



# India

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## Overview

Few other countries illustrate the vast potential and the domestic challenges of unleashing and harnessing ICTs as vividly as the billion-strong subcontinent of India. As a content-rich country with a free press, an affluent, tech-savvy, diaspora population spread across the world from the Silicon Valley and Sydney to Singapore and Southall, and a huge pool of cutting edge IT and design skills, India has a lot to offer the domestic and global Internet markets. But there is also the dark side to the proverbial coin: poor connectivity outside of the major cities, low levels of B2B activity online, and government policy foot-dragging in terms of creating a level playing field for infrastructure players.

India has about 10 to 12 million Internet users, 8 million cell phone users and a teledensity of just over 3 percent in a country with close to half the population hovering around the poverty line. Though India is still by and large a developing nation, there is also a burgeoning information society within. Twenty-five percent of India's workers are in the service sector, 60 percent in the agricultural sector, and 15 percent in industry. India has more information workers than Japan and the same number as the USA. Overcoming the digital divide in conjunction with other socioeconomic divides will remain one of the key development issues for decades to come. Innovations in low-cost devices have yet to reach take-off stage, and the open source movement is making notable but slight inroads into the education and government sectors.

Standardisation of local language fonts and keyboards has been a stumbling block for local language digital content publication, though some initiatives are beginning to make headway. The youth – especially in urban areas – are very Net-savvy, and the gender divide is narrowing in this segment as well. At a time of growing religious conflict, the Internet is being used actively to spread messages of peace via Web-based signature campaigns and circulation of awareness-raising articles via e-mail.

In terms of employment, the IT and IT-enabled services sector in India is a burgeoning industry and continues to draw significant pools of talent and energy, despite the current economic downturn globally. India seems to have cemented its position as the “outsourcing centre of the world”; and Indian software, services and content companies are gearing up to move up the value chain from basic services

to products. In addition to tapping the global software market, having a sizeable domestic user base means India can sustain a lot of local infrastructure, content, foreign capital investment and an online market in general – unlike other, smaller countries that need to focus much more on overseas markets.

“No other nation provides a better example of the role of the new communication media in the development process through which a country moves from being an agriculture-based economy towards becoming an information society,” according to Arvind Singhal and Everett Rogers (2001).

Much attention has focused on the digital divide in developing countries as a question of lack of access to ICTs. The answers to bridging the gap, however, involve much more than basic Internet access. The key to unlocking ICTs for development involves a focus on a range of parameters which can be referred to as the 8 Cs of the digital economy: connectivity, content, community, commerce, capacity, culture, capital and cooperation (Rao, 2002). In other words, it is important to have affordable and widespread access to ICTs, locally relevant content in local languages, offline and online forums for discussing ICT applications, e-commerce services, human resource capacity, a culture which embraces innovation, investment capital, and cooperation between multiple stakeholders. This chapter will assess India's digital environment along some of these parameters.

## Content

India is an extremely content-rich country with a very free press: the news, culture, entertainment, sports and medical knowledge base of this country represents a formidable pool of content for the digital publishing industry.

Like some other emerging economies, one peculiar feature of the Indian Internet scene has been that there were initially more Internet users of Indian origin outside the country than within. As a result, much of the initial push to create India-related content came from outside the country, especially from the academic and non-profit sectors in the USA, in the form of mailing lists and Usenet newsgroups. As local diffusion of the Internet picked up, more content development work mushroomed at home.

There are at least ten measures of market maturity for online content in a country (Rao, 2002):

- Total number of websites about (and published in) the country
- Local relevance and usefulness of this content
- Local language standardisation and usage on the Web
- Amount of subnational content (about states, provinces, cities)
- The presence of meta-content like directories and search engines
- Amount of revenue from advertising targeted at online audiences via these sites
- The presence of third-party services from online traffic auditors, ad revenue auditors and market research groups
- Entry of international content players into the domestic content market
- Business agreements between content sites, online ad networks, and content syndicators and aggregators
- Commerce-driven content services such as pay-per-article or subscription sites

In terms of content, the number of websites focusing on India is estimated to be around 150,000 sites, mostly in English (followed by Hindi, Tamil, Telugu, Bengali, Gujarati and Kannada).

Many Internet consumers in India are beginning to find significant local benefits from accessing local content on the Web; subnational content is beginning to appear on sites dedicated to specific cities and states (e.g. Goa, Kerala). Most sites prefer to register themselves under the “.com” domain name rather than “.in” owing to lengthier and more bureaucratic procedures for local registration.

Comprehensive directory and search services covering local content in English have been in existence since 1997, such as Khoj and 123 India.com. Portals like Rediff and Indya also offer search engine services; international portals Yahoo, Altavista and MSN have set up Indian editions of their services as well.

Third-party audits of online traffic to Indian websites are largely lacking, and it is difficult to obtain periodic authoritative survey of user popularity across the various categories of sites.

The initial channels for delivery and publishing of South Asian online content were mailing lists, Usenet newsgroups and gophers; websites came into the picture in the mid-1990s. Much Indian content on the Internet today is Web-based, but e-mail forums can still play a useful role – especially in areas where bandwidth is low and the quality of telephone connections is poor. In that sense, e-mail-based discussion lists are an under utilised channel in online communications in India.

For instance, a search on the Liszt directory of mailing lists <<http://www.liszt.com>> reveals that out of about 90,095 mailing lists on the Internet, only about 40 focus on India. The more active mailing lists and news digests on

## India facts

**Total population:** 1.037 billion <sup>a</sup>

**Rural population as a percentage of total population:** 72%<sup>b</sup>

**Key economic sectors:**

Agriculture, industry, services, IT<sup>a</sup>

**Literacy in national language(s):** 52%<sup>b</sup>

**Literacy in English:** 5%<sup>b</sup>

**Computer ownership per 100 inhabitants:** 0.6<sup>c</sup>

**Telephone lines per 100 inhabitants:** 4.2<sup>d</sup>

**Internet hosts per 10,000 inhabitants:** 0.35<sup>e</sup>

**Internet cafés/telecentres per 10,000 inhabitants:** 0.1<sup>f</sup>

**Internet users per 100 inhabitants:**

0.33 subscribers,<sup>f</sup> 1.65 users<sup>c</sup>

**Cell phone subscribers per 100 inhabitants:** 1<sup>g</sup>

**Number of websites in the national language(s):** 20,000<sup>h</sup>

**Number of websites in English and other languages:** 130,000<sup>h</sup>

**International bandwidth:** 1,670.3 Mbps<sup>i</sup>

### Sources:

(a) Centre for Monitoring Indian Economy.

(b) National Readership Survey, 2002.

(c) Exchange4Media.

(d) Ministry of Telecommunications.

(e) Orbicom, 2002.

(f) ISP Association of India.

(g) Cellular Operators Association of India.

(h) *Asia-Pacific Internet Handbook*, 2002.

(i) *Telegeography*.

development issues in India include IDRC's PanAsia, S-Asia-IT, India-GII, Digital Opportunity Channel, DigitalDivide, Linux in Education, Linux Users Group, and BytesForAll.

### Portals and news sites

According to studies like the Indian Readership Survey and the National Readership Survey, India's media industry reaches 180 million readers, 384 million television viewers and 189 million radio listeners out of a total population of 1.1 billion speaking dozens of languages. The reach of the press is 57 percent in urban areas and 24 percent in rural areas. In India, 72 percent of the population lives in villages. However, besides India's vast illiterate adult population (252 million), there are 248 million literate adults who do not read newspapers or magazines.

Most English newspapers and magazine groups in India have an online presence. (Full lists of online media around

the world can be obtained from sites like Newslink.org and MediaInfo.com.) Some traditional media groups like the Times of India Group (which launched a portal called IndiaTimes.com) have also joined the fray with Web-only publications and portals (e.g. Rediff, Indya).

In India, content aggregators and syndicators like ValueNotes and FridayCorporation have emerged, providing content for entertainment and e-finance sites. Among the major international portals, local editions have been launched by Altavista, Lycos, MSN, Yahoo and Orientation.

English has generally been the national language for business (especially in the cities) and has been the dominant language of the IT and Internet professional communities. But the local language publishing gap is closing: newspapers of most regional languages are online; portals have emerged in most local languages, such as WebDunia, NetSansar and TeluguPortal.

Part of the problem was an initial neglect of local language IT products and services by the Indian IT industry. However, in the past couple of years, there have been moves to standardise representation schemes, fonts and keyboard layout for Indian languages like Tamil.

India's Centre for Development of Advanced Computing (CDAC) has recently launched a multilingual webware promotion scheme called iLEAP-ISP; a multilingual word processor with Internet and e-mail support in Indian languages has been supplied to Internet subscribers through their respective ISPs.

i-DNS.net International, the company behind the Internationalised Domain Name System technology that allows people to use the language of their choice for domain name registration, expects to raise US\$50 million in revenue within the next two years from netizens in India from its Indian language domain name and e-mail services.

### Entertainment and lifestyle sites

India is the world's largest producer of movies and has a prolific music industry as well. Online gaming is emerging as a popular sport, particularly among the youth. Higher disposable incomes in the post-liberalisation era has spurred the growth of numerous lifestyle sites. Cricket is a massively popular game in India (despite recent allegations of corruption and match-fixing!), and a handful of cricket sites are engaged in heated competition to capture the clickstream of trivia-hungry cricket fans.

Notable sports and entertainment sites include Cricket.org, CricketNext.com, Khel.com, Hungama.com, Rajshri, BollywoodExchange.com, and the entertainment sections of sites like Indya and Rediff. MP3 files of Bollywood hit songs freely circulate over the Internet, and the music industry has been generally cautious in embracing the Web.

### Public services, health care

The Internet can be very well leveraged for public health information and for disaster relief during the region's frequent national calamities such as publishing lists of victims and survivors, contact numbers of relief agencies, and live news updates. Some organisations have effectively used the Web and e-mail campaigns to raise relief funds during the Andhra Pradesh cyclone and the Gujarat earthquake (e.g. India Network Foundation <<http://www.indnet.org>>, CauseAnAffect.org), but much more can be done in this regard in India.

Sites geared towards medicine, personal health care, indigenous medicine (where India has strong traditional knowledge bases) and the medical care industry include IndOrth.org, WebHealthCentre.com and Dabur.com.

### Education and research

Internet diffusion in schools, colleges and universities has not quite reached adequate levels; academic journals published from India are just emerging online. Access to research-oriented content – such as online databases from the Institute of Scientific Information, which is a major provider of online research content to Western academics – is available at many academic institutions.

“Now that the ISP monopoly has been lifted, India needs to look at creating powerful content and knowledge infrastructure,” says N.V. Sathyanarayana, managing director of Bangalore-based Informatics and a member of the National IT Task Force's Working Group on Content Creation and the Content Industry.

Informatics is a Rs 140 million company involved in the compilation, consolidation and distribution of CD-ROM and online databases. It has tie-ups with other international database companies like the Institute of Scientific Information, Silver Platter, Reuters, Elsevier, McGraw-Hill and UMI. It manages titles like *Exim India* (trade policies), *India Business Insights Database* (news abstracts) and *CABSAC* (South Asian agricultural literature).

“Web-enabled databases can provide more enhanced, multifunctional and personalised services that the print medium cannot provide,” Sathyanarayana says. Informatics' clients are academic, corporate, and government research institutions in India, such as the Indian Institutes of Technology (IIT), Indian Institutes of Management (IIM), Council of Scientific and Industrial Research, and Tata Chemicals.

Numerous professional training and educational institutions in India have launched online content offerings in IT areas like software development and e-commerce design. These include ApTech, National Institute of Information Technology (NIIT), SSI Technologies and Pentagon Academy. The Indira Gandhi National Open University has expanded its educational offerings to include online courses. Other notable players include eGurucool.com.

## Government resources

Today, most state governments in India have some degree of departmental computerisation underway. Many have basic information websites, and some even have IT secretaries and IT parks. Indian state and federal governments are likely to spend about US\$890 million in 2001–2002 towards e-government, according to the National Software and Services Association (NASSCOM).

Many government agencies are actively publishing reference information online. These include the National Informatics Centre and various state governments like Tamil Nadu and Karnataka. Spurred by the boom in the Indian Internet user base, a number of state governments have announced modest Internet initiatives, ranging from online trade and investment services to high-tech corridors conducive to foreign investment.

Andhra Pradesh chief minister Chandrababu Naidu has launched initiatives to provide government content and services online, such as land records, property taxes, birth and death data, and applications for certificates.

Tamil Nadu is also making notable progress in online citizen services in Tamil and English languages, especially Web-based information such as land records, birth and death certificates, subsidy schemes, geographical information systems (GIS), college admission forms and examination results.

Other online services include passport application <<http://passport.nic.in>>, registration procedures <<http://igreg.nic.in>>, school examination results <<http://results.nic.in>>, trade guidelines <<http://commin.nic.in>>, telemedicine <<http://indmed.nic.in>>, customs EDI <<http://www.chennaicustoms.com>> and land records computerisation in *taluks* (districts).

Indian states with official websites promoting activities like tourism and industry now include Uttar Pradesh <<http://www.upindia.com>>, Sikkim <<http://sikkim.nic.in>>, Madhya Pradesh <<http://www.mptourism.com>>, Punjab <<http://www.nic.in/punjab>> and Maharashtra <<http://www.maharashtra.gov.in>>. Links to these resources and other e-government initiatives can be found at the website of the Ministry of IT <<http://www.mit.gov.in>>.

In the southern state of Kerala, a Knowledge Village Portal has been developed by Karakulam Panchayat, a village body. An electronic citizen database has been created for more than 20 million Kerala citizens in the form of electoral identity cards. The state government has also introduced interactive voice response systems in their citizen interaction, such as for distributing election results.

While the states of southern India seem to have taken the lead in launching e-government services and creating conditions favourable for the growth of local ICT industry clusters, other states are becoming active on this front as well, such as Haryana, Madhya Pradesh, Bengal and Gujarat.

The World Bank's annual development report, *Knowledge for Development*, stresses the importance of leveraging new media technologies like the Internet in emerging economies for areas such as transparency of government and financial institutions, lifelong learning, training and retention of skilled workers, and rural as well as distance education.

"Whether you are talking about information regarding government spending by politicians, the quality of milk, crop inspection standards, databases of importers, or global economic indicators, publishing on the Net can effectively augment traditional communication channels," according to Tara Vishwanath, principal author of the report.

## NGO resources

National NGOs (e.g. AIDS Relief Freedom Foundation in Bangalore), international NGOs (e.g. Child Relief and You – CRY) and global organisations (e.g. UNDP) have a modest online presence in India. IndiaLink and the Centre for Education and Documentation <<http://www.doccentre.org>> have played a major role in documenting the work of NGOs and publishing them online.

NGOs and voluntary organisations are expected to play a key role in bringing the Internet to rural areas, as well as in compiling traditional knowledge in sectors like medicine, cuisine and folk culture (e.g. Archival Resource Consortium of India <<http://www.archive-india.org>>).

Digital democracy must include online publishing and participation by sociocultural complexes like arts clubs, libraries, youth associations, gender groups, cooperatives, tribal organisations, human rights activists, disaster relief agencies, and advocacy groups for disabled citizens, according to Damodaran Sivakumar of the University of Kerala.

"There is no doubt at all that the Net has been invaluable in assisting communities which are vulnerable and have been victimised," says Manchin Hangzo, at the Bangalore office of ActionAid <<http://www.actionaidindia.org>>. "We found that AIDS patients were able to uncover a lot of useful information online and get in touch with support groups via the Net. The relative anonymity of the Net can also help rape victims come out and talk about their problems and find help and resource organisations online," she says.

In addition to relief for such marginalised groups, the Internet can also play an important role in nurturing local communities, especially in rural areas. Across the world, conferences like the recent Global Community Networking summit in Barcelona <<http://www.gcn2000.org>> have focused on the intersection between the global economy and local communities via telecentres and community access points.

Bangalore-based media advocacy group NGO Voices is setting up a community Internet access programme for persons with disabilities in the Kannakkapura area.

## Business content

Much of the drive towards e-commerce in India will be driven by transactive content, that is, content which facilitates the completion of entire commercial transactions or a significant part of them. Many business sites have gone beyond the basic brochureware stage to offer task-specific content. E-commerce sites like Rediff.com and business portals like SteelRX publish reviews of books and updates on the steel industry, respectively. E-trading sites like ShareKhan and IndiaBulls offer copious information on stock market movements for prospective traders. Planet Customer.com empowers consumers by aggregating content about their experience with products and services of Indian corporations.

Trade databases of importers and exporters are published by numerous government agencies and third-party publishers. Yellow pages business listings of dozens of Indian cities are available on the Internet thanks to the online efforts of yellow pages publishers like IndiaCom Directories <<http://www.indiareference.com>>.

Business articles, sector reports, and credit ratings information are available on a pay-per-download or subscription basis from sites like IndiaInformer.com (recently acquired by FridayCorporation) and CRISIL (Credit Ratings and Information Services of India, Limited).

In addition to the above categories, special measures must be taken to provide online content rapidly during times of disaster like earthquakes and floods. Legal developments concerning content classification, regulation and enforcement in countries around the world must also be tracked more closely by Indian publishers and lawmakers.

Besides content drivers from the media and organisational sector, a key role is played by community-driven content. India has a globally dispersed diaspora numbering to over 20 million. Over a million are in the USA, two million in the UK, and hundreds of thousands in other European countries, Africa and Australia. Numerous sites thrive on content and community that are geared towards various pockets of the Indian diaspora, many of whom find the Internet to be the perfect “online glue” for tying together the global Indian tribe to catch up on news, discussion, culture, business and entertainment.

A good example of an Indian community leveraging the Internet across state and national boundaries are the 75 million Tamil-speaking population worldwide. The Tamil Nadu state government and business community are also working closely with the governments and IT sectors of Singapore, Malaysia and Sri Lanka on Tamil language initiatives. Tamil is an official language in these countries as well, and standardisation efforts are being coordinated by the International Forum for Information Technology in Tamil (INFITT).

Other Indian languages with a significant presence on the Internet include Hindi, Gujarati, Bengali, Kannada and

Telugu. India has over 18 official languages and over 400 dialects. Just as the cable television industry tapped greater revenue streams by branching out from English to local language fare, so too the various Indian communities can leverage the Internet. The cultural environments of the various diaspora pockets differ of course, and accordingly many Indian sites have a focus which includes their newly adopted countries of residence. Such community sites include IAOL.com (Indians Abroad Online) and Sulekha.com (a literature site).

## ICT industries and services

Although the growth in percentage has dipped a bit, the Indian IT industry still continues to grow at a steady pace. Irrespective of the slowdown, leading Indian IT software and service companies have continued to grow at over 50 percent (compared to over 65 percent in the past).

The Indian software and services industry has mushroomed from US\$50 million in 1988–89 to US\$3.9 billion in 2000–2001, over half of it in exports to countries like the USA. It covers the entire spectrum from low-skilled medical transcription and remote call centres to high-end telecommunications software and e-commerce services. In the late 1990s, a number of Internet media pioneers have emerged as well, led by Rediff and Satyam Infoway, who have listed on NASDAQ.

Creating and sustaining a mature ICT economy requires building and harnessing the requisite capacity in areas ranging from software and hardware to data communications and management skills. This requires formal educational and vocational training of students and workers in e-business and m-commerce. In India, the IITs and IIMs are offering courses and modules in areas like web publishing and e-commerce. Professional training institutes like ApTech, NIIT, Pentagon Academy and SSI Technologies offer a range of courses in Java, C++, XML, object oriented programming and web design in India and dozens of other countries as well.

As a result, India has more info-workers than Japan and the same number as the USA. India’s software sector accounts for close to 325,000 employees, and at least 55,000 new workers are needed each year to meet existing levels of demand.

“What was India’s biggest challenge – its large population – is in the process of being transformed into its most significant asset. Just as the discovery of oil transformed Middle Eastern countries, so will the Internet in India,” says Uday Pabrai, a pioneer in Internet training services based in California, with franchisees in India.

Indian software exports have risen from US\$100 million in 1990 to US\$5 billion in 2000. Software currently accounts for over 2 percent of GDP, and is set to cross the 10 percent threshold by 2010. Titans of the Indian software industry include Wipro, Infosys and Tata Consultancy Services.

Vertical specialisation in various disciplines is also emerging. Educational institutions like the National Institute for Fashion Technology are stepping up course offerings and internship programmes for students in areas like Internet marketing and B2B commerce.

Multimillion-dollar state government initiatives for massive skill-building at the school level have been awarded to NIIT and ApTech, who are imparting IT skills to hundreds of thousands of students across states like Tamil Nadu and Karnataka. Innovative experiments are also targeting learners outside traditional classrooms. One of NIIT's more innovative schemes in this regard is its "Hole in the Wall" experiment to expose children living in the slums to the Internet.

Today, close to 300 Indian software companies have a US presence. At one end of the spectrum, the Internet opens up a huge market in teleservices: transcription, translation, data entry, project design, accounting, network management, web services, remote education, and help desks. Some critics view these companies as low-tech sweatshops for multinational corporations (MNCs), but they provide much higher salaries than local jobs while exposing employees, to global standards of professionalism and new emerging ideas for potential start-ups.

A highly publicised report on the IT industry in India, released by NASSCOM and McKinsey Consulting, urged the Indian software and services industry to lift its revenue goals from US\$3.9 billion in 1998–99 to US\$87 billion by 2008. Software exports of Rs 400 billion in 2001–2002 will represent a 41 percent growth over the previous year's software and services export revenue which was Rs 283.5 billion.

India will have to produce over 2.2 million high-quality knowledge workers in software-related areas by 2008. A recent study by NASSCOM and the Boston Consulting Group projects a US\$9 billion business opportunity for Indian IT companies from global e-solutions services market by 2005. The domestic market for e-solutions is expected to grow from a base of US\$65 million in 2000 to US\$500 million in 2005.

The worldwide market for e-solutions products and services, estimated at US\$180 billion in 2000, is expected to grow to US\$640 billion by 2005. Customer relationship management (CRM) and supply chain management (SCM) solutions account for 70 percent of e-solutions spending with over 50 percent of the market concentrated in North America.

Venture capital investments in Indian technology companies amounted to US\$20 million in 1996, US\$750 million in 2000, and could reach US\$10 billion in 2008.

The global IT services market is expected to grow to US\$1 trillion by 2008, according to DataQuest. The top spenders will be financial services and manufacturing. The market for software products is expected to grow from US\$134 billion in 1998 to US\$770 billion by 2008, according to IDC.

Indian IT companies like TCS, Infosys and Ramco have launched a series of software products for human resource management, banking automation, and enterprise resource planning. Other companies targeting original product offerings include HCL Technologies (VOIP), DCM Technologies (chip IP), Hughes Software (Bluetooth), Sasken (ASIC design), Web/wireless integration (Net4Nuts), Infosys (wireless Internet) and Wipro (packet voice).

The crown jewel of India's IT industry is the south Indian city Bangalore. Formerly a hub of the aerospace industry of India, it then became a major centre for hardware and subsequently software companies. Bangalore's strengths include widespread English skills, sheer numbers of programmers, experience in managing global software and services projects, growth in MNC's development centres, and connections with non-resident Indians in Silicon Valley who are excelling there (e.g. venture capitalist Vinod Khosla, Sabeer Bhatia of Hotmail fame, Desh Deshpande of Sycamore, K.B. Chandrashekar of Exodus).

With its strong base of government defence laboratories and manufacturing companies in the automotive and electronic sectors Bangalore has blossomed and matured as a major design and development location. Intel, Sun Microsystems, ZiLOG and a number of other companies have set up design and development centres there. Sun's India Engineering Centre there may eventually become its largest such centre outside the USA. Lucent Technologies, Hewlett-Packard, and Oracle also plan to exploit Bangalore's cost and talent advantage and expand their operations there.

A recent Merrill Lynch report on core technology R&D services in India identifies Indian companies which are focusing not just on IT budgets of their clients but R&D budgets in areas like ASIC design (targeted by Wipro and HCL Technologies), VOIP (Hughes Software) and protocol stacks (Sasken). Domestically, however, Indian IT companies spend far less on R&D as a percentage of sales revenue (0.6 percent on average) than US firms (14.8 percent on average).

The IT-enabled services market includes a wide range of activities like engineering product design, purchase order processing, editing, transcription, remote network management, logistics tracking, financial processing, call centre support, telemarketing, remote billing, collection centres, subscriber management, and help desks. For many of these services, 50–90 percent of the processing can be out sourced, and 70–80 percent of these costs can be significantly reduced. While the IT sector may be nervous about economic slowdowns in the USA, the IT-enabled services sector in India may actually gain from US companies outsourcing non-core functionalities to Indian companies. NASSCOM had projected revenue from such IT-enabled services to hit about US\$1.4 billion in the year ending 31 March, 2002.

Numerous companies are targeting the e-CRM space in India, such as Talisma, Interact Commerce, Parsec Technologies, Syntax Soft Tech, Sovika IT, Trivium,

Customer Asset, 24X7 Customer, Rave Technologies, Datapro Infoworld, Vision Info Solution, Daksh, Knoah Communication, and Trisoft. Some, like 24X7Customer (which manages 85 percent of Altavista's e-mail-based customer support), manage the entire outsourcing operation right from setting up telecommunication switches in client premises and routing calls to managing the private leased circuit to offices in India and servicing customer requests.

Voice-based call centres and Web-enabled CRM services are being offered not just for technical support – as with QSupport.com – but for other customer-centric activities for US and European companies, such as financial order processing and payroll processing to ticket bookings and medical transcription. These are run either by Indian companies or the Indian subsidiaries of MNCs like GE Capital and Dell.

According to IDC, India will record a CAGR above 50 percent in the call centre market until 2005. The total size of the call centre services market in Asia Pacific will grow to over US\$4 billion by 2005 from US\$1.2 billion in 2000. Out of this, the India-based call centre services market is pegged at US\$200 million and is expected to cross US\$1 billion in around five years. More than 100 call centres have been granted licences by the Department of Telecommunications. In India, this industry employs over 35,000 professionals.

The trend-setter here is GE Capital, whose service centre in Gurgaon, near Delhi (another one is planned in Hyderabad), offers other companies services in accounting, telephone support, transaction processing and e-commerce support. The India centres form part of a global GE service network which includes Mexico, Ireland and the Philippines.

Other examples of global companies with service centres in India include Bechtel (CAD and 3D modelling), British Airways (airline reservations, frequent flier programme management), Healthscribe (medical transcription for US hospitals), Convergys (call centres for 3Com) and Citibank (customer service, telebanking).

Indian software and services companies are scrambling to migrate from legacy application development and maintenance to Internet-centric computing and convergent platforms. Wipro, NIIT and Aptech have software development centres in India for high-volume offshore work and have marketing presence in over 35 countries. Companies like Infosys are moving to a more value-based pricing approach instead of a cost-based approach. Some Indian companies have also begun making small acquisitions in the USA, and set up alliances abroad.

Areas ripe for foreign companies to consider Indian alliances include strengthening Internet security, data caching, Web-enabling legacy systems, XML-enabled application integration, implementing e-commerce sites (e.g. auctions, B2B exchanges), developing enterprise portals, managing content-heavy sites, standardising plug-and-play technologies, evolving WAP utilities, spinning off high-tech

consulting services, remote education and training, and online market research.

Precious management expertise from Indian Internet veterans in Silicon Valley is increasingly being ploughed back into the home country via numerous start-ups and outsourcing partnerships. These entrepreneurs have become popular role models for an entire generation of aspiring ICT-savvy youth. Much of this “brain bridge” from Silicon Valley also extends to venture capital.

At the B2E level, Web-based knowledge management and e-learning are gathering steam as ways of improving organisational capacity for e-readiness. For instance, Wipro Technologies and Infosys have created virtual communities to assist in troubleshooting and accumulating lessons from project management. Infosys has a company-wide intranet called Sparsh which spans its India and US offices. It has devised its own KMM (knowledge management maturity) model, along with Knowledge Currency Units to reward employees who contribute and use the knowledge management system.

## Examples of innovative and key initiatives

Numerous examples of ICTs in development have been chronicled by Bhatnagar and Schware (2000), Rajora (2002) and Rao (2002). Many of these have gone beyond the pilot project stage and have become successful and even self-sustaining initiatives. Systematic chronicling of these best practices and more sharing between states are called for.

The examples covered below span a wide range of activities: rural Internet kiosks, community centres, e-healthcare, GIS systems, dairy sector applications, teacher training, online agricultural services, land record automation systems, wireless local loop (WLL) solutions, databases of rural innovations, and other services targeted at women and children.

Drishtee has set up 90 Internet kiosks across five Indian states as part of the rural ICT infrastructure, providing government information and market prices. The states include Punjab, Uttar Pradesh, Rajasthan and Orissa. Drishtee is also part of the core team constituted by the Ministry of Technology and MediaLab Asia for the implementation of community information centres in northeast India.

As part of the India Healthcare Project in Rajasthan, village health care workers used handheld computers made by Apple (the Newton) for data entry in local languages, reducing data entry and speeding up decision-making.

The Gyandoot government-to-citizen network <<http://www.gyandoot.nic.in>> won the Stockholm Challenge Award in 2000 as well as the Computer Society of India's National Award. Launched in 1999, it was a rural community network initiative to meet information needs, such as agricultural commodity prices in nearby markets, land records, property

registration, micro credit financing, employment listings, grievance redress, application forms, matrimonial services, weather forecast, local news, ration shop information, village council records, distance learning, voter lists, marketing services for dairy and handicraft products, emergency services, and expert advice (on health, agriculture, cattle, law).

In Maharashtra, site of a severe earthquake in 1993, a GIS-based disaster management information system has been rolled out to improve resource mobilisation, decision-making and situation monitoring.

The M.S. Swaminathan Research Foundation is developing “knowledge centres” in south Indian villages to help ensure food security. The project includes local language content and wireless Internet access.

In Gujarat, IT-enabled machines at the milk collection centres of the Amul Cooperative are used to measure butterfat content of milk and to increase the efficiency of making payments to farmers. This has helped reduce the tendency to increase the quantity of milk by adding water and reduce the time for payments from ten days to a matter of minutes.

World Links, a Washington-based international NGO and the lead NGO in the World Economic Forum’s Digital Divide Initiative for India, has announced its plans to bridge the digital divide in India by training secondary school teachers in 125 Indian schools in the classroom application of IT. It will also provide school connectivity, basic computer literacy, and professional development training to teachers in Delhi, Karnataka, Kerala, Andhra Pradesh, Punjab, Gujarat and Tamil Nadu.

One of the most IT-savvy state governments in India is Andhra Pradesh. The bilingual CARD (Computer-Aided Administration of Registration Department) initiative is spread over 200 locations in the state and has helped create a more transparent and less corruptible system of property valuation. The initiative will also reduce archival problems with old paper documents and introduce a more scientific structure to document classification and retrieval. Automated systems for delivery of certificates of income and nativity as well as ration cards, court documents and census data are being rolled out in over 1,124 *mandals* (the administrative level just above village level) in Andhra Pradesh. Other systems are being implemented at post offices as well.

In Tamil Nadu’s Madurai district, WLL technology is being used by the Sustainable Access in Rural India (SARI) project, jointly undertaken by Media Labs, MIT, TeNeT Group of IIT Madras, Harvard Center for International Development and I-Gyan Foundation of Boston for deployment of telephones and Internet in villages. SARI is tying up with a number of content developers and application providers, encouraging creation of a variety of Internet content useful to rural areas. It has tied up with Dhan Foundation, an NGO in the area, for agricultural information systems and transactions.

At the level of grassroots innovation, the Honey Bee knowledge network catalogues in a multimedia database innovations pioneered by villagers. Entries include a tilting bullock cart for easier offloading and a powder preservative for grain storage.

A kiosk system has been launched in Tamil Nadu’s Nellikuppam, the town where the Parry sugar factory is located. Forty Internet connections have already been installed in the villages of the command area. A portal called Indiagriline.com has been created, with the latest weather updates, fertiliser and pesticide stock positions of dealers in the area, seed and seedling availability of local dealers and nurseries, scheduling of migrant labour, tractor rental, farm consultancy offered by farmers in the area, and more – all in the local language Tamil.

The Warana Wired Village project covers 70 villages around Maharashtra’s Warana River and provides a network of kiosks for information services in agriculture, medicine and education.

Software and training institute NIIT pioneered an innovative “Hole in the Wall” experiment to expose children living in slums to the Internet. This initiative of IT training via “technical emergence” of Internet browsing skills has received US\$1.3 million in funding from the World Bank.

The Self-Employed Women’s Association uses one-way video, two-way audio teleconferencing networks for training rural women managers in water conservation, child development, and financial services.

Another notable example of what ICTs can do for quality of life in developing countries is the computerisation of India’s railway reservation system, one of the largest in the world. It has saved millions of citizens hours of waiting time in long queues, which used to be the case before computerisation.

## Policies and regulation

Since independence from British colonial rule in 1947, India has made modest progress: life expectancy has increased from 32 to 63 years. The Green Revolution in the 1970s and the White Revolution in the 1980s have ushered in massive expansion of the agricultural and dairy sectors, respectively.

The New Economic Policy of 1991 effectively ended centralised approaches to economic planning and ushered in a decade of deregulation, privatisation and liberalisation – along with increasing Westernisation and consumerism. The government has also decided to allot at least 2–3 percent of its budget for IT expenditure.

Up to 2000, the data communications environment in India was governed by colonial-era legislation like the *Indian Telegraph Act of 1885*, which stipulated that the government is the sole owner and controller of telecommunications and broadcast channels. Other regulatory blocks include the prohibition of coupling between different service infrastructures (e.g. VSAT and Internet backbones).



Regulatory bodies, such as the Telecommunications Regulatory Authority of India, have unfortunately been hamstrung by interdepartmental politicking in their efforts to create a conducive Internet climate.

While India may often be criticised by outside observers as being a fractious and divided set of communities who have yet to align their interests with overall national considerations of proficiency and professionalism, the Internet sector companies have come together very well as an integrated set of interests.

The rise of the software industry in India owes its success in part to the tremendous lobbying efforts of the NASSCOM <<http://www.nasscom.org>>, which has done a stellar job of rallying software companies under its banner, conducting market research, hosting frequent industry forums, lobbying for progressive IT legislation, and evangelising the prowess of the Indian IT sector to government agencies and chambers of commerce around the world.

Throughout the coming decade, NASSCOM hopes to aggressively promote the India Inc. or India.com brand abroad, on lines similar to Ireland's IDA. Numerous memoranda of understanding for bilateral cooperation in the software sector have been signed with countries like the USA, UK, France, Ireland, Australia, Japan, Spain, South Korea and Singapore.

The hardware sector has a similar lobby called MAIT (Manufacturers Association for Information Technology), but unfortunately hardware has been generally treated as a stepchild by much of the IT industry and the government. As a result, precious opportunities in tapping the exploding market for personal digital communication devices are lost to other parts of Asia.

ISPs in India have formed the ISP Association of India to lobby for quicker opening of access to international Internet gateways. A similar consortium has been formed for the ASP Industry, ASPIN (ASP Industry of India). The Computer Society of India has dozens of chapters across the country, focusing on the needs and contributions of computer professionals. For instance, a recent regional gathering focused on the role of the Internet in boosting the tourism sector. INFITT in India, Singapore, Malaysia, Sri Lanka and Mauritius focuses on promoting the use of Tamil on the Internet.

Cooperation between Indian research institutes and the private sector in the Internet market has occurred only at modest levels (e.g. Infosys has in part underwritten the cost of an IT Centre at IIT Mumbai, but this has only just been launched). International heavyweights are already active in this space (e.g. IBM and IIT Delhi, Ericsson and IIT Mumbai).

The government began to promote the software industry in the late 1980s via the Software Technology Park initiative, which included tax breaks and affordable bandwidth. The Prime Minister launched an IT Task Force in the late 1990s. While there was initially some alarm at the creation of an IT

Ministry as well – several IT companies prefer a hands-off approach by the government in the IT sector – the track record until now seems to be more of open cooperation, with considerable space for inputs on policy-making on key IT decisions.

Cooperation between the private and the civil sectors on using the Internet for greater empowerment of citizens has been modest at best. Much more can be done by systematically tapping the spare time, capacities and energies of well-meaning socially aware IT employees, who do not seem to find organised outlets for their progressive inclinations.

At the state level, Karnataka, Andhra Pradesh and Tamil Nadu have the most forward-looking ICT policies and are active users of ICTs themselves. Others like Kerala are also catching up. For instance, the tourism board of Kerala has launched French and German versions of its informative tourism website, which is now used by 12,000 tourists a month.

IT tends to be one sector where all political parties are generally in agreement that there is some potential relief for alleviating some of society's problems. But a considerable amount of sharing of lessons and expertise between the different states of India is needed.

In addition to state government agencies, some public sector companies are also making a mark in IT usage. For instance, Bharat Petroleum, India's second largest oil company in terms of market share, is aggressively promoting B2C and B2B services. The giant corporation has a customer base of over 30 million with products ranging from petrochemicals and solvents to aircraft fuel and specialty lubricants. Its vast network in India includes 4,510 gas stations, 967 kerosene dealers and 1,389 liquid petroleum gas distributors. Residents in some cities like Hyderabad can now order their gas cylinders online.

At the government level, India's Commerce Ministry has selected several organisations for coordinated electronic data interchange (EDI) implementation, such as the Customs, Directorate General of Foreign Trade, Reserve Bank of India and Container Corporation of India.

The *IT Act 2000* has several useful features. It legally recognises e-mail as a valid form of communication in India. Acceptance in an electronic form of any offer, culminating in an electronic contract, is legal and enforceable. It has recognised digital signatures for the first time in Indian Law. The new law has also granted a hierarchy of infrastructure consisting of a controller for certifying authorities, adjudicating officers and a Cyber Appellate Tribunal.

Hacking has been defined for the first time, as also its punishment in the form of imprisonment of up to three years or a fine, which may extend to Rs 200,000, or both. This is a welcome measure as hacking has assumed tremendous notoriety of late. The penalties for damage to computers, computer systems, etc., have been fixed as damages by way of compensation not exceeding Rs 10,000,000 to affected

persons. It is a laudable effort by the government to create the necessary legal infrastructure for the promotion and growth of e-commerce, according to Supreme Court advocate Pavan Duggal (who maintains the site <<http://www.cyberlawindia.com>>).

Unfortunately, the Act also has potential for trampling cyber liberties and freedom. A police officer of the rank of a Deputy Superintendent of Police has been granted unheard-of powers, in cyber law history, to do almost anything for the purpose of apprehending a cyber criminal. It also gives immunity to the central government and its officials, including police, from any suit, prosecution and other legal proceedings for any act done in good faith in pursuance of the provisions of the Act. It also talks about a legal infrastructure for e-commerce without touching on the other important legal issues for the corporate sectors like intellectual property rights, domain names, Internet policy, linking or disclaimer.

More support is required at the regulatory level to work out the tensions and roadblocks, as India's telecommunications sector privatises, between telecommunications and wireless operators. Support for rural-level Internet access also needs to be boosted.

"The Indian government demonstrates a strong reluctance to give up its control over telecommunications services. Government control is not always benign; in most instances, in India, it has been neither customer- nor industry-friendly," according to Singhal and Rogers (2001).

Much of the growth of India's information society will depend on the telecommunications sector. Until recently, telephones were considered luxury items by the government, but more aggressive development of the telecommunications infrastructure has taken place in recent years. Eighty percent of the existing telecommunications infrastructure was added in the 1990s alone, according to Singhal and Rogers. In 1988, only 4 percent of villages had telephone access; in 2000, over half of them had access.

The Centre for Development of Telematics, set up in 1984 and headed initially by Sam Pitroda, played a major role in the proliferation of 650,000 public call offices across India for local and long-distance calls.

More efforts and innovation are needed along the lines of Bangladesh's Grameen Bank-supported peer-enforced micro credit programmes for access to mobile phones and the Internet. One of the key lessons of the proliferation of public call offices is that ordinary citizens should be not just passive consumers of ICTs but rather their owners.

Eager to emulate the success of Silicon Valley, many Indian cities are trying to create a local "technopolis" – best exemplified by Bangalore and Hyderabad. Care must be taken to ensure that such cities do not become victims of their own success via overcrowding, pollution and skyrocketing prices.

One area where India could step up its role is in south-south cooperation on the ICT front with other developing countries. Many memoranda of understanding have already been signed with countries ranging from Cambodia to South Africa.

In the area of Internet governance, organisations based in India have not participated adequately in international forums like ICANN and IETF. Key questions of Internet governance, such as domain names and IP addressing, are discussed at such forums, but India has a very low profile in these international bodies.

## Open source movement

Leading commercial distributors of endorsed Linux software, like RedHat and Caldera, operate in India. The Free Software Foundation has active support in India (FSF-India); and its founder, Richard Stallman, has visited the country in this regard <<http://www.gnu.org.in>>.

Linux user groups are present in cities like Bangalore <<http://www.linux-bangalore.org>>, Calcutta <<http://www.ilug-cal.org>> and Delhi <<http://www.linux-delhi.org>>. There is also an umbrella organisation called Linux India Users Group <<http://www.linux-india.org>>. Conferences and workshops are held by these associations on an annual basis for increasing visibility, developer networking and capacity building. The groups include engineers, corporate users, consultants, journalists and ordinary computer users. News on the Linux movement in India can be found at the sites <<http://www.linuxmagindia.com>>, <<http://indlinux.sourceforge.net/bookmarks.html>> and <<http://linuxinindia.pitas.com>>. Tamil language Linux developments can be tracked at <<http://www.tamillinux.org>>.

At the government level, IBM and Hewlett-Packard are expanding their e-government solutions offerings to include support for Linux platforms. CDAC <<http://www.cdacindia.com>> is active in this regard as well.

IIT and the National Centre for Software Technology (NCST) have developed Tamil and Hindi language systems based on the Linux operating system. Linux enthusiasts are also active in the Homi Bhabha Centre for Science Education at the Tata Institute of Fundamental Research.

IndLinux is a volunteer group working at the desktop level (KDE/GNOME) using Unicode (ISCII, the Indian standard character interface and South Asian equivalent of ASCII, will also be supported with the provision of converter tools). The current focus is on open-type fonts development and translation for GNOME 2.0 <<http://www.indlinux.org>>.

"I am proud to state that Kerala is the first and perhaps the only state in India to have made a clear policy pronouncement in this regard. Many of our e-Gov initiatives like MIS Industries, take advantage of open source systems," according to Ajay Kumar, industries, secretary of the southern state of Kerala. Its official IT policy states:

The Government wishes to encourage the judicious use of open source/free software that compliments/supplements proprietary software, to reduce the total cost of ownership of IT applications/solutions without compromising on the immediate and medium term value provided by the application. The Government welcomes research in the use of open/free software in the context of education, governance, and for general use at home, to make IT truly a part of the daily lives of the people of the State.

## Research into ICTs

While much of the Indian software industry has devoted the bulk of its focus to Western (particularly US) markets, notable activities – especially by government and academic institutions – are emerging on the domestic front as well. The research initiatives discussed below focus on local language representation and applications, voice interfaces, wireless solutions for access, and open source tools.

In September 2002, the government launched the Research and Training Centre of the Development Gateway Foundation at NCST <<http://www.ncst.ernet.in>>. With NCST as the implementing institution and IIT Mumbai as its first collaborating partner, the centre will support and develop practical ICT-based solutions for bridging the digital divide. Potential areas of research include Internet technologies to facilitate information sharing and management, language technologies that allow the retrieval of information in multiple languages, and technologies that address the information needs of specific sectors, such as agriculture, health care and education. NCST and IITs have already developed Tamil and Hindi language systems based on the Linux operating system.

IIT Hyderabad's Language Technology Resource Centre has developed language dictionaries, plug-in for viewing ISCII, and font converters. It is also working on a machine-based translation tool (Anusaaraka). Most of its work is released under GNU general public license.

IIM Bangalore has launched entrepreneurial research and advisory services at the N.S. Raghavan Centre for Entrepreneurial Learning for areas including IT.

Other organisations supporting IT in development include UNDP, the World Bank, and Digital Partners. The Datamation Foundation, set up by IT services company Datamation, has been actively supporting mass-scale job creation in the IT sector for rural, deprived and marginalised people from India for the last 15 years.

Delhi-based Sarai <<http://www.sarai.net>> works on issues of media theory and art, including incorporation of ICTs in urban culture, promotion of free software, and digital art. Its Garage initiative is aimed at designing applications and hardware configuration for low-cost connectivity and authoring tools. The Centre for the Study of Developing Societies focuses on democratic politics, cultures and the politics of knowledge, critical discourses on science and technology, and violence, ethnicity and diversity.

A pioneer in WLL technologies for Internet access (especially in rural India), Professor Ashok Jhunjhunwala is the head of the Electrical Engineering Department at IIT Chennai. Low-cost Internet access technology called CorDECT, developed by the institute's Telecommunication and Networks (TeNeT) Group <<http://www.tenet.res.in>>, has been used in France, Brazil, China, and in Indian districts like Kuppam (in Andhra Pradesh) and Madurai (in Tamil Nadu). Other trials have been launched in Hyderabad, Patiala and Delhi (Connaught Place).

TeNeT's areas of focus include WLL digital subscriber loop and telecommunication switches. It has licensed its technology to a number of companies, including Midas Communications, Banyan Networks, Nilgiri Networks and AdventNet. Its corDECT WiLL (Wireless in Local Loop) solution for voice and Internet access is manufactured in India under licence by telecommunication companies Crompton Greaves, Electronics Corporation of India Ltd, HFCL and Shyam Telecommunications. It has been adopted by a number of private and public sector telecommunications service providers as well as ISPs.

TeNeT has provided seamless integration of both voice and Internet services (at 35/70 Kbps). n-Logue Communications, incubated by the TeNeT Group, has developed a business model for local entrepreneurs based on the franchise model. Its offerings include a public kiosk, telephone instruments. 100 MHz Pentium PC (with colour monitor, local language word processor, and browsing and e-mail software), 16-hour power back-up for telephone, 4 hour back-up for PC and an STD PCO meter.

Backbone Internet connectivity is taken from Satyam Infoway. Such kiosks are provided to village entrepreneurs at a cost of about Rs 35,000, making it economically viable right from the beginning. Connections are also being provided to schools, individuals and government offices.

"The Internet is more than telecommunications – it is power. But the Internet can create a strong digital divide if you don't do anything about it," warns Jhunjhunwala. "We need regulatory change in India to allow private companies to more easily offer telecom solutions like CorDECT in rural areas," he urges. More companies need to focus on growing the Internet market in developing nations; many of the companies in mature urban markets pay only lip service to rural market access, Jhunjhunwala says.

Dhvani is a text-to-speech system for Indian languages being developed by the Simputer Trust Group and others.

## Future trends

Efforts will be stepped up by government and private sector agencies to tackle obstacles like poor infrastructure, high telecommunications tariffs, government bureaucracy, low R&D spending by IT companies, inadequate original and locally developed intellectual properties, lack of user-friendly citizen interfaces in local languages, and unwillingness among government agencies to embrace open styles of functioning.

According to an IDC study in 2002, in the Asia-Pacific region (excluding Japan), India is expected to be next only to China in terms of the total number of Internet users by the close of 2005. The number of households with cable television is expected to rise to 70 million by 2004–2005, up from 37.5 million in 2001–2002, driven by increased content availability and affordable pricing from large, consolidated operators. About 10 percent of these households are expected to subscribe to the Internet, driven by lower prices of cable modems and lower access charges.

Projections for the number of cell phone users in India for 2010 have been released by Goldman Sachs (67 million), Morgan Stanley (68 million) and KPMG Consulting (76 million). Wireless channels and handheld devices may usher in new and more powerful forms of development-oriented ICT services than those offered by the current PC-centric generation.

India's Achilles heel is the lack of a cutting edge hardware industry for affordable PCs and cell phones compared to its East Asian counterparts. The lack of access to reliable basic electricity supply also hampers the widespread diffusion of PCs. Promising developments like the low-cost Simputer, developed in Bangalore but to be manufactured in Singapore, could help improve IT diffusion.

On the telecommunications front, better revenue sharing between telecommunications providers and ISPs could help reduce dial-up costs further. In rural areas and poor urban neighbourhoods, more community centres and cyber cafés should be spawned to provide shared Internet access and local content generation, as with the case of the Gyandoot networks in the state of Madhya Pradesh.

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