execution.

Seid's India focus is on businesses that are asset-light, have low or no capital requirements, and do not own real estate. Lightspeed also likes low-capital-intensity “shadow plays”—the hotel management company versus the hotel operator, or the engineering/construction services firm, boiler making firm or maker of electrical transformers, rather than the large infrastructure project itself. Seid is especially wary of the power that large family-owned or public companies in India have to dominate a sector. “We look for ideas the big guys can't just copy and do,” he explains, “and we look for markets where there is room for more than one winner.”

Cleantech is likely to offer major new opportunities down the road, Seid says, but he stresses that the biggest India deals may not be in cutting-edge technology. “India's economy is growing in such a way that there's an opportunity to create the next Wells Fargo, Goldman Sachs, or Sprint for India,” he says, “which will not only be a winner for a 300 million-person economy, but also for a 1.2 billion-person economy.”



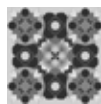
IDG Ventures India, a \$150 million venture fund, focuses primarily on early-stage technology companies. Most investments support management teams made up of Indians who have returned from the U.S. and local Indians with startup experience. The fund's primary backer is privately-held International Data Group (IDG), the Boston-based technology publishing, conference, and research group.

Manik Arora, founder and managing director, previously with Battery Ventures in Silicon Valley, says IDG Ventures India focuses on \$1–5 million investments in early-stage companies that go beyond outsourced services and Internet to building unique products for emerging markets, using India as their initial launch market. “Emerging markets customers tend to have different needs in terms of the price/quality mix that western companies are still learning to address,” Arora says. “India is a perfect test market for companies tapping this segment before they scale to South East Asia, the Middle East, and other locations.” The firm has invested in 9 companies to date, across areas as diverse as software, Internet, medical devices, and energy management. Among other plays, IDG funded Kreda, India's first online gaming company.



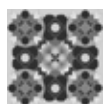
Matrix Partners, with offices in India, Silicon Valley, and Boston, determined from its inception in 1996 that it would focus on India's consumer markets and that to do so it would need an India presence and a dedicated India fund. Its principal focus is on early-stage companies (Internet, mobile, financial, media, and entertainment) that sell directly to Indian consumers. Current investments include an online DVD rental company, a search firm, a company offering elevator advertising similar to China's Focus Media, and a Chinese fast food chain. Initial investments are in the \$2–10 million range. Down the road, the firm plans to make 5–7 investments per year, possibly including growth-stage (\$10–\$25 million) investments.

Matrix partner Rishi Navani, a Silicon Valley veteran, notes that in the Valley, a VC firm might see up to 1,000 companies per year, but in India there are fewer companies, so the number is closer to 200. There's no problem finding good investments at their current level of investing (5–7 companies per year), but it would be hard to justify a larger number. He also notes that the rate of uptake in India is lower than in Silicon Valley—“you have to look at more companies to find good deals.” The ideal profile of an investment-worthy management team is to have a Silicon Valley entrepreneur teamed with a local Indian with operating experience in the local market. Companies in India's top ten cities, where most of the wealth is concentrated, currently offer the best opportunities; ten years from now, those cities will each have 20–30 million residents. But in the next five years, India will also have 50–60 Tier 2 cities with populations of over a million, and further down the road there will be massive business opportunities (though not necessarily for VCs) in India's rural areas.

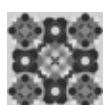


Another high-profile deal by Bay Area venture capitalists was a combined \$18.8 million investment in 2005 by **Norwest Venture Partners** of Palo Alto and **Gabriel Venture Partners** of Redwood Shores in Pune-based software product developer Persistent Systems, which counts Google and Oracle among its clients. Gabriel also joined **Battery Ventures** in a \$15 million Series C investment in telecom optical packet-switching network

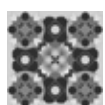
developer Tejas Networks in Bangalore. Norwest is an investor in Bangalore business process software firm Epiance, as well as cross-border hybrids such as Veraz Networks Inc., a San Jose telecom equipment company that outsources software development to Persistent, and Bay Area companies like fabless ASIC chip designer Open Silicon of Sunnyvale.



The hybrid Bay Area-India business model has proven attractive for its ability to manage cost and access specialized talent: **Walden International** of San Francisco has invested in Mountain View wireless security solutions provider AirTight Networks, and Palo Alto-based **Sevin Rosen Funds** has had in its portfolio Teneros, a Mountain View developer of Microsoft backup and disaster recovery solutions, and Palo Alto enterprise software developer SolidCore Systems. All rely on product development in India.

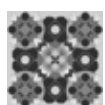


Charter Ventures, **Alliance Venture Management** and **BlueStream Ventures**, along with Texas Instruments' TI Ventures, pumped \$32 million into the December 1999 startup of **Xalted Networks**, to bring to market an advanced telecom network switch technology that would enable mass deployment of broadband over new and legacy phone networks. By 2000, the tech sector collapse had stalled broadband rollouts, and the switch wasn't fully developed. Over 2003–04, the venture partners helped Xalted raise \$9 million in preferred stock, moved it to Santa Clara, and shifted product development to Bangalore. Today, most of Xalted's management team is Indian and the company has made a niche for itself developing service fulfillment, billing, and fraud prevention software for the telecom industry.

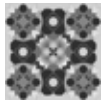


Clearstone Venture Partners, founded in 1998, has invested in more than a dozen early stage companies that rely on back-end operations in India. The Menlo Park VC firm had also aggressively recruited Indian managers for its \$200 million Clearstone Fund III, which closed in April 2005 and includes the State of California and the University of California among its investors. The next logical step, in 2006, was establishing Clearstone Venture Mauritius, a local India investment arm with offices in Bangalore and Mumbai, and Clearstone Venture Advisors, a Mumbai-based independent advisory group that serves as an initial point of contact with Indian entrepreneurs.

Clearstone initially made four India investments: \$7.5 million in online bill payment services provider Billdesk, \$5 million in Bangalore mobile handset designer DigiBee Microsystems, \$5 million in Indian massive multi-player online gaming (MMOG) site Games2Win, and 160 million rupees in Mumbai-based express delivery company Elbee Express. It has recently announced plans in to invest in four more companies, at an average level of \$10 million each, in the educational entertainment and financial services sectors.



Silicon Valley entrepreneur Raju Vesegna's **Infinity Capital Ventures** paid \$62.6 million in November 2005 for Satyam Computer Services' 31.61% stake in Indian Internet, network, and e-commerce services firm Sify Ltd. Infinity later spent an additional \$37 million to raise that stake to 40%. Vesegna founded integrated circuit designer ServerWorks Corp., which was acquired by Broadcom in 2001 for \$1.8 billion. He currently heads ServerEngines, a maker of network controllers, adapters and system-on-a-chip (SOC) designs, in addition to his role as CEO, chairman and managing director of Sify.



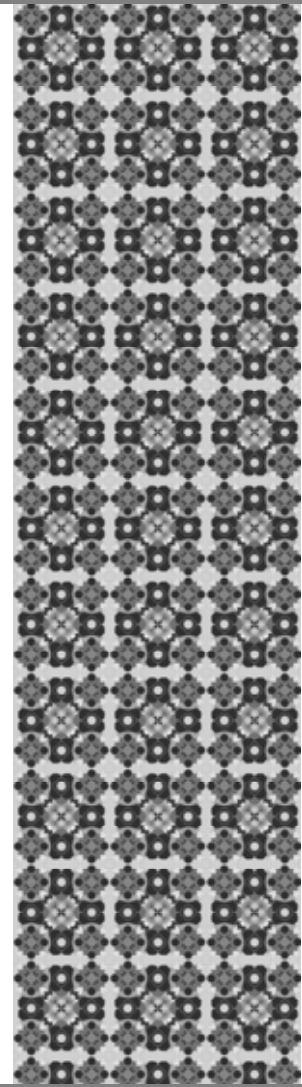
Ram Shriram, a graduate of the University of Michigan's Ross School of Business, migrated to California and ended up in Silicon Valley working as a senior sales executive for Netscape from 1994–98. He invested in and ran an Internet startup, Jungle (Hindi for “wild” or “ill-mannered”), that developed advanced virtual database technology enabling online comparison shopping and was acquired by Amazon.com for an estimated \$186 million. His ground floor investment in Google—ultimately leading to the acquisition of 3.4 million shares—earned him a place on Google's board and made him a billionaire. Today, Shriram's Sand Hill Road investment firm, **Sherpalo Ventures**, has a portfolio that includes Campbell-based customer lifecycle management IT services and BPO firm 24/7 Customer, India online classified advertising site Naukri.com, online gift merchandiser Zazzle, travel portal Cleartrip, India mapping portal MapMyIndia, web entertainment portal Mevio, online financial planning site Mint.com, and Southern California frozen dessert chain Pinkberry, among other ventures.

Up Next: Animation?


Los Angeles-born Sandeep Sood earned an undergraduate degree from Berkeley, and built upon his experience working for Peoplesoft to start software development company **Monsoon** focusing on producing high quality software offshore. Bay Area clients include Wells Fargo, Cisco, and HP. (Monsoon currently fields a team of 80 engineers for HP in India, including 15 in Chandigarh producing touch-screen applications.)

For several years Sood also produced a comic strip, called Badmash, that made fun of Indian culture and the oddities of growing up Indian in America. In 2005, with support from the Palo Alto venture firm **Velocity**, the strip morphed to become Doubtsourcing, a television show poking fun at the peculiarities of global work, with the setting mainly in India. Three episodes have been produced so far, with ten more planned by the summer of 2009. To develop the show and future products, Sood runs an animation studio in Pune with an initial team of 20 animators.

He notes that there's a shortage of experienced animators in India, and he has needed to send his people to the U.S. for training. Lots of mid-level people are doing contract work (for example, DVD work for Warner Bros.), he says, but India isn't generating its own intellectual property yet. Sood thinks his studio may be the first. But India's film industry is large and it's IT capacity impressive, so it may be only a matter of time before India also emerges as a player in digital entertainment. India's two largest contract animation studios are Toon and Prana, which is funded by Ram Shriram, through Sherpalo, his venture firm.

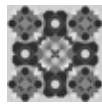


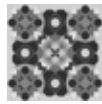


 In 2003, **Kleiner Perkins Caufield & Byers** (KPCB) saw companies it had invested in starting to go to India. By 2005, a network of more than thirty were there, and were continuing to ask the firm for advice. At that point, the firm began to view India not just as a resource, but as a market to invest in. KPCB doesn't have a separate India fund, but invests there as part of its general strategy. By the end of 2008, KPCB had a portfolio of nine early-stage Indian investments, all in consumer markets (Internet, mobile telephony, and clean-tech), and one of its investees, jobs-listing company Nauri.com, was the first consumer Internet company in India to go public (in 2006) and reach a market capitalization of \$1 billion.

In another high-profile investment, Vinod Khosla began working in 2000 with Jagdeep Singh, a Stanford and UC Berkeley graduate and co-founder of two previous companies (OnFiber Communications and Lighters Networks), on development of a photo-integrated circuit (PIC) that could handle much higher volumes of broadband traffic over the Internet at lower cost. By June 2007, Singh's new company, Infinera Corp., raised \$182 million in an oversubscribed IPO, and today it is a \$1.8 billion company providing optical transmission equipment to companies such as Cox Communications, XO Communications, and 360Networks.

 In 2007, **Mayfield Ventures** purchased a minority stake in Indian investment bank Avendus Advisors for \$15 million; Silicon Valley Bank participated in Series A funding for mobile telephony value-added services developer One97 Communications; and IDG Ventures India invested \$2.5 million in iViz, a Kolkata network security startup that uses artificial intelligence techniques and next-generation hacker simulations in an automated network vulnerability testing software program.

 Palo Alto-based **Accel Partners**, established in 1983 and currently with \$4 billion in assets under management, teamed in July 2008 with Indian investment group Erasmic Venture Fund to launch what is to be a \$10 million **Accel India Venture Fund**. Focusing on cross-sector seed and early-stage companies, Accel, along with Lightspeed, Amazon.com chief Jeff Bezos, and others, invested \$24 million in health care search engine **Kosmix, Inc.** of Mountain View. Kosmix founders Venky Harinarayan and Anand Rajaraman hold computer science PhDs from Stanford and founded the online shopping search firm Junglee, described earlier.

 Finally, Draper Fisher Jurvetson's **ePlanet Ventures**, teaming with HSBC Private Equity Ltd., put \$11 million into Chennai medical device value-added reseller and distributor Trivitron in November 2007. The money is to be used as part of a broad strategy to acquire medical device companies, form joint ventures, and build a 25-acre product development cluster outside Chennai. ePlanet has a stable of 15 life sciences firms, many in medical devices, that it believes could participate in cross-border relationships with India.



Bay Area Venture Capital Firms Active in India (Partial List)

Accel Partners	Matrix Partners
Battery Ventures	Mayfield Ventures
Bessemer Venture Partners	New Enterprise Associates
Blueprint Ventures LLC	NewPath Ventures LLC
Burrill & Company	Nexus India Management LLP
BVP	Norwest Venture Partners
Canaan Partners	Oak Investment Partners
Clearstone Venture Partners	Outlook Ventures
Doll Capital Management	Sequoia Capital
Diamondhead Ventures	Sevin Rosen Funds
Draper Fisher Jurvetson (ePlanet)	Shah Capital Partners
Evolve India Life Science Fund	Sherpalo Ventures
Gabriel Venture Partners	Sierra Ventures
Global Catalyst Partners	Storm Ventures
Globescan Capital Partners	Technology Crossover Ventures
Granite Ventures LLC	TeleSoft Partners
IDG Ventures	Trident Capital
Infinity Capital Ventures	Venrock
Intel Capital	Velocity Interactive Group
Inventus	Walden International
Khosla Ventures	Warburg Pincus
Kleiner Perkins Caufield & Byers	Westbridge Capital Partners
Lighthouse Capital Partners	Woodside Fund
Lightspeed Venture Partners	

Indian Investors Arrive in the Bay Area

Indian companies acquired six U.S. firms in 2003, according to research by Mergermarket, Ltd. and Virus Global Partners. By 2007, the number had risen to 93. Earlier sections of this report mention past deals, from industrial acquisitions facilitated by Bay Area law firms, to Taj Hotels' purchase of San Francisco's Campton Place Hotel, to specialized IT services acquisitions by the major Indian companies like Infosys and Wipro. Other transactions include:

- the acquisition of **Mendocino Brewing Company**, the producer of Red Tail Ale, by United Breweries of America, the U.S. affiliate of Vijay Mallya's United Breweries Group, in 1997;
- Patni Computer Systems' 2004 \$68 million purchase of **Cymbal Corp.**, a Fremont telecom IT services firm founded by Indian entrepreneurs;

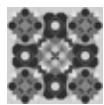
- Indian BPO holding company e4E Group's 2005 acquisition of Santa Clara enterprise applications management BPO **iCelerate**;
- Mahindra & Mahindra's 2004 acquisition of Milpitas business process and technology consulting company **Bristlecone**; and
- Mumbai IT services and consulting firm Larsen & Toubro Infotech. Ltd.'s 2006 purchase of **GDA Technologies, Inc.**, a San Jose end-to-end semiconductor designer.

Arun Kumar, a partner in global accounting and tax firm KPMG's India practice, values the 93 acquisition transactions at some \$8 billion, dominated by large deals that were primarily but not entirely in IT. He sees an emerging two-way U.S.-India investment corridor forming, with investors on both ends seeking markets and talent. KPMG and competing firms provide M&A due diligence, tax and regulatory strategy consulting, and audit services to U.S. and Indian parties.

Reflecting on the emerging cross-border model, Kumar sees particular opportunities in the automotive and telecom sectors. He also sees new markets in India in areas such as medicine, water treatment and delivery, and environmental technologies and processes. In India, Kumar says, "business and government are more conscious of opportunities to do social good and provide services to people at the bottom of the pyramid."

He expects a clean division of labor—with efficient back-end processes, proximity to emerging markets, and access to talent coming from India, and with innovation, management expertise, and capital coming from the Bay Area—to remain in place for some time.

Knowledge Investment



Ajoy Mallik, global head of venture capital for Tata Consultancy Services (TCS), sees investment in a different way: he envisions a future of ad hoc global innovation clusters that bring the best specialized talent to a project or enterprise, collaborate as long as needed, and then reform in new groupings tailored to solve the next problem or bring the next product to market.

Launched in early 2006, the TCS Co-Innovation Network (COIN) is an ecosystem of universities, entrepreneurial startups, venture investors, and strategic partners linked to and providing specialized knowledge and support to the worldwide network of TCS Innovation Labs. "Our focus," Mallik says, "is on how to bring the right set of innovation assets across the globe to solve problems for clients. What we love is to hear CIOs say that they want TCS to handle all of their IT-related infrastructure—that they don't want to deal with forty startups and twenty outsourced tech vendors. The question is who does Pfizer feel comfortable outsourcing all of its IT to?"

COIN has taken on more than 20 strategic partners, out of more than 800 considered. A sizable share come from the Bay Area, including Stanford University, Intel Corp., Hewlett-Packard, Cisco Systems, Sun Microsystems, VC firms Kleiner Perkins and Sequoia Capital, and three startups—San Jose developer of cloud computing software for data systems Cassat, Brisbane distributed

Global Reach

computing software developer Collabnet, and Palo Alto developer of quality management, regulatory compliance, risk management, and corporate governance IT solutions MetricStream.

Mallik has advised and invested in Silicon Valley startups as an angel investor and through his early-stage VC firm Skyblaze Ventures, which recently invested in Santa Clara mobile software and services provider Webaroo. “When you think of the Bay Area you think value creation,” he explains. “It’s a huge marketplace in itself. The source of technology is already big. It’s not like we have to invest. The issue is how to monetize prime source technology.”

He sees global opportunities in coming years in enterprise search (“Can you reach with one click a single reference stored in a database over a decade?”), IT security, natural language processing, and green data centers that run faster, cheaper and cooler on less power. Mallik does not necessarily see specific revenue streams from COIN in the short term, but more likely over two to six years.



8

Findings

The Bay Area and India enjoy a complementary and mutually beneficial relationship that has grown dramatically since the early 1980s. When personal computing, networking and semiconductor firms ramped up to meet global demand and commercialize the Internet, a generation of Indian engineers in Silicon Valley helped launch Sun Microsystems, SanDisk, Juniper Networks, the Pentium chip, Hotmail, Cirrus Logic and the fabless foundry chip design format—to name a few among many companies and innovations. Indian immigrants have played a major role in shaping the technology economy of the Bay Area, at first as students, and later as engineers, CEOs, entrepreneurs, and investors.

When U.S. businesses began a wide-scale restructuring in the 1990s, cutting costs and improving quality and productivity in order to compete globally, U.S. universities were not producing the needed engineers and programmers in sufficient numbers. Indian engineers, entering the U.S. on H-1B visas and placed on-site with IT clients to do software and systems integration, filled the gap. The Y2K scare and concurrent tech bubble pushed demand up further.

It is important to understand the nuances behind the data when discussing interactions with India. Too often the tendency is to have an overly general debate over the pros and cons of “exporting jobs overseas” through outsourcing back office and call center activities and/or offshoring value-added technology work to lower-cost global locations. That discussion fails, however, to distinguish among skill levels, and it often overlooks the changing process of value creation inside and between transnational organizations.

In Silicon Valley, a relatively small number of highly-educated technologists and entrepreneurs from India have driven innovation, either at established companies or by striking out on their own. On the other side of the equation, a large amount of entry-level BPO and mid-level R&D or product engineering work has been done by workers in the U.S. on H-1B visas or has shifted to India where large pools of moderately skilled workers were immediately available. While cost is a factor, both trends have been driven by shortfalls in the supply of comparably trained engineers at home.

Today, most major Bay Area technology companies have R&D centers in India, as nodes on global R&D networks that leverage the talent available in different parts of the world to develop software, networking, Internet, and other applications across a wide range of industry verticals. Parallel with the development of captive centers, Indian IT firms have emerged as global technology players serving a wide swath of multinational and other companies. Many U.S. technology companies have both captive centers and major Indian partners, with work allocated to one or the other based on core/non-core functions, whether the product is for global or Indian markets, or IP considerations.

In recent years, the capabilities of India's IT sector—whether indigenous or foreign-owned—have grown, advancing from call centers, to back-office processing and writing software code, to IT systems integration, and more recently to end-to-end product development. In this new relationship, Indian centers are increasingly integrated with their parent companies' and partners' global operations.

In the early days of the offshoring debate, for most U.S. companies the relationship with India was all about lower costs. While cost is still a driver, today it is much less compelling. Most U.S. companies are in India not for cost arbitrage but to create value on a global scale. That value can take many forms: product innovation for India's growing domestic market, product development for other emerging markets, product development for global markets, the application of engineering talent to complex technology challenges, or the assumption of responsibility by Indian companies for baseline product maintenance (freeing U.S. personnel to focus on new products and innovation). For both U.S. and Indian companies, the focus of the relationship is shifting from cost saving to intellectual property creation.

These economic relationships with India in some ways parallel those with China, but the relationships also differ in important ways. Both India and China offer large domestic markets and host large numbers of Bay Area and other foreign companies. Both also serve as significant off-shore platforms for global business development. Where relationships with China focus heavily on manufacturing, however, relationships with India focus almost exclusively on services and on the use and development of intellectual property. Compared to China, in India the guiding hand of government is less pervasive, arguably enabling the formation of deeper business partnerships. Perhaps the greatest difference is the collaborative model that defines India's global positioning: where business flows with China tend to be compartmentalized and flow in one direction, India is on the whole more deeply integrated with its partners through complementary business models and shared global objectives. It is this aspect of the U.S.-India business relationship that carries the most powerful implications for the future.

The pioneering investment of Bay Area companies in India and the relationships of Bay Area companies with Indian partners will yield long-term benefits to the region by: (1) providing access to the world's largest and youngest source of educated talent; (2) improving global competitiveness by lowering costs and improving business efficiency; (3) shifting responsibility for baseline products and services to Indian units, freeing Bay Area workers to focus on higher-end product, technology, and service innovation; and (4) developing products and services to serve the fast growing markets of India and other rapidly emerging economies.

A new transnational model is taking shape, in which companies source materials, components, technology, capital, and talent from the most capable cost-effective worldwide locations, to develop products and services on a global scale, that are tailored to address local needs and markets.

A key question for California and the Bay Area is what roles they will play in this global process. India's growing capabilities and economic potential, like China's, suggest that in the future more R&D and product development will happen overseas, and that business, investment, and employment will migrate to global centers that offer a compelling combination of talent, domain

Findings

expertise, and market scale. That shift will not necessarily come at the expense of the United States, Europe, and Japan, but it will almost certainly result in a more globally distributed economy where functions once primarily performed in places like Silicon Valley will now be performed in a range of global centers, including India.

The Bay Area and Silicon Valley have been emulated throughout the world but never quite duplicated. With a deep capacity for fundamental (blue-sky) research, a diverse and highly educated workforce drawn from throughout the world, and a culture that rewards entrepreneurship and risk-taking, the region has been a consistent source of cutting-edge technology, product innovation, and wealth creation. Complacency would be a mistake, however. Cross-border collaboration and growth opportunities in India, China, and elsewhere have drawn talent and investment to those markets at an accelerating rate. Significantly, this includes Chinese and Indian entrepreneurs who have honed their skills in Silicon Valley.

Roughly 60% of doctoral students in engineering and 40% of masters degree students in the United States are foreign nationals. According to the National Science Foundation, 42% of combined science and engineering PhD graduates in the U.S. today are foreign born. Carrying this into the economy, UC Berkeley visiting scholar Vivek Wadhwa also finds that one-quarter of all technology and engineering startups between 1995 and 2005 were created by immigrants. In Silicon Valley, the number was 52%. Another recent study by the U.S. Small Business Administration found that 16% of high-tech companies surveyed had at least one foreign born founder, with the largest proportion coming from India. While the U.S. and the Bay Area have benefited from this inflow for decades, its continuity is imperiled.

In a recent survey of 1,000 Indian and Chinese foreign students and 1,000 returnees, researchers at UC Berkeley, Duke University, and Harvard found that for most, opportunities to start a business or for professional advancement were considered better at home, and fewer students now in the United States want to stay permanently. Concerns were expressed about the ability to find jobs and the availability of work visas. Students and entrepreneurs such as these have historically made powerful contributions to the region's economy and cannot easily be replaced.

And while India is not currently a source of world-leading technology or innovation, it has shown the capacity to innovate in other ways by leveraging its deep pool of educated workers. While the Bay Area should for the foreseeable future retain its role as the world's leading center for technology innovation, India's growing prowess in process innovation is redefining its role as a global partner. The evolution of its relationship with India in turn raises important issues concerning the Bay Area's economic future:

- A troubled primary and secondary education system is not attracting qualified teachers or producing a critical mass of students in grounded in science, math, technology, and business.
- U.S. visa policy is not designed to attract top foreign students and researchers and discourages them from staying after they complete their studies.

- Buy America provisions of the 2009 federal stimulus bill restrict the hiring of foreign nationals, which limits the access of U.S. companies to the best global talent and removes job opportunities for foreign-born graduates of U.S. universities.
- As Indian technology and other professionals now in the Bay Area see growing entrepreneurial and investment opportunities in India, recent students and longer-term residents are starting to return home.
- The once clear division of labor between Silicon Valley innovation and lower-end support work done in India and elsewhere is blurring, as India becomes increasingly central to companies' global strategies and tech-related work, and as India's contributions are increasingly integrated into companies' global strategies.
- Labor standards on the books in California—including threshold wage levels for software programmers set during the tech bubble that trigger overtime, vacation time, and other mandates and were specifically aimed at Indian BPO firms—invite frivolous lawsuits and diminish tech job opportunities across the board.

This is an appropriate time for California and the Bay Area to undertake a reevaluation and redefinition of their roles in a global economy where value is increasingly created by and distributed across virtual borderless communities of knowledge and expertise. Even as more manufacturing and service work that was once done in the Bay Area has migrated around the world, the region has retained its role as a source of leading-edge technology and service innovation, as an important source of investment capital, as a “necessary partner” for global technology enterprises, and as a hub that integrates and leverages resources on a global scale. To sustain that role and preserve high quality jobs in the region, the state, and the nation need to invest in ways that enhance their competitiveness. Research and interviews for this report generated a number of policy perspectives and suggestions which focus on:

- increased emphasis on math and science in primary and secondary education, including magnet charter schools, stepped up recruitment of fully-credentialed teachers, local and statewide innovation contests, and partnerships with cutting edge technology companies;
- high school level and college level business courses emphasizing entrepreneurship and global economics alongside traditional economics and management;
- immigration reform to develop a J-1/L-1 visa program that allows graduate professionals and researchers to take jobs and contribute to the economy without first returning home;
- immigration reform to provide a fast-track to green cards (permanent residence) for foreign students graduating with advanced degrees from U.S. universities in priority disciplines (such as computer science or engineering);
- development of state, federal and local strategies to bring clean technology solutions to market, build competitive companies, and strengthen the critical mass of cleantech activity in California;

Findings

- development of R&D, investment, and export opportunities to address India's growing renewable energy, energy efficiency, and green urban design markets;
- development of federal, state, and local policies that support job growth through entrepreneurship, new company formation, and innovation;
- state and federal support to help small and mid-size businesses develop export opportunities in India;
- expansion of university and research laboratory coordination with Indian counterparts; and
- expansion of travel opportunities between the Bay Area and India through airline competition and marketing the Bay Area's unique connections to India and roots in the Indian community.

Developments that are desired on the Indian side are:

- for Indian IT companies that wish to become truly global enterprises to increase employment of non-Indian nationals in service centers outside of India (i.e., corporate localization) to accelerate community engagement and strengthen their identity as national (domestic) firms;
- for the Indian government to sustain economic reforms to lower barriers and increase the scope for partnership in areas such as retail, banking, trade, legal services, wine, and higher education.

The Bay Area's connection with India—historic, cultural, and business—is unique. The level of education, wealth, entrepreneurial activity, and business leadership that can be found in the Bay Area's Indian community is unsurpassed in the United States, and Bay Area companies have led the world in establishing a presence in India and strategic partnerships with Indian counterparts and service providers. That relationship, properly managed, can play a major positive role in positioning the Bay Area for continued success in the global economy of the early 21st century.





Interviews

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Global Reach

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In cases where multiple sources were sought out to confirm or clarify specific information, the most relevant one or two are cited. Where published articles were accessed via the Internet, page numbers are not always available. Weblogs, Wikipedia and other Internet-based sources were used as starting points for initial research, but in most instances are not cited, in favor of more verifiable follow-up sources. Primary sources interviewed for this report are listed in the *Acknowledgements* section at the front of this publication.

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Business and Organization Index

This index lists Bay Area businesses and organizations highlighted in this report that have an active presence in, engagement with, or focus on India. The listed page references are to the principal citation of the business or organization, but references to these companies and organizations may also appear elsewhere in the text as well.

- 37 Degrees, 194
- Accel India Venture Fund, 239
- Accel Partners, 239
- Actuate Corp., 146
- Adobe Systems, 137
- Ageia Technologies, 145
- Agilent, 215
- Ali Akbar College of Music, The, 28
- Alliance Venture Management, 236
- AMD, 107
- American India Foundation, 43
- Apple Inc., 205
- Applied Materials Inc., 112
- Asia Foundation, The, 47
- Asian Art Museum of San Francisco, 29
- Autodesk, 134
- Bank of India, 88
- Battery Ventures, 235
- Bay Area Gujarati Cultural Association, 28
- Bay Area Maharashtra Mandal, 28
- Bay Area Prabasi, 28
- Bay Area Telugu Association, 28
- Bechtel Corp., 170
- Berkeley Group for Architecture and Planning, 173
- Berkeley India Initiative (BII), 52
- Bessemer Venture Partners, 80
- Bhatia Group, 173
- Bloom Energy, 191
- BlueStream Ventures, 236
- BP Solar, 191
- Bristlecone, 241
- Brocade Communications Systems, 212
- Burrill & Company, 216
- Cadence Design Systems, 109
- Calibrated, 157
- California Energy Commission, 186
- California Public Employees' Retirement System (CalPERS), 227
- California Public Utilities Commission, 186
- Campton Place Hotel, 80
- Center for South Asia Studies (CSAS), 52
- Cerent, 37
- Charter Ventures, 236
- Chevron Corp., 185
- Chiron Corp., 215
- Chugh Firm, The, 96
- CII-Sohrabi Godrej Green Business Centre, 164
- Cirrus Logic, 38
- Cisco Systems, 200
- CITRIS (Center for Information Technology in the Interest of Society), 54
- Cleantech Group, 192
- Clearstone Venture Partners, 236

- cMango, 147
Cost Plus World Market (CPWM), 69
Cradle Technologies, 39
CSU East Bay (Hayward), 63
Cybermedia Inc., 39
Cymbal Corp., 240
Cypress Semiconductor, 108
Digité Inc., 39
Draper Fisher Jurvetson, 190, 229
Draper International, 228
Dynno, 38
eBay, 209
EDAW Inc., 169
E-Loan, 146
Elucido Media Networks, 94
Embarcadero Technologies, 147
ePlanet Ventures, 239
EPPIC (Enterprising Pharmaceutical Professionals from the Indian Sub-Continent), 32
Evolvence India Life Sciences Fund, 217
Federation of Indian Associations (FIA), 45
Fenwick & West LLP, 95
Franklin Templeton Group of Funds, 228
Fresno State University, 63
Gabriel Venture Partners, 235
Gangagen, 215
GDA Technologies, Inc., 241
Gensler, 166
GeoHazards International, 170
Gilead Sciences, 215
Global India Venture Capital Association (GIVCA), 31
Global Trust Bank, 89
GlobalLogic, 123
Google, 206
Guava Technologies, 216
HaraBara, 194
Hargreaves Associates, 166
Hewlett-Packard, 198
Hindustan Computers Ltd. (HCL), 150
Hindustan Semiconductor Manufacturing Corp., 104
HOK, 169
iCelerate, 241
IDG Ventures India, 235
India West, 27
Indian Business & Professional Women (IBPW), 31
Indian Community Center (ICC), 44
Indian School of Business (ISB), 41
Indo-American Council (IAC), 45
Infinity Capital Ventures, 236
Infosys Technologies Ltd., 143
Infrastructure World LLC, 192
Ingres Corp., 146
Inmage, 36
InSilica, 232
Institute for the Study and Development of Legal Systems, 95
Intel Corp., 105
Intergy Corp., 193
Inventus, 36
Ion America, 191
IP Infusion, 147
JQ America Corp., 71
Juniper Networks, 208
Kana Software Inc., 123
Kannada Koota Northern California, 28
Kaptron, 37
Kastner Banchemo LLP, 95
Khanna Enterprises, 80

Business and Organization Index

- KLA-Tencor Corp., 110
Kleiner Perkins Caufield & Byers, 238
Konkani Association of California, 28
Kosmix, Inc., 239
Lawrence Berkeley National Laboratory, 186
Levi Strauss & Co., 76
Lightspeed Venture Partners, 233
Lumira Capital, 216
Magma Design Automation, 111
Malayalee Association of Northern California, 28
Matrix Partners, 235
Mayer Brown LLP, 93
Mayfield Ventures, 238
McAfee, Inc., 133
Mendocino Brewing Company, 240
Mission National Bank, 89
Monsoon, 237
Montgomery Hotel, 80
Morphogenesis, 166
National Semiconductor, 108
NEA Indo-U.S. Ventures, 232
Nektar Therapeutics, 215
Network of Indian Professionals (NetIP), 31
Nevis Networks, 232
NewPath Ventures LLC, 232
Nishith Desai Associates, 96
Norwest Venture Partners, 235
Nvidia, 145
Opti, 38
Oracle Corp., 127
Orrick Herrington & Sutcliffe LLP, 93
Pacific Gas and Electric Company, 187
PanIIT, 66
Patra Corp., 155
Perkins Coie LLP, 92
Photonera Inc., 37
PortalPlayer, 206
Presidio Partners LLC, 166
Punjabi Cultural Association, 28
QB3 (California Institute for Quantitative Biosciences), 59
Rajasthan Association of North America, 28
Reamatrix, 215
Reva Electric Car Company, 189
RightWorks, 39
Riya Inc., 122
Ropers Majeski Kohn & Bentley, 96
Salesforce.com, 139
San Francisco Bay Area Tamil Manram, 28
San Francisco State University (SFSU), 62
San Jose State University (SJSU), 63
SanDisk Corp., 111
Santa Clara University, 64
Satyajit Ray Film and Study Collection, 29
Searles Valley Minerals Inc., 94
Selectica, 38
Semindia, 104
Sequoia Capital, 230
Sevin Rosen Funds, 236
Sherpalo Ventures, 237
Sierra Club, 194
Sikh Foundation, 37
Silicon Valley Bank (SVB), 229
Silicon Valley Indian Professionals Association (SIPA), 30
Sindhi Community of Northern California, 28
Skidmore Owings & Merrill, 167
Skybox Security, 146
Software Technology Group, 155
Solar Electric Light Fund, 188
Solaria, 181

Global Reach

SolFocus, 181
South Asia Initiative (SAI), 56
South Asian Bar Association of Northern California (SABA), 31
Stanford University, 56
State Bank of India (California), 88
Stion Corp., 181
Sun Microsystems Inc., 210
SWA Group, 169
Sybase Inc., 133
Symantec, 130
Symphony Technology Group, 40
Synopsis, 108
Taj Hotels, 80
Tata Consultancy Services (TCS), 149
Telsima, 232
Teneros Inc., 123
Tensilica, 147
TiE (The Indus Entrepreneurs), 32
U.S.-India Business Council (USIBC), 42
UC Berkeley, 52
UC Davis, 57
UC San Francisco, 58
UC Santa Cruz, 61
UmeVoice, 35
University of San Francisco (USF), 63
URS Corp., 170
U-Systems, Inc., 216
VaST Systems, 147
Velocity, 237
Visa, 87
VMware, 136
Wadhvani Foundation, 39
Walden International, 222, 236
Wells Fargo Bank, 88
Willdan Energy Solutions, 194
Wilson Sonsini Goodrich & Rosati, 92
Wind River Systems, 147
Wipro Ltd., 144
Xalted Networks, 236
Xilinx Inc., 113
Yahoo!, 203
Z Research, 146

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The Bay Area Council Economic Institute is a public-private partnership of business, labor, government and higher education that works to support the economic vitality and competitiveness of California and the Bay Area. Its work builds on the twenty-year record of fact-based economic analysis and policy leadership of the Bay Area Economic Forum, which merged with the Bay Area Council in January 2008. The Association of Bay Area Governments is its principal governmental partner. The Economic Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research institutions and laboratories. Through its economic and policy research and partnerships, the Economic Institute addresses major issues impacting the competitiveness, economic development and quality of life of the region and the state, including infrastructure, globalization, science and technology, and governance. Its Board of Trustees, which oversees the development of its products and initiatives, is composed of leaders representing business, labor, government, higher education, science and technology, and philanthropy.

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