.in

India

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Total population	1,112 million (2006)
GDP per capita	USD 3,547 (PPP)
Key economic sectors	Agriculture (18.6 per cent), Industry (27.6 per cent), Services (53.8 per cent) (2005 est.)
Fixed-line telephones per 100 inhabitants	4.1 (2004; up from 0.6 in 1990)
Mobile phone subscribers per 100 inhabitants	4.4 (2004)
Internet users per 100 inhabitants	3.2 (2004)

Sources: IMF 2006, UNDP HDR 2006.

Overview

India has an estimated 45 million Internet users. But only about 10 million are 'power users', that is, those who regularly use the Web for research and e-commerce. Government efforts to loosen restrictions on access, and the entry of private companies into the Internet market, are said to be driving the growth (Kaufman Bros. 2006).

Figures vary. According to the Internet and Mobile Association of India (IAMAI) and IMRB International, Internet users in India reached 37 million in September 2006, up from 33 million in March 2006. During the same period, the number of 'active users' (those who have used the Internet at least once in the last 30 days) has risen from 21.1 million in March 2006 to 25 million in September 2006. The survey was conducted in early 2006 among 16,500 households covering 65,000 individuals across 26 major metros and small towns in India, with an additional coverage of 10,000 business and 250 cybercafé owners. The survey did not include the rural areas.

India's potential in shaping the Internet globally—because of its large population—should not be overlooked. Of the seven Asia Pacific nations in the top 20 countries in terms of number of Internet users, three—China, Japan and India—are in the top five (Make-IT-Safe April 2005).

However, the quality of usage can be questioned. Also, the lack of sufficiently widespread local language solutions could hamper future growth. Wikipedia points out that '[n]otably absent from ... [the languages used on the Internet] is Hindi, one of the most commonly spoken languages of the world, as well as the national language of India, the second most populated country in the world.' The reasons cited are lack of access to the Internet by the large majority of the Indian population, and a preference for English among those with Internet access.

According to India's National Readership Survey 2006, there are currently 9.4 million Internet users who log in every week, up from 7.2 million users in 2005. But this figure, says the study, constitutes only 1.2 per cent of India's 12 years plus population. Urban India has shown faster growth in Internet reach—from 2.3 per cent to 3.4 per cent, says the survey. Mobile phones are reaching a critical mass. The reach of this medium, as measured by the proportion of the population accessing value-added-service (VAS) at least once a week, grew from 1.1 per cent in 2005 to 2.7 per cent in 2006—translating to nearly 22 million individuals (Hindu Business Line 2006).

As for mobile subscribers in India, the estimate as of July 2006 was 111 million mobile subscribers, representing some 10 per cent of the total population. Short Messaging Service (SMS) is believed to be the leading method of communication (Kaufman Bros. 2006) in the country. But while the figure might seem large, in the context of India's total population (1.1 billion) the coverage is obviously far from sufficient. ITU (2007) argues that countries that are leaping ahead in Internet use, such as India, may have a sluggish mobile sector.

In September 2006, the Manufacturers' Association for Information Technology (MAIT), the lobby group of the hardware, training and R&D services sector in India, said that sales of desktops and laptops together exceeded 1.2 million units in the second quarter of fiscal year (FY) 2006–07. They expect desktop sales in FY 2006–07 to exceed 5.6 million units. According to MAIT, IT consumption in the country continues to

be dominated by industry verticals and corporate sectors such as telecom, banking and financial services, manufacturing and IT-enabled services. Apart from these traditional sectors, high consumption was also witnessed in SMEs, education, retail and other computer-centric small enterprises. Aggressive pricing by PC vendors has also helped improve the PC penetration, especially in the households and the SME segments (MAIT 2006).

Internet growth

The youth are the main drivers of Internet usage in India. College students and those below the age of 35 are the biggest segments on the Internet. Both these segments have the highest proportion of conversion of 'ever' users to 'active' users of the Internet. According to an IAMAI-IMRB study, the 'ever' user base is estimated to grow from 37 million in September 2006 to 42 million in March 2007 and 54 million in March 2008, while the active user base will hit 28 million in March 2007 and 43 million in March 2008. Smaller cities and towns recorded a whopping 142 per cent year-on-year growth, with 25 per cent of users coming from smaller towns.

Kaufman Bros. (2006) suggests that 'due to the limited online population and the smaller subset of researchers and purchases on the Web, the concept of assisted Internet has taken root in India'. This refers to Internet-based companies opening 'retail storefronts' throughout the country. Kaufman Bros. (2006) says that India still awaits a 'killer application that drives consumers not only to the Web, but [also] to obtain a broadband connection'. Such an application could be in education, commerce, entertainment or gaming.

According to a NASSCOM analysis (2007), Indian IT vendors are increasingly turning their attention to the domestic market. NASSCOM is the trade body for India's software and service companies. The Indian user industries are outsourcing parts or entire IT infrastructure to specialized vendors. Recognizing the growing importance of the domestic market, NASSCOM put the domestic software and services segment at USD 3.9 billion in 2003–04, up from USD 3.0 billion in 2002–03.

NASSCOM also sees potential in the rise of smaller cities as new investment destinations for the IT-ITES sector, with the industry taking a keen look at these locales that are now gradually taking the pressure off the already infrastructure-strapped, saturated metros.

Some like Mohan Krishnan, Vice President and Country Manager of the eTechnology Group@IMRB, have argued that, 'The next round of growth will be driven by new and innovative applications such as blogs, P2P, video on demand and online gaming while the old favourites such as email, Chat and IM will drive first time users to the medium' (IAMAI September 2006). Indeed, 51 per cent of Indian Internet users come from the low-middle class. Checking blogs is the second most preferred online activity, according to a study which notes that Indian languages, small towns and broadband are gaining prominence. The Internet is making deep inroads in the lives of Indian people, spreading horizontally and vertically, perhaps leading to the probable reduction of class, language and regional barriers (Srivastava 2006).

Digital content

As India grows more accustomed to the digital world, local content initiatives are increasing. But the lack of local language solutions and widespread acceptability is limiting potential growth.

Some initiatives help keep track of what's happening in diverse areas. For example, India's Manthan Awards (http://www.manthanaward.com/) encourages 'the development of e-content at every level and enhancing the e-content production capabilities and inducing poverty alleviation exercises'. Among the 2006 winners were the Agriwatch portal (www.agriwatch.com), meant to be a knowledge hub for the agricultural sector in India; www.sumul.coop, covering milk procurement, cattle feed management and more; the bhojpuria.com portal for people speaking the regional Bhojpuri language; indianheritage.com launched in 1997; anandautsav.com which focuses on the regional Durga Puja festival of Bengal; and namiindia.com which builds awareness to reduce the stigma among families and persons affected by mental illness. Other awardees came from the fields of telemedicine projects for rural areas, e-governance (deployed for 'panchayati raj' or rural governance, grievance handling, ICT initiatives for local governance, utility-driven websites for municipalities), and a prison management system. In e-learning, there were vernacular-language Braille solutions, IT training lessons, multimedia content for high schools and a knowledge-sharing website.

Other categories of awards were 'e-inclusion', e-news, e-localization, e-environment, e-youth and e-content. Community broadcasting became a new category for Manthan Award 2007. The award panel noted that community broadcasting 'is the most effective way of empowering the masses at the grassroots level in India where oral communication is a medium of information and knowledge sharing'. There have been plans to open up non-commercial, non-state community broadcasting for a decade now. But while the authorities have been cautiously opening on-campus radio projects, the arrival of 'community radio' is still happening only very slowly.[1]

Meanwhile, the Traditional Knowledge Digital Library (TKDL) is a Government of India initiative based in New Delhi that aims to build a database of traditional knowledge that

'enables the protection of such information from getting misappropriated'. TKDL says it has completed the transcription of 36,000 Ayurvedic formulations into English, German, French, Spanish and Japanese since an inter-disciplinary team started working in October 2001. It has also made a presentation at the IPC Union in Geneva. One of the issues that TKDL addresses is the erroneous application of patents to traditional knowledge. According to TKDL director V.K. Gupta, 'A majority of the patents (taken on Indian knowledge) is by expatriate Indians or multinational corporations. There are about 2,000 patents which have been wrongly issued, in our view. Each takes 11 years to fight.'

In mid-August 2006, a digital knowledge centre set up at a cost of INR 7 million (about USD 173,913) was inaugurated at the central library of Anna University. The digital centre aims to help students, scholars and faculty access the Internet, the online journals and periodicals subscribed to by the university, and digital libraries. There are also plans to digitize selected books and journals in the main library. Alumni from the batch of 1979 contributed INR 2.5 million (about USD 62,111.80) towards the infrastructural needs of the project. They also undertook the installation of the systems. Anna University funded the purchase of computer systems at a cost of INR 4.5 million (about USD 111,801.24) (*The Hindu* 2006b).

In another initiative, the Natural Disaster Information System (NDIS) was launched as 'a first of its kind pilot project aimed at alerting people about any impending natural disaster' (*The Hindu* 2006a).

At the Indian Telecentre Forum held in New Delhi on 23–25 August 2006, representatives and leaders of telecentre networks from countries around the world had an opportunity to meet and discuss common concerns, issues and opportunities.

Networks such as BytesForAll (www.bytesforall.net and http://groups.yahoo.com/group/bytesforall_readers) and India-GII (https://ssl.cpsr.org/pipermail/india-gii/) deal with ICT or ICT4D issues in South Asia and India.

Elsewhere, a new initiative hoped to become the craigslist (www.craigslist.com) for India, especially for places other than the largest Indian cities. Allahabad-based bitsTek launched vargikrit.com (http://www.vargikrit.com) to 'provide a classified platform to community'. In this website all postings are free and there are no banner or pop-up ads.

The spirit of sharing knowledge and information also appears to be catching on. For example, there is some discussion about a 'dollar one encyclopedia', or a wikipedia-on-a-CD for easy and inexpensive distribution (Thejesh 2006).

Other online ventures like YouTube.com also encourage the sharing of local content. Tools like the Wikipedia (http://en.wikipedia.org), which is among the 20 most visited globally, help give Indian content and issues global visibility. For example, Wikipedia has been highlighting on its home page a number of Indian issues, including the Indian Institutes of Technology, a group of seven autonomous engineering and technology-oriented institutes built to create a 'skilled workforce to underpin India's economic and social development after independence in 1947...' (Wikipedia).

During his visit to India in late August 2006, Wikipedia founder Jimmy Wales noted that the volume of volunteer contributions to the Kannada Wikipedia has been growing 22 per cent per month while the volume of volunteer contributions to the Bengali Wikipedia has been growing 35 per cent per month. This is significant because although other Asian languages are spoken by millions, there tends to be little sign of them in the English-dominated cyberspace. 'We still have an enormous amount of work left to do. India has 23 official languages. English [is the only language used in India with] more than 10,000 articles. We aim to have 200,000 articles for every language spoken by a million people. That covers 94 per cent of the people on the planet,' Wales said. By the end of September 2006, the Bengali Wikipedia, built both in Bangladesh and India, crossed the landmark of 10,000 articles. It became the 50th language to do so, and only the second from South Asia. Bengali is spoken by almost 220–250 million people; it is the seventh largest language in terms of total speakers. The Telugu Wikipedia, representing the south Indian language, now has over 15,000 articles.

Meanwhile, an 18-month-old 'Wikipedia for India' network on the social networking site Orkut has some 215 members. The network aims to become 'the place where u can find info on anything from Hindu mythology to Besant Nagar beach...or Connaught Place'.

Knowledge commons issues have been debated. There is a deepening debate on how knowledge is shared or controlled in this new information-dominated century, and it is a debate of vital relevance to a country that is making an increasingly visible global impact through its brain power and at the same time has one of the most impressive collections of traditional medicines and knowledge. There are diverse views on how these kinds of issues should be tackled, as was obvious at the 'knowledge symposium' held in New Delhi on 24–25 August 2006. The issue of the need for 'IP-unencumbered software' has also come up (Noronha 2006a).

Open Access is a new trend in India. This refers to free online availability of research-oriented scientific and scholarly journal articles. It picked up globally since around 2002. According to Chennai (South India)-based information scientist Subbiah Arunachalam, 'Nearly a hundred journals (in India) have already taken the Open Access route.' In early 2006, the Bangalore-based information company Informatics (India) Ltd,

launched Open J-Gate (www.openj-gate.com), a portal covering more than 3,500 English-language journals. Some 2,000 of these are peer-reviewed. Open J-Gate claims to be the 'world's biggest Open Access English language journals portal'.

But more action in this area is needed. As Arunachalam argues: 'Research performed in India, funded by Indian taxpayers, is reported in a few thousand journals, both Indian and foreign. Since some of these journals are very expensive, many Indian libraries—including sometimes the author's own institutional library—are not able to subscribe to them.' Arunachalam estimates that Indian researchers publish approximately 20,000 papers a year in 2,500–3,000 journals in 130 countries, 'including in (small countries like) Pakistan, Bangladesh, Sri Lanka or Croatia.' Because of the current situation, researchers cannot even read their peers. Besides, most Indian journals have poor circulation: only six of the crucial Council of Scientific & Industrial Research's 20 odd journals have over 1,000 subscribers. Few Indian researchers reach high-impact journals abroad, while roughly half of all Indian research is published abroad. Thus, Indian research work does not reach a wide audience, which affects both its visibility and its impact.

India's Open Access journals include 11 journals published by the Indian Academy of Sciences, four journals published by INSA, one journal published by the Indian Institute of Science, one journal published by the Indian Council of Medical Research, and three journals published by the Calicut Medical College. In addition, the National Informatics Centre of the Government of India operates the Indian Medlars Centre, which makes available electronic versions of 38 Indian biomedical journals, mainly published by professional societies. Indian Medlars Centre also has an ePrints-based archive called OpenMED where biomedical researchers from anywhere in the world can deposit their papers. IndianJournals.com, a Delhi-based company, publishes eight Open Access journals dealing with subjects like forensic medicine, fire engineering, neonatology, agricultural sciences and veterinary sciences. medind.nic.in offers free access to 38 biomedical journals. The Institute of Mathematical Sciences (IMSc) was the pioneer in Open Access archiving in India. Also gaining increasing attention is the GNU EPrints archive at the Indian Institute of Science in Bangalore.

LexLibre aims to contribute projects or articles as working papers to the public domain. Promoters say 'this will enable the creation of a large database of legal resources, something which is sorely needed in India'. There is also an ongoing consultation on making theses available online. The University Grants Commission (UGC) of India is inviting public comments on its draft consultation paper 'Electronic Thesis Online (India) UGC (Submission of Metadata and Full-text of Doctoral Theses in Electronic Format) Regulations, 2005' (Digital Opportunity Channel 2005a).

Proponents point out the many advantages of Open Access institutional archives. They not only make Indian research work more visible, but also help Indian research papers win more citations. Such archives are easy to set up as the required software is free.

Some major global commercial publishers had promised to offer access to countries with less than USD 1,000 per capita incomes. But they went back on their word in India, arguing that they enjoyed sizeable subscriptions in the country. On the positive side, in November 2006 44 scientists and policymakers from Brazil, China, Ethiopia, India and South Africa met in Bangalore to set guidelines for developing countries to freely access publicly funded research. The success of their draft national policy will depend on whether the relevant governments, funding groups and research institutes will adopt their recommendations (Noronha 2006b).

Enabling ICT policies and programmes

One of the big plans currently being unveiled is Mission 2007 (http://www.mission2007.in/), which aims to connect a targeted 25,000 villages in the first year by pooling resources from various states, government agencies and corporations, and using affordable and accessible technology. According to the project planners, 'Mission 2007 will initiate formation of consortia of content developers to provide content and ensure that local livelihood needs are met and available content resources are pooled for achieving the common goal... The endeavour will...make it possible for local communities to collect, access and use data on their livelihoods and assets using these applications for local, regional and national planning.'

In connection with the plan, there are efforts to 'influence policy issues such as low tariff and de-licensing of last mile ICT applications, especially wireless spectrum and community media'. The project seeks to include training and capacity building of 'village entrepreneurs'. Other issues raised include peer-to-peer learning, sharing of knowledge at the village level, working towards a suitable legal and regulatory environment, Open Source and content, security issues, educational programmes, and building the technology infrastructure. Because it is an ambitious project, there are doubts about the degree of effectiveness and timeliness of implementation, end-use

deployment of practical results and its actual impact on rural India.

In May 2004, Union Minister for Communication and Information Technology Dayanidhi Maran announced a 10-point agenda, including achieving convergence of ICTs; bringing about transparency in administration and making government functioning more 'citizen-centric'; providing broadband connectivity to all 'at the most reasonable prices'; leapfrogging to next generation (4G) mobile wireless technologies; connecting all ISPs in India to a national Internet exchange; significantly improving the Indian Internet Domain Name service; migration to the IPv6 protocol; cyber infrastructure protection and security and digital signatures; promoting Media Lab Asia work in rural connectivity, healthcare, literacy through distance education and development of low-cost PCs; local language computing; outsourcing skilled human resources and an R&D thrust.

Referring to the 10-point plan, Gartner Research suggests that India's ICT Ministry cannot achieve most of these goals on its own 'because the power to make the necessary decisions is distributed among many players, including the Telecom Regulatory Authority of India, the federal economic and other ministries and the country's state governments'. Gartner Research also notes that the Indian ICT Ministry has a limited budget. Moreover, the two government-owned telecom providers, BSNL (Bharat Sanchar Nigam Ltd) and MTNL (Mahanagar Telephone Nigam Ltd), fund most of their capital outlays through internal accruals, and this is unlikely to change. The IT section of the Ministry of Communication and Information Technology likewise has limited resources for IT projects.

Gartner Research notes that the Ministry can make a difference only through policies that promote investment and competition and remove market distortions. It also suggests that the Indian government 'promote the use of IT by using it aggressively, both for internal processes and for citizen services. Because of the scale of government operations, this can "kick-start" the domestic IT market, a segment that has lagged.' Also suggested is a reduction in the cost of IT for all user segments through fiscal and other incentives, to spur domestic demand. 'This will help with the legitimate social goal of bridging the Digital Divide', Gartner argues (Kumar et al. 2004).

There are other ICT initiatives, such as the Natural Disaster Information System (NDIS) launched in mid-February 2006 by the Union Minister for Science, Technology and Ocean Development Kapil Sibal. The project seeks to alert people about any impending natural disaster using the local language, mobile phones and a specially set up wireless public address system. It was developed by a private–public partnership between the Technology Development Council (TDC) and Bangalore-based Geneva Software Technologies. Data security is assured with a 128-bit exception using dedicated leased lines. Alerts will then be sent out to mobile phones in the language of the local community concerned. The voice message will be streamed as an outbound call and sent to the wireless public address system for direct audio alert[2] (*The Hindu* 2006b).

In October 2006, the AirJaldi Summit was held in India, with the intention of addressing 'some of the ways that wireless solutions can be used to provide affordable Internet access in rural communities'. The conference focused on 'showing the advantages that wireless networks can provide, by enhancing the quality of education, governance and health care, increasing economic development, and promoting cultural exchange'. The spotlight was on the Dharamsala Community Wireless Mesh Network developed and managed by the Tibetan Technology Center (TibTec) to provide Internet connectivity to rural communities, schools and institutions in the Dharamsala region. This relatively large-scale experiment saw a combination of low-cost yet robust technology and community-based implementation. The Summit organizers said the Dharamsala project is an appropriate model for many rural areas around the world.

Some projects at the state (regional)-level include: Akshaya (Kerala), Bhoomi (Karnataka), CARD (Andhra Pradesh), e-district (Tiruvarur), FAST (Andhra Pradesh), FRIENDS (Kerala), Gyandoot (Dhar, MP), Kalyan-Dombivli Municipal Corporation (Maharashtra), Koshwahini (Maharashtra), Sarita (Maharashtra), Community Information Centres (Lakhimpur, Assam), Drishtee kiosks (Assam), Bhulekh (Orissa), commercial taxes (Bihar), e-computerized operations for police services (eCOPS), electronic data interchange of the NIC, electricity power billing (Bihar), e-procurement (Andhra Pradesh), Oswan (Gujarat), Integrated Financial Information Systems (Andhra Pradesh), Kaveri (Karnataka), Khajane (online treasure computerization project) in Karnataka, Lokmitra (Himachal Pradesh), Saukaryam (Andhra Pradesh), SETU (Maharashtra), SmartGOV (renamed as CaringGOV) in Andhra Pradesh, STAR (Coimbatore, Tamil Nadu), Sukhmani (Punjab), Tarahaat (Punjab) and the Automatic Vehicle Tracking System (Delhi).

Also among the regional initiatives is the launching of the Goa Knowledge Commission website (http://www.knowledgeforgoa.com/). In addition, the National Association for the Blind in New Delhi has been conducting a weekly programming workshop online moderated by Arun Mehta. Different people are learning different languages at different speeds.

Media Lab Asia: Building on ruined plans?

Media Lab Asia appears to have come unstuck. This much-hyped project between the MIT Media Lab and the Government of India, among others, failed to work as planned and, amidst a lot of dissatisfaction, both partners went their own way. However, here is a list of projects that have been supported under this initiative. It would be interesting to track the attainments of each.

aAQUA: An agro information system being tested in Maharashtra
Ashwini: A Broadband Wireless Network for delivery of virtual services being tested in rural areas of Andhra Pradesh
Ca:sh: Hand-held device-based health data collection and management being tested in Haryana
CHIC: Craft revival: A CAD tool for helping the Chikan embroidery artisans, being deployed in Lucknow, Uttar Pradesh
Digital Gangetic Plains: Long range Wi-Fi tested over a distance of 75 kms in the Lucknow–Kanpur belt
Digital Mandi: An electronic trading platform for agro commodities, being tested in Uttar Pradesh
e-Sagu: An IT-based tool for agricultural extension, being deployed in Andhra Pradesh
GramPatra: Store-and-forward messaging system being tested in Karnataka for land records delivery over the BHOOMI project
Polysensors: Portable and affordable water quality test kit being tested in Maharashtra
Sahayika: A system for supplementing the knowledge requirements of school students, field-tested in West Bengal
Sanyog: A communication system for the speech impaired and for people affected with cerebral palsy, being tested in West Bengal and Delhi
Sehat Saathi: Portable/Mobile health-care delivery being tested in the Lucknow–Kanpur belt and in Andhra Pradesh
Shruti: An embedded Indian language text-to-speech system being tested in West Bengal

Source: Media Lab Asia is dead; Long live Media Lab Asia. (2003).

Industry initiatives

One of the more impressive networks—because of its breadth of vision, the persistence of its initiatives, and the number of initiatives taken up—with an ICT4D agenda is the Telecommunications and Computer Networking Group (TeNeT), linked to the IIT-Madras (http://tenet.res.in/). Its mission is to transform communication in India by enabling 200 million telephones and 50 million broadband connections; to connect every village in order to double rural per capita GDP; to set next-generation wireless standards; and to develop high-quality distance education for rural areas.

TeNeT and its partners have developed a number of technology solutions for the rural areas such as:

- The Cable Wireless Internet Triple-play Unified System (indigenous broadband access solutions such as CitiusTM) of Midas Communication Technologies.
- Broadband corDECT, a wireless local loop solution with per-user always-on data speeds of up to 336 Kbps and a spectrum efficiency approaching 1.66 bits/second/Hertz, also by Midas Communication Technologies.
- CygNet, a product of NMSWorks, another TeNeT partner, designed to provide network management solutions for large telecom operators.
- An 802.11 b/g based mesh network for rural communities.
- Gramateller, an ATM designed to enable a low-cost model of delivering banking services in rural areas.
- An affordable telemedicine solution which includes a Remote Diagnostic Kit developed by Neurosynaptic. The kit, which can be installed at villages and other remote locations with Internet connectivity, connects rural patients to a doctor in the city via a video conference link.
- Online Tutorials to enable rural students to pass examinations.
- Indic Computing which aims to extend the reach of computing to India's non-English speaking masses.

TeNeT says it is exploring the possibility of using the ICT infrastructure established by n-Logue through its Chiraag network of villages, to enhance income generation. Several crafts

initiatives have been initiated and outsourcing to rural areas is planned. In collaboration with the Indian Society of Agribusiness Professionals (ISAP), an NGO based in New Delhi, they are offering online consultancy to farmers in Tamil Nadu, Gujarat and Karnataka through videomail using the software MV4.

Ashok Jhunjhunwala of TeNeT says they have been setting up Internet kiosks in India for INR 55,000 (about USD 1,356.69) per kiosk. The only requirement is that the kiosks be set up in a cluster of nearby villages within a 25 km radius.

The TeNeT Group incubates R&D companies and collaborates with 'like-minded organizations' such as Midas Communications in telecom infrastructure (www.midascomm.com); Banyan Networks Limited (www.banyannetworks.com), which merged with Midas Communication Technologies in 2004; NMSWorks (www.nmsworks.co.in), which works on integrated network management systems for emerging convergent networks; NexGe Technologies Pvt Ltd, which develops IP communications products targeted towards carriers, broadband operators and ISPs; iSoftTech, a product development company in the networking space; iSoftTech (www.isofttech.com) for embedded solutions and enterprise solutions in Data Networking, VoIP and WLan; Nilgiri Networks (www.nilgirinetworks.in); and Amdale (www.amdale.com), which is working to create what is probably the only open standards-based packaged CTI suite which can be used to build a vast array of computer-based telephony solutions.

Others in this network of companies are Novatium (www.novatium.com); N-Logue (www.n-logue.co.in) for evolving technically superior and cost-effective solutions for countries like India; CK Technologies Pvt Ltd which is currently involved in promoting Indian language computing as a subject (www.shaktioffice.in); Vortex Engineering Pvt Ltd for low-cost electromechanical systems for rural areas; Neuro Synaptics (www.neurosynaptic.com) for medical devices, software and solutions for telemedicine; OOPS or Object Oriented Programming Services for network telephone applications; Lattice Bridge (www.lbinfotech.com) for speech technologies; and Tekriti (www.tekritisoftware.com), which is engaged in outsourced product engineering services in the domain of social networking, rich Internet application development and media publishing, the aggregate of which is referred to as Web 2.0.

There have been some difficulties in implementing TeNeT projects on the ground, for example in villages that get power for only two hours a day. Yet, this network continues to inspire many to carry on the dream.

Regulation and security

The Ministry of IT's e-Security Division 'deals with technical matters related to [the] Internet, e-regulation and e-security and implements a programme that promotes research and development in the area of e-security'. An official note says that the division promotes R&D through grant-in-aid support to recognized autonomous R&D organizations and academic institutions proposing to undertake time-bound projects in the thrust areas identified by the Working Group on e-Commerce and Information Security.

The Working Group provides full advisory support to the information security sector through analysis of technology trends, identification of thrust areas, preparation of technology development plans, as well as evaluation of submitted project proposals for execution with financial support from DIT. Project proposals are accepted via http://www.mit.gov.in/R&D/projects/index.asp. Projects already carried out by various organizations have led to the development of network security tools, cyber forensic tools, a virtual private network security solution, a biometric identification and authentication system, a public key infrastructure solution, a payment gateway for e-cheque or credit card, an intrusion detection system, an information security management system, network monitoring tools, a brain mapping technique to examine suspects, a secure print document tool, tools for enterprise system security management and tools for steg-analysis.

Current 'thrust areas' identified by the Working Group are cryptography and cryptanalysis, biometrics for identification and authentication, network security, systems security and security architectures, risk assessment and assurance, monitoring, surveillance and forensics (Department of IT 2007).

Free/Libre and Open Source Software

India's interest in Free/Libre and Open Source Software (FLOSS) is being closely watched around the world. Across India, there are over 130 GNU/Linux, Linux and Free Software User Groups, an indication of the interest in this field (visit http://wikiwikiweb.de/LugsList for a listing of GNU/Linux and FLOSS user groups in India). A number of FLOSS techies maintain blogs and some of these can be accessed at http://planet.foss.in.

Ironically, while FLOSS has grown rapidly on the ground and among technical and academic networks, it has received little support from the government.

A handful of regional governments, more the exception than the rule, have been pushing for wider FLOSS adoption, as has happened in the south-western pocket of India. An example is the plan of the south Indian state of Kerala to adopt FLOSS for the computers used in some 12,500 high schools in the state.

The use of computers across the country is being encouraged by the distribution of free CDs that contain localized versions of popular open source applications. For example, the government

has started distributing CDs containing Tamil-language versions of various open source applications (Marson 2005). At Vigyan Bhavan New Delhi, a Hindi Software Tools CD was launched by political leader Sonia Gandhi. The CD contains open source software that runs both on Windows and Linux. It includes Open Office, Firefox, Gaim, Columba E-mail and Limewire (CDAC 2006).

There are also low-cost 'CD outlet options' where FLOSS software is downloaded, replicated and sold at a reasonable rate of INR 50–250 or about USD 1–6 (depending on whether CD or DVD). See one example of such operations at http://linuxdvdsale.tripod.com.

The Technology Development for Indian Languages (TDIL) programme of the Department of Information Technology (DIT) aims to develop information processing tools and techniques that remove language barriers from human–machine interaction. Officials say efforts are being made to provide these language tools to the masses through the Indian Language Data Centre (http://www.ildc.in/index.aspx).

The Asia OSPA (Open Solutions is Public Administration) Forum is intended to analyze and support the use of Open Data Standards (ODS) and Open Solutions (OS) for e-Government and Public Administration (PA) in Asia Pacific. It was scheduled to be held along with the South Asia e-Government Summit in New Delhi in October 2006.

Meanwhile, Indian techies and campaigners have been involved in the drafting of the GPLv-3, the General Public License of the Free Software Foundation (FSF). GPLv-2, released in 1991, is the most widely used free software license. Jaldhar H. Vyas, who is unusual in being both a Hindu priest and Debian geek, has pointed out that one of the problems facing GNU/Linux users in countries like India is low bandwidth. Therefore he argued, a distribution on CD or DVD is preferred over large network installations or updates. He has found a sponsor and is looking for a 1-DVD version of the Debian system.

Sarai.net's Project Resource Centre is a network for students interested in discussing GNU/Linux and FLOSS projects. Some networks are offering support to students wanting to undertake FLOSS projects (see http://ekalavya.it.iitb.ac.in/brochure.do). The main objective of the e-GURU programme is to assist students in their final year in a Bachelor's or Master's degree course in computer science, information technology or electronics who find it difficult to carry out a project, a major component of their curriculum, due to lack of resources and mentors. NRCFOSS (National Resource Centre for Free and Open Source Software) offers a common page for student project proposals, fellowship proposals and other FLOSS projects (NRCFOSS). Other NRCFOSS plans include:

- Getting the technical universities and colleges to offer two FOSS elective courses to undergraduate students.
- Arranging for or conducting Teacher Training Programmes (TTPs) for faculty of colleges of engineering.
- Supplying engineering faculty with teaching materials, books, lab ware and the like.
- Assisting colleges to migrate to FOSS equivalents wherever possible (personal e-mail from Professor C.N. Krishnan 2006).

Finally, an open source simple computer for agriculture in rural areas (called OSCAR) was launched in January 2004. It aims to develop an open source weed identification software for the major weed species of the rice-wheat crop systems which can be deployed on computers or simputers. The application is intended for agricultural extension workers, farmers/farmer groups, and students in the Indo-Gangetic plains (Digital Opportunity Channel 2005b).

Local language solutions

Clearly, this is an issue where a breakthrough is still awaited. In recent years, technology solutions that would make computing in Indian languages easier on both proprietary and FLOSS platforms have been announced. But large-scale and effective Indian-language computing is still a challenge, for a range of reasons. This is evident from the lack of mailing lists and blogs in Indian langauges, and the difficulty of building websites or wikis in the Indian languages.

There are a few initiatives underway. HP Labs in Bangalore have been engaged in developing a Devanagiri input device which works on the basis of partial handwriting recognition. During preliminary studies it was revealed that in spite of a large demand for a Hindi keyboard, the ones available in the market (QWERTY keyboards with Hindi labels) have not been accepted. See other HP proposals at http://www.hpl.hp.com/india/.

Bangla/Bengali OpenOffice.org 2.0: Ankur group is the official team for Bangla OpenOffice.org. Translation work is reported to have started in 2006. Their goal is to have Bangla as a supported language. OpenOffice.org 2.0 is already out with most of the menu entries translated in Bangla. Future versions of OpenOffice.org will have more translated modules (Angkur Supporting Bangla [Bengali] on GNU/Linux).

C-DAC Mumbai is working on *Project Janabhaaratii for Localisation of Free/Open Source Software: Development, Deployment and Community Building*. Initiatives include contributing to community efforts in developing a software suite based on GNU/Linux and made available in Indian languages. The project is funded by the TDIL group at the DIT, Ministry of Communication and Information Technology.

The DIT says its mission is to 'proliferate the use of Indian languages on computers, to overcome language barriers that restrict the nation's path to knowledge and development'. It has invited individuals, public, private agencies and academic institutions to participate in a national public–private partnership to launch and distribute applications, tools, utilities and products developed for Indian language computing.

Dr G. Nagarjuna, Chairman of the Free Software Foundation (FSF) of India and scientist at the Homi Bhaba Centre for Science Education, has been focusing on the issue of 'self-reliant e-governance in Indian languages'. He argues:

> Keeping in mind that only about 5 per cent of the Indian population can manage with English-speaking computers, the need for e-governance, by default, in a multilingual system is clearer than daylight and no additional argument is required. Since public documents must live for eternity, the need of open standards for e-governance will be underlined. If these values of self-reliance in information technology and local language computing with open standards are to be followed in letter and spirit, then it is mandatory that Governments must legislate the use of Swatantra Software and open standards.

On another level, an Israeli firm is teaming up with CK Technologies to produce Shakti Office Suite (http://www.shaktioffice.in), an 'indigenous, affordable bilingual alternate to popular office suites'. It will be the first to integrate FastKeys, software developed by the Israel-based FTK Technologies. Its interface 'intuitively' toggles between English and one of the 18 Indian languages and vice versa. The integration of FastKeys in the Office Suite is meant to make the product more user-friendly. When typing in Hindi or Tamil, most users would have to constantly glance between the keyboard and the monitor which makes the process difficult. Other existing solutions are prohibitively expensive. FastKeys addresses the problem by projecting onto the monitor a real-time simulation of the keyboard and user's hands as they type. The keys on the virtual keyboard would show the characters in the vernacular, simplifying the process for a new user who might otherwise have to plough through scripts of character positions on the keyboard.

Meanwhile, the Center for Research in Urdu Language Processing (CRULP) at the National University of Computer and Emerging Sciences, Lahore, Pakistan has announced the release of an updated version of the open source character-based Nafees Web Naskh Open Type Font for writing Urdu in Naskh script based on Unicode standards. Such initiatives from across the border could benefit India, which has a significant Urdu writing population.

Jitendra Shah announced via the Indic computing users mailing list that http://203.199.16.202 contains a few GIS applications and a few Web-based database applications using FLOSS. This includes tenders of the Maharashtra government

ICT tools for diverse groups

- The Chief Minister of Andhra Pradesh, Y.S. Rajasekhara Reddy, announced the release of a CD comprising an e-Governance solution for the Drug Control Department. The CD details 336 court judgements (*Business Line* 2005).
- In a pilot installation in a village near Mumbai, India, students use PCs donated by Via Technologies to perform geometry homework, while local women use computers to track their savings in a micro-payment programme (Kanellos 2005).
- Encore Software Ltd has announced plans to launch a range of cheap desktops costing around USD 230–280, three years after it launched the USD 200 Simputer. These desktops are targeted mainly at basic users like students, small shop owners and educational institutions (Roy 2007).
- Parivartan.net is growing into a full-fledged portal with 25 different services, under the Maharashtra Knowledge Corporation. Its goal is ICTs for agriculture. It has a network of infomediaries, offers information to farmers' queries, and promotes courses like a certificate course in good agricultural practices. They also have some half dozen CDs on mango cultivation, bio-fertilizers, mushroom cultivation, medicinal plants and dairy management.
- A special type of foot-operated PC-based communicating tool for children with cerebral palsy has been developed by the Industrial Design Centre of the Indian Institute of Technology, Mumbai in cooperation with the Happy Hours Centre from suburban Khar. This special tool can be used as an effective communication device by children with physical disabilities, including those affected by cerebral palsy.

for rate-contracts where OpenOffice.org with Marathi (Gargi) fonts are compulsory on either platforms (proprietory or open source). The Maharashtra government buys an estimated 5,000 PCs annually.

Education and R&D initiatives

India-based Digital Learning Asia (http://www.digitallearning.in/index.asp) aims to take stock of the progress of Asian countries in utilizing ICTs to enhance the quality and reach of education to develop human capital that will respond to the needs of a globalized world.

Another attempt to make IT relevant in education is Laxman Mohanty and Neharika Vohra's *A Guide For School Administrators*, a book that recognizes the potential of ICTs to make the school curriculum more relevant and purposeful.

The Centre for Science, Development and Media Studies (http://www.csdms.in/), an NGO located at Noida near India's capital city of New Delhi, has been publishing what is probably the world's first ICT4D monthly. Founded in 1997, the Centre is 'committed to advocacy and developing solutions for underprivileged societies through the use of innovative and effective ICTs and Geographic Information Systems (GIS)'. The Centre used to be known as the Centre for Spatial Database Management and Solutions.

Changes have also been reported regarding the delayed plans for building the Simputer, a low-cost alternative to the personal computer that allows for sharable computing. Geodesic Information Systems (GIS), a Mumbai-based Internet product company, has acquired Bangalore-based PicoPeta Simputers, a company founded by the co-inventors of the Simputer. However, although the Simputer has been in the news in recent years in India, its delivery has been delayed because of a number of financial, technology obsolescence and production challenges.

Conclusions

India continues to be a land of contrasts. Positive trends like the lowering of bandwidth costs and mobile services are expanding access. Yet many hundreds of millions are totally untouched by the benefits of IT and cyberspace. Because of its size, even a small percentage of Indians getting access to the Internet could change its complexion and orientation. Moreover, India has become a 'poster boy' of sorts for ICT4D. However, ensuring wider coverage for the bulk of its 1.1 billion population is obviously still an unmet task.

Notes

1. On 16 November 2006, a long-awaited development materialized when the federal Indian Cabinet decided to grant non-profit organizations and educational institutions permission to set up community radio stations under certain terms (Press Information Bureau 2006). In an unrelated development, engineer Vickram Crishna wrote that a 'suitcase' radio station for very local broadcasting (within a radius of 400 m roughly) could be available for under USD 120.
2. For an overview of the official take on this project, see the annual report for 2005–06 of the Ministry of IT at http://mit.gov.in/download/annualreport2005-06.pdf

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