DIGITAL PARTNERS INSTITUTE

Background Paper to the Consultation with Outcomes and Suggestions

Increasing Poor Communities' Access to IT and Telecommunications in India – How e-ready is India?

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Introduction

Development experts, non-governmental organizations, foundations and people of all strata are looking at IT as having potential to accelerate development and bring the benefits of the knowledge-based economy to the poor. However, the extent to which we can use Telecommunications and Information Technology to accelerate development and bring direct economic benefit to the people will depend on the policies we promote and the infrastructure we put in place—both at the backbone and hardware level.

A consultation to address these issues was conducted with support from USAID-India that brought together experts from the government, business, academia and non-profit organizations to together address the question how communications and information technology policies work together to increase the access to telecommunications and information technology (IT) by peri-urban, rural and other under-served populations? This paper provides the reader background on what some of the current issues dealing with policy are, including universal services, provision/pricing, spectrum allocation/availability of broadband, and interconnection issues and provides the outcome of the consultation.

At this consultation we aspired to:

1. Understand how e-ready India is in terms of policy and infrastructure
2. Identify particular policy, regulatory and market challenges to more ubiquitous access.
3. Identify specific ideas, and facilitating conditions, for some early IT application experiments and build in ways of publicizing and sharing the good and bad of each of these experiments

At the end of this document we have suggested some specific policy modifications as India develops a robust telecommunications and IT policy and infrastructure framework. However, before sharing the outcomes of the consultation we are highlighting the current status i.e., backbone and hardware penetration, and regulatory status so that the suggestions by the experts at the consultation can be put in perspective.

Infrastructure – Backbone and Hardware – Current Status

India has a multi-faceted infrastructure with a number of providers but its network services are dominated by the former monopolists, especially BSNL. India 's network has the usual technological mix (ranging from coaxial cable through a fiber optic backbone, satellite, cellular, Wireless Local Loop and cable TV). A total of about 8 million route kilometers of cables, lines, wires provide the connectivity to the subscribers.

India's telecommunications network has been divided into 20 circles (coinciding with the States, except in North-Eastern States where these have been clubbed in one circle and in UP where the State has been bifurcated in two circles) and 4 metropolitan cities viz. Delhi, Mumbai, Calcutta and Chennai. There are 322 SSAs (corresponding to telecom districts) and more than 21,000 exchanges.

Yet, India still has an extremely low "teledensity" ratio (the number of telephone lines per one hundred citizens) of 3.5 as per the highest estimations (vs. a teledensity of 14 in Brazil). Moreover, there is, as in every developing economy, a vast difference in teledensity between urban and rural areas in India – with the national rural teledensity at just 0.4.[2] By comparison, in Mexico the teledensity in Mexico City is about 33 while it is in 3.6 in rural Chiapas – which is still higher than India's national average. Furthermore, teledensity does not capture IT accessibility. For example in Mexico the percentage of the country with access to the Internet is estimated at about 1.5%. India is estimated to have an Internet penetration rate of 0.5.[3]

Table I
Comparison between developed and developing nations of telephone networks (1998)[4]
GNP Per Capita and Telephone Lines per 100 Population

COUNTRIES	GNP PER CAPITA (Dollars) 1999	TELEPHONES PER 100 PEOPLE 1998
USA	30600	66.1
U.K.	22640	55.7
Germany	25350	56.7
Japan	32230	50.3
Sweden	25040	67.4
Australia	20050	51.2
Belgium	24510	50.0
Bulgaria	1380	32.9
Argentina	7600	20.3
Brazil	4420	12.1

[2] 3.5 percent National Teledensity is a figure given in the February 28 budget recommendation speech by Finance Minister Yashwant Sinha in New Delhi. As per 2000 figures by the International Telecommunications Union's Information and Communications Technology global statistics, the teledensity in India was 3.20 overall and 0.4 for rural India.

[3] This is according to a recent estimate reported on August 3, 2001 on Economic Times, Mumbai edition based on an ICT survey by Boston Consulting Group.

[4] Source: World Development Report, 2000/2001

China	780	7.0
Indonesia	580	2.7
India	**450**	**2.2**
Pakistan	470	1.9
Sri Lanka	820	2.8
WORLD	**4890**	**14.6**

Just as importantly, India needs transparent information about the cost of building and deploying network and IT infrastructure. In a country as vast and varied as India this requires both regional and national data. It is important that it benchmarks its costs against best international practices, particularly in light of changing technology options. Policy flexibility is often necessary to ensure that the speed of implementation can match up to the speed with which technologies and markets change. For example, in most developing countries pro-competitively regulated and efficiently implemented wireless network access is quickly surpassing fixed wire lines as the primary mode of network access. As Tables II (1998) and III (2000) demonstrate, India lags badly behind other developing countries. The comparative examination between the two sets of statistics would reveal that both Brazil and China have made significantly higher gains in their communications access spreads even over the past two years, when the Indian telecommunications sector has been more liberalized. The most noteworthy gap is in the number of mobile network users. Mobile and fixed wireless networks have been used very gainfully in developing nations with weak infrastructure and lower GDP levels. Wireless technology is a particular boon for rural service because the cost per user of laying a cable to distant villages with smaller populations is very high (especially in areas with challenging climates). Different forms of wireless technology are likely to be much cheaper. And the creation of next generation IT devices changes the options for IT infrastructure.

Table II
Comparison of Teledensity* (Fixed and Mobile Networks) and Internet penetration, 2000

	Fixed line	Mobile	Internet users **
United States	69.97	36.45	34.66
Brazil	18.18	13.63	2.94
China	11.12	6.58	1.74
India	3.2	0.35	0.49

*Teledensity=Communications “lines” per 100 inhabitants
** Users per 100 inhabitants

The logical center for data gathering and information publishing would be the Telecom Regulatory Authority of India (TRAI). Data gathering will also benefit from competition because new entrants yield valuable market information for regulators and are political supporters for decisions that increase transparency. International financial institutions can further assist with the supply of the comparative national data. But the key is public accountability so that all stakeholders can understand the basic economics of access.

Achieving Connectivity – the Backbone

There is so much happening on the technology front that it is difficult to suggest robust approaches for taking telecom to rural areas. The policy in the past few years was focused on imposing a universal service obligation on fixed line basic service providers. However, recent experience suggests that fixed line basic service providers are focusing more on corporate users urban areas. The total number of lines that basic providers have added in urban areas in the last three years is 0.2 million and this is to service high bandwidth data needs of large corporate users.[5] As we discuss later, fixed line providers might shift this strategy if India changes its policies. But, irrespective of changes in wired networks, cellular telephony has made bigger strides in India. Already a subscriber based of 2.1 million has been generated. Therefore it seems likely that the future of rural telephony may ride on such wireless technologies such as cellular, wireless in the local loop and CorDECT (developed by IIT, Madras). The current limitations of low data bandwidth on wireless may also be overcome in due course

The wireless technology options will be diverse and innovative. Some will originate from India's technology centers and some from global suppliers. The policy environment has to encourage freedom of experimentation and innovation. See Box 1.

Box 1 Wireless Technology Innovation and Local Service: The CorDECT Wireless Local Loop Rural Projects (TeNeT – IIT, Madras) Kuppam, Dhar, Nellikuppam, Sikar, Madurai

There are many ways in which innovations in wireless technology can bolster rural networking. One example is the product of research and development in India.

The CorDECT Wireless in Local Loop (WiLL) technology developed by the Indian Institute of Technology, Madras, has been used in urban areas of Rajkot, Bhopal, and Mohali. The first CorDECT project in a rural setting was undertaken in Kuppam Mandal in Andhra Pradesh. This project planned to bring access to 80% of the Mandal population from over 100 villages. These villages had no telecommunications access because previously used technology was handicapped by rocks, hills and a thick band of dense vegetation that obscured the line of sight from transmission towers to outlying areas. Since the villages offered very low subscriber bases and were located as far as 30-35 km. from each other, there was no significant private interest in promoting access. The CorDECT system had initially planned to provide access to 65 villages in the district.

Each access center in the CorDECT system acts as a node and has a DECT Interface Unit (which acts as a private EPABX) and a base station tower, about 50 feet high that can reach out to villages within a 20 km radius and can sustain about 1000 Internet connections. There is no physical link between the access center and individual access units within the 20 km radius. This removes the last-mile link cost completely.

This system has served three major purposes

- It provides access through a wireless base where line laying is cumbersome and expensive.
- It provides simultaneous voice and data transfer.
- It is more economical for areas that have sparse subscriber bases over expansive geographical areas.

CorDECT implementation has also been done in Dhar district and in Nellikuppam in Tamil Nadu. Nellikuppam is the site for the sugarcane factory of the EID Parry Murugappa group. The initial implementation phase saw 40 connections setup by EID Parry of which 14 were franchised out. Under the initial plan, there is to be no access charge levied on the village users.

[5] Times of India, August 5, 2000

The TeNeT group at the Indian Institute of Technology, Madras, is promoting the CorDECT system. An offshoot of the TeNeT group, n-Logue communications, is specializing in rural communications projects. The firm currently sets up direct entrepreneurship projects under n-Logue in areas it finds commercially feasible (current projects include a network in Tambaram, a Chennai suburb), establishes corporate partnership projects offering technical expertise – such as the Nellikuppam project in partnership with EID Parry, and social welfare projects (currently proposed for rural Madurai) which are set up as a service for impoverished and underserved populations.

Due to specific local problems, these prototype projects can fail. The Kuppam Mandal project is currently suspended. The slow progress of the Kuppam Mandal project was especially the product of the original project selection. The choice of Kuppam for the project was related more significantly to its being N. Chandrababu Naidu's constituency than any significant existing local demand. Regulatory policy has weakened the momentum also for the EID Parry (Cuddalore) project. This project is suffering because the local network could not connect successfully to the outside network of the established national carrier.

Fiber Optics

Companies such as Reliance and others are not only laying fiber but are also have plans to set up information kiosks – a majority of which will be in rural areas.[6] Entertainment group, Zee Telefilms, is building bandwidth to feed its cable TV customers. Zee plans to link 26 cities through optical fiber links, involving a total investment of Rs 24 billion. India's software industry is growing at more than 50 per cent per year. Cable TV penetration is expected to grow to around 80 million by 2008, and Internet subscribers to around 35 million.[7]

WLL and PABX

Servicing rural areas has always posed a challenge and conventional solutions may not suffice. Rural areas, some suggest need to be serviced through low cost, low bandwidth solutions that have high reliability. This means that technology solutions will have to be adapted to local terrain and conditions. Demand for information services would have to be generated through aggressive marketing and overheads will have to be kept low to serve a cost sensitive market. Large organizations in the public or private sector are unlikely to be able to operate in this manner. Responding to these needs will require a different policy mix on licensing, pricing and competition, as we explain later. For example, cable operation has been considerably less regulated than telecommunications carriers on entry and pricing and this has enabled large number of small players to spread the network throughout rural India.

Since communications in rural India is largely need-based (as opposed to social or leisure), voice telephony is not of paramount importance. Voice, email in local script and a variety of information services riding over the Internet may well be the answer to the communication needs of rural areas. Long-term exclusive territory license for specified technologies may be detrimental - they lock out potential entrants that come with more cost effective technologies. WiLL terminals at village coupled with PABX to provide a local village exchange and multiplying the number of phones available from a single line - VP operator could become a local network operator. PCO operators could become total

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6 Times, Internet Limited, June 22, 2000.

7 Reuters, Indian Express Newspapers (Bombay) Ltd, 2000.

communication shops providing phone, fax, email, Internet, computer training, photocopying services.

The traditionally contentious question of infrastructure is no longer as imposing a task as it has been in the past. These apply both to bringing basic telecommunications services to rural areas and expanding existing bandwidth and services in areas with existing infrastructure. On the macro scale, the expansion of long-distance fiber-optic networks and satellite technologies and at the local level, the innovations in wireless local area networks can speed up access incrementally.

Wireless LAN over longer distances is now feasible with outdoor antennas and by using higher power.[8] WLAN is already spreading like wildfire in India and there are networking companies offering WLAN connectivity for corporations.

There are emerging VSAT solutions. Hughes Electronics has announced plans to provide satellite-based Internet service to nearly 1,100 cities in India. Hughes will use a combination of VSAT (very small aperture terminal) technology and some 50,000 community-access kiosks located in coffee houses, restaurants, and other gathering places. Users will pay a per-use fee, much like a pay phone. It is projected that as many as 25 million potential subscribers will have access to the system.[9] .

Increasing connectivity and competition in order to make voice and data services more affordable and accessible is also a challenge in many urban areas in India. Yet the consumer welfare benefits would be very substantial. Wireless local phone and data service offering limited mobility is growing in popularity in North America. Its proponents argue that it would offer major advantages for India. See Box 2.

Box 2: Urban Service Options: Limited Mobility with Wireless Local Loop

India's New Telecom Policy of 1999 provided spectrum for and encourages fixed service providers (FSPs) to use wireless local loop technology for rapid deployment of "last-mile," linkages, especially in rural areas. On January 8, 2001, the Telecom Regulatory Authority of India (TRAI) recommended that fixed service providers be allowed to offer "limited mobility" services using the wireless local loop technology within their short distance charging areas (SDCA) encompassing around 25 km, which denote local tariff boundaries. This effectively meant that consumers who had before been restricted to making phone calls from their house could now utilize a wireless handset and move within their short distance calling area making calls for the same price as a fixed call. (Two blocks of spectrum of 5 MHz each was set-aside for four FSPs in the 800/900 MHz band and 2.5 MHz each for four fixed service providers in the 1.8/1.9 GHz. Among the FSPs to utilize wireless local loop technology are MTNL, BSNL, Tata Teleservices, Reliance Telecom, Shyam Telelink, and Bharti.

In an attempt to attract a higher number of limited mobility phone customers, Mahanagar Telephone Nigam Limited (MTNL) has proposed the new set of rates for WLL phone service using CDMA technology to the Telecom Regulatory Authority of India. MTNL is planning to slash one-time security charges and monthly rentals. MTNL intends to cut the one-time security fee (fee includes the handset)

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[8] See http://www.wavelan.com for Lucent's OriNoco series of outdoor solutions.

[9] Wall Street Journal, March 24, 2000. Other solutions are based on DVB-RCS (Digital Video Broadcast) featuring 30Mbps downstream and a Return Channel through Satellite of 64-512Kbps upstream. DVB-RCS is an ETSI (open) standard. There are DVB-RCS-like solutions that have DVB based on the standard and a proprietary TDMA system for the up-link. The DVB systems have become very cheap because of DTH television ex. DirectTV. Up-link costs have also come down

by 50% from the current Rs 10,000 ($US 208) down to Rs 5,000 ($US 104) and to lower the monthly service fee to Rs 450 (US$9.40) from Rs 550 (US$11.40). If TRAI accepts the proposals, the consumers of Delhi and Mumbai will be able to make calls at the same price as fixed line calls (Rs 1.20, or $US 0.026, for three minutes and free incoming calls) but will have the ability to move within the 25 km of their home.[10] MTNL's Chairman and General Manager of the Delhi service indicated that MTNL's subscriber base are those who use phones for long hours and generally do not move out of town. MTNL has launched its WLL service in Delhi under the brand name of Garuda and is scheduled to launch it shortly in Mumbai.

The CDMA FSO operators claim that their system uses spectrum much more efficiently than GSM cellular networks. As a result, they plan to introduce data services to supplement voice services without requiring significant increases in spectrum. If they are correct, this could significantly increase competition and contribute a significant option for low-cost data networking comparable to conventional phone lines in many urban areas.[11]

Hybrid Solutions

Various groups in India have proposed innovative approaches that combine conventional systems in unique partnerships. For example, Sasken Communications of Bangalore wants to provide universal Internet access through a hybrid satellite-terrestrial network. The basic idea is to replicate once again India's two successes in the television area: (a) providing nearly ubiquitous television coverage through satellites and an extensive network of over 1000 Doordarshan ground stations and (b) the viral expansion of cable network. Sasken, among other Indian communications companies, has endorsed free spectrum for rural connectivity and encouraged infrastructure aid for such hardware as satellite transponders. These firms argue that freeing up some spectrum in both the 2.4 and 5+ GHz bands as unlicensed spectrum by the Govt. of India could give rise to incredible innovation in terms of connectivity solutions. Many industrial countries have created some unlicensed bands to spur innovation, although many of the uses are for more local wireless networks and applications (ranging from 802.11 through Bluetooth network devices).

Interesting terminals are becoming available that combine telephony with WLAN. Symbol Technologies offers a phone called NetVision that allows two people to talk in a walkie-talkie mode over WLAN over distances of 750 m. This, in India, would mean that subscribers from the same village or town could talk to each other for free. These WLAN phone islands of villagers could be connected to each other using DVB-RCS system to create a macro network of the kind never seen before where villages are all connected up for only the cost of the spectrum and the satellite transponder systems.

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[10] The Indian regulations stipulate that the tariffs for limited mobility subscribers must be the same as those charged by fixed wireline subscriber whereas the cellular operators are not limited to any tariff conditions. The TDSAT (Telecom Dispute Settlement Appellate Tribunal) is currently considering an appeal of the regulatory agency TRAI's decision to permit this service. The appeal was brought by the Celluar Operators' Association. If TDSAT upholds TRAI and the FSP operators fulfill their initial pledges about coverage, the FSPs will be entitled to receive additional 2.5 MHz spectrum over a predefined period of time.

[11] CDMA operators in India are also planning to introduce third generation mobile systems. V. Rishi Kumar "India: Cell to WLL migration on?" Business Line (The Hindu) (India) Fin. Times Info Ltd-Asia Africa Intel Wire. Business Line (The Hindu) Copyright (C) 2001 Kasturi & Sons Ltd; Devesh Kumar, "MTNL to halve WLL deposit," Nov. 9, 2001 http://economictimes.indiatimes.com/articleshow.asp?art_id=2127073479

Under current policy partnerships between BSNL/DOT and private entrepreneurs for such innovations are necessary because large licensed operators are not very interested in operating end-user technologies. They prefer the more technical job of supplying operating service and having a straightforward method of collecting revenue. This provides a substantial market opportunity for facilitating the operation of end-user technologies and services, especially those that provide consistent, high-quality and low-cost services.[12] But such franchising relations face many problems in regard to creating compatible business incentives and administrative coordination. This is one reason why it is generally desirable to let the potential "franchisee" also have the option to provide the service independently. Creating such an option for local services in India would require a shift in the proposed licensing policy that is discussed later in this document.

Wireless Solutions at the Edge of the Technology Envelope

There are many new technology systems that remain unproven but have substantial backing from major commercial players. Under the new convergence bill, some of these newer technologies will have an easier time being introduced into India. They have the potential for changing the economics of network build-out very significantly if they live up to their claims. Two examples can illustrate their potential.

Teledesic LLC, a US firm is one of several companies that have planned a global satellite system with the potential to deliver data to rural areas. The Teledesic concept features a global, broadband Internet-in-the-Sky network, using a constellation of low-Earth-orbit satellites. Teledesic executives believe that their access capacity will be comparable to fiber optic data transfer – providing solutions for computer networking, broadband Internet access, high-quality voice and other digital data needs. This technology will run through small fixed devices placed in the open anywhere on the globe – and the pricing strategy places the product at par with prevailing technologies. As a significant improvement over previous existing technologies – the offering now is of expanded broadband, rather than limited bandwidth services. Importantly, the service may offer access anywhere on the globe, but does not intend to carve a niche market in 'reaching the inaccessible' – therefore the pricing will be competitive. To date, all systems like Teledesic have faced a variety of design and financial problems but there is clearly a significant technology option that is developing cumulatively across the individual projects.

Another interesting approach may be to develop an airborne platform at 10-15,000 feet (3-5,000 m) that can provide mobile cellular coverage for up to 150,000 to 200,000 subscribers over an area 200km across. Some of these new technologies are being tried in the West and may have value in developing countries. For example, the plans of Platforms Wireless International Corporation (PWIC), a US based developer and marketer of an airborne wireless telecommunications technology known as the Airborne

[12] See Subhash Bhatnagar "Enhancing Telecom Access in Rural India: Some Options", Paper presented at the Conference on Telecommunications Reform in India, Asia/Pacific Research Center, Stanford University, November 9 & 10, 2000.

Relay Communications "ARC" System. The ARC System is capable of hosting a multitude of interchangeable telecommunications payloads (cellular communications, wireless Internet, broadcast, etc.) Hence the system can also support advanced data services such as GPRS; and the capability to deploy other services such as UMTS and fixed broadband for Videoconferencing, High Speed Internet, etc.

IT Accessibility

Just as a transparent effective program for universal service is important for telecom accessibility, there must be a clear program for IT accessibility. Part of IT access can be encompassed by an adjunct to the telecom program—for example, wiring schools can include the installation of IT devices on the school network. But the equally important part of addressing IT accessibility is examining how it will be used for innovative applications.

This conference assisted this discussion by looking at:

1. Setting goals for public spending on support for experiments with IT applications in rural and under-deserved areas.
2. Suggesting policies to reform government use of IT in such a way as to provide spin-offs for the underserved.
3. Examining the obstacles to the private and non-profit sector pioneering new uses of networked IT for economic and social development.

Such recommendations imply a prior agreement on how national and local governmental authorities can work together. Most countries with federalist systems have arrangements for some divisions of power over these policies. Many make telecom development policies more centralized than policies for IT applications. In India, a crucial factor in charting out a course for universal access will be directing discussions based on an examination of the distribution of policy responsibilities and implementation power between the central government and state agencies.

Given the huge diversity among regions and villages there is strong reason to encourage a more decentralized approach to the IT component. But it is vital to find ways of efficiently sharing information from these decentralized “experiments.”
Efforts to make government more responsive to local needs through IT may require considerable work on how to integrate widely scattered series of records. Even in a wealthy, IT intensive society like the US, studies have discovered that a huge coordination effort is necessary to obtain the full benefits of IT for improving health care. The information and billing systems of public and private, national and local authorities are often highly incompatible. These issues will surface whether the goal is to improve tax collection or to get market data on crop production to farmers more quickly. (See Box 3.) The sheer technical complexity of large-scale projects and the huge diversity of interests involved suggest that this conference should focus on projects that are smaller in scale and tied to very specific districts or towns. These projects have the added benefit of

being easier to benefit from local "social entrepreneurs" whose personal commitment and skills can make a significant difference in both starting and sustaining a project.[13]

Box 3 Web access in rural areas: The "Gyandoot" project in Dhar District, Madhya Pradesh

The award-winning Gyandoot project in Madhya Pradesh's Dhar district brought low-cost rural Intranet through information kiosks set up in villages across the district. The project served multiple functions of data dissemination, grievance redressal, multi-regional crop price information, sales/auction assistance through Internet price announcements and provision of government record copies for citizens. Villages that were placed strategically in the transport system or function as Block headquarters or hold the weekly markets in tribal areas or are located on major roads were chosen for establishing the kiosks. Each kiosk serves 25 to 30 villages.

Break up of kiosks established

Towns	7 centers
Villages with population of above 5000	8 centers
Villages with population of 1000-5000	7 centers
Villages with population of below 1000	9 centers

The entire network of 31 kiosks covers 311 Panchayats (village committees) an area of over 600 villages and a population of around half a million (nearly 50% of the entire district). The kiosks were established in Panchayat buildings and the entire cost of maintenance is borne by the Panchayats. The kiosks may be leased out to private managers at an income-sharing (10%) agreement. Connectivity is provided through dial-up lines to local exchanges on optical fiber or UHF links. A remote access server is located at the District Panchayat office. Users are charged nominal fees for access and are assisted at all times by an operator from the local region trained to use the Internet.

- The State government has made efforts to ensure that a support system is created. This has been done through institutions and by encouraging participation from users.
- The Internet kiosks have been promoted as a resource center rather than as an outlet for learning or browsing.
- Land record copies provided by the Gyandoot kiosks have been given recognition by all the banks in the districts for use as collateral in sanctioning loans.
- There has been an effort to look into complaints and requests coming in from kiosks briskly.
- Users who utilize the services for obtaining government certificates for income, caste or domicile save a great deal of time and money as the number of trips required to district headquarters is reduced.
- Scholarships are awarded to 10 students a month to encourage individuals to start using the network within a specified time frame. There are secondary school students who are taken on tours of the Gyandoot kiosks.

Gyandoot is a good example of how the creation of incentives can play a major part in providing telecommunications services for even the most underserved regions. Dhar is a tribal district and is in the lowest economic quartile among Indian rural districts with 60 per cent of its population below poverty line. Nonetheless, every Gyandoot center is owned and maintained by the local Panchayat. However, the setting up of the system may be an easier task than its maintenance.

[13] It is seen that small-scale ICT projects often do very well despite occasional lack of state support due to the possibility of individual or group initiative. State support can greatly enhance the effectiveness of such projects, which can thereafter serve as pilot initiatives for others to follow. Examples of this include the Dhar district IT project, the Kuppam district WiLL initiative, The SARI project in Madurai by MIT Media Lab and Harvard Center for International Development, and the work done in Pondicherry by MSSRF. Each of the projects has among other circumstances; a small core group of committed planners and is concentrated over a geographical area of size manageable to a compact team.

A World Bank report has stated that despite the enthusiasm of politicians and bureaucrats at higher levels, the local politicians and administrators have blocked the efficient running of the project.[14] While it is vital that the support system for the kiosks is sustained and succeeding governments show the same eagerness for efficient e-governance and service as the current government, it is equally vital such initiatives also emphasize on social empowerment.

Infrastructure – Hardware

It may be correct to say that PCs remain expensive, fragile, quickly obsolete, English-centric, complex and difficult to master, and therefore almost entirely elite in their scope and operation. Nevertheless, *networks* of human-mediated computer kiosks, shared among *multiple users* of a rural community, could in fact prove to be the most inexpensive and inclusive form of rural infrastructure possible today as some of the above examples demonstrate.

Further, a key to effective IT access is hardware that can be used by the poor and at a cost that is affordable. Besides Wireless-in-Local-Loop there are other efforts launched by different groups that are seeking to increase rural connectivity such as TouchMuch Networks in Madhya Pradesh, which uses a voice interface to call up Internet sites on a regular telephone. Using the phone, they can ask simple questions and get spoken answers, hear e-mails, and also transact in the not so distant future. Inabling Technologies (www.inablers.net) is another example of a low cost email appliance that can send and receive standard text e-mails without a PC or even an ISP and is targeted to PC-phobic or laptop-impoverished Indians who are looking for affordable alternatives to personal computers. The most well-known of these efforts is the Simputer (see Box 4), the pocket-sized computer developed by a group of Bangalore-based academics and technologists, which incorporates specially developed software called 'Dhvani', where a built-in loudspeaker speaks the text entered in Hindi, Kannada or Tamil.

Box 4 – The Simputer

Professors and students at the Indian Institute of Science in Bangalore and engineers from Encore Software are creating an innovative hardware solution to the prohibitive cost of computers. They are designing a handheld Net appliance, the Simputer– 'Simple Inexpensive Multilingual Computer.' The pocket-sized computer developed by a group of Bangalore-based academics and technologists, incorporates a novel, stylus-based text entry system called 'tap-tap', obviating the need for a keyboard. The Simputer works on just three standard AAA batteries which can be easily bought anywhere in the world. To keep down the system cost, the operating system is based on the 'open software' Linux and the computer works on a StrongARM (for Advanced RISC Machine) chip which consumes much less power than the Pentiums. The selling price is expected to be around Rs 10,000 or $200. The Simputer is being designed with non-literate users in mind and will enable India's illiterate population to surf the Web. It is expected that the Simputer will be used not only as a personal Internet access device but also as a resource serving whole communities of users at kiosks. A smart-card interface to the device will enable the use of the device for applications such as micro-banking. A subsequent version of the Simputer will also offer speech recognition for basic navigation through the software menus and the speech dictionary will be customizable to support different languages. A text-to-speech system will also be developed to take the technology to India's illiterate population. Later versions will also offer wireless technology.[15]

[14] http://www.worldbank.org/publicsector/egov/gyandootcs.htm

[15] Bytes for All, http://www.bytesforall.org

Support of these and other devices such as Smart Card applications for micro-credit, healthcare and rural banking can lead to improved efficiency and reduction in costs of services provided and accuracy of data that is being used.

India's Telecommunications and IT Policy – The Regulatory Environment

In India we stand at the threshold of a new communications era with the new Convergence Bill of 2001 that is currently going through Parliament. If sanctioned, India will become the second country in the world after Malaysia to enact a Convergence Law. Malaysia passed its Multimedia Act in1988. For a better understanding of the policies and infrastructure needs in India and how this consultation can contribute to the on-going dialogue, a short summary of the convergence bill is in order.

Convergence Bill 2001

The New Convergence Bill of 2001 is sanctioned will repeal five existing laws: The Indian Telegraph Act, 1885, the India Wireless Telegraph Act, 1933, the Telegraph Wires (Unlawful Possessions) Act 1950, The Telecom Regulatory Authority of India Act, 1977, and the cable Telecom Networks (Regulation) Act 1995.

The main objectives of the convergence bill are:

- To facilitate the development of national infrastructure for an information backed society and to enable access thereto
- To provide a choice of services to people with a view to promoting plurality of news, ideas and information
- To establish the regulatory framework for carriage and content of communication in the scenario of convergence of telecommunication, broadcasting, multimedia and related technologies and services
- To establish the powers, procedures and functions of a single regulatory and licensing authority and of the appellate tribunal.

The CCI will try to uphold public interest by ensuring competition and prevention of monopolies while issuing licensing for providing communication services. It will also stipulate the eligibility conditions for such licenses. The CCI has been empowered to grant licenses in its discretion for 5 different categories. These include:

1. To provide or own network infrastructure facilities including earth stations, cable infrastructure, wireless equipment, towers, poles, ducts and pits used in conjunction with other communications infrastructure;
2. To provide networking services;
3. To provide network appliance services;
4. To provide content application services; and
5. To provide value added network application services.

The convergence bill therefore, identifies four basic elements or functions – that cut across methods of carriage: viz, network infrastructure, network service, application service and application content. The convergence bill argues that regulation needs to cover each function as a single item. Hence, e.g., on network infrastructure, any technology that delivers network infrastructure, for example: cellular or wire-line, would be similarly regulated. Therefore under the new Bill, different providers of network

infrastructure will be regulated similarly – that is companies providing basic telecom, cellular, Internet and satellite television do not need different licenses to provide these services and do not require to be regulated by multiple agencies. However, if the provider supplies network services, it will be regulated differently from a provider of infrastructure. The proposed law will create the Communications Commission of India (CCI) with wide-ranging powers, functions and duties. The adoption of the Convergence Bill 2001 tries to cut out red tape and make competitive entry into multiple services easier. The precise crafting of the Bill and its implementing regulations will, of course, be crucial to determining if it achieves its goals. If the new regulatory Commission, for example, is not genuinely independent and able to enforce its decisions, the prospects for reform weaken.

The Central Government will be responsible for coordination with international agencies in respect to matters relating to Spectrum Management and also for allocation of available spectrum for strategic and non-strategic/commercial purposes. Finally this bill legalizes Internet Protocol Telephony (IPT) in the country and includes IPT in the category of network application services. However, this bill also confers immense powers of content censoring to the CCI. The provisions are so encompassing of all forms of broadcasting that even a simple personal website will fall under its purview and critics argue that this could stifle innovation.

The Potential

The current Telecom network in India has averaged a Growth rate of 20% over 5 years it is one of the top 10 largest telecom networks in the world. See Table III for details on the network.

Table III

Number of telephone connections	30 million
Number of Telephone Exchanges	28256
Switching capacity	34.60 million
Village public phones	378,460
Cellular	3 million
Pager	0.7 million
Internet Customers	2.5 million
Optical Fibre route Length	185,231 kms
UHF & Microwave route Length	174,067 kms
Global connectivity with ISD –	0ver 13,220 locations

2nd among the emerging economies other than China

The most important landmark in the process of telecom reforms was NTP 99 which was made effective from 1st April 1999. This paved the way for change-over from a fixed license fee to revenue sharing, migration of existing operators to the new regime - thus resolving their long-standing difficulties, strengthening of Regulator (TRAI), opening of the National Long Distance, preponement of opening of International Long Distance from 2004 to 2002, corporatization of telecom services, and establishment of Bharat Sanchar Nigam Limited (BSNL) etc.

NTP 99 laid out some clear objectives which were to create a modern, efficient country-wide telecom infrastructure that was affordable to all and that telephone connection would be available to all on demand by year 2002. Further, the policy also set a goal of providing telecom coverage to all villages by 2002 and Internet services to all districts by 2000-2001. Further, it aims to deliver on the Universal Service Obligation (USO), optimize the spectrum utilization and attract private investment and encourage private participation.

The challenge facing India as it moves ahead to implement the NTP 99 and the new Convergence Bill is to assure IT access in a way that will promote economic and social development of underserved regions and populations. It will also take pro-competitive policies to lower the cost of IT devices and software. Ubiquitous networks and lower cost IT will then open the way to the most powerful driver of productive change in rich and poor areas, user-led innovations.

Competition we believe will stimulate private investment while lowering the costs of building out the network and encouraging technical flexibility in response to changing user needs. Whether wire-line or wireless, fixed or mobile, circuit or packet switched, technologies are available to provide widespread access at costs at least an order of magnitude lower than a decade ago.

To the extent that markets cannot provide universal access to networks on their own momentum, governments can institute transparent subsidies for universal service programs that would be more cost effective than traditional funding programs precisely because they are coupled to competition.

Universal Access Provision

This conference focused on the future of telecommunications and IT in peri-urban and rural India, and for traditionally under-served populations. Concrete benchmarks for progress that balance capabilities and costs with economic and social benefits are necessary. For example, many countries have set concrete timetables for build-out of the communications network to rural areas. Typically, these schedules envision universal but limited access for all villages in the first phase and then more robust networking at a later stage. Some lay out targets for expanding services to lower income populations in urban areas. The commitments to IT accessibility and applications usually takes the form of pledges to create access to computer networks for schools, libraries, hospitals, and other key public institutions. This is complemented by programs to promote experiments with specific new forms of applications of IT to societal needs. For example, some countries have seen promising results with a commitment to rural "telecenters" that combine network access, IT infrastructure, and training programs for local use of networked information.[16]

[16] Many international development agencies have become active in promoting telecenters all around the developing world. USAID is working through AED's LearnLink program to set up local telecenters that are joint ventures in Africa, Eastern Europe and Latin America. IDRC (Canada) has also even undertaken work in remote regions of Mongolia. In India, there have been promising efforts to duplicate the success of telecenters elsewhere in rural districts through independently-run local-

The Resources for Achieving Universal Service

The same level of transparency and accountability is vital for judging the revenue resources available for financing the infrastructure. Applicable rate structures must be published. Combined with information on basic demographics this permits a more realistic picture of what can be afforded. In virtually every country such reviews demonstrate the need for substantial rate rebalancing in order to make it possible to finance network build-out. Typically, this involves raising the rates for local services and lowering them for long distance. Some object to rebalancing fearing it will make the network unaffordable. But if rates are too low the network will not be built. Affordable prices for a non-existent network do no one any good. And, as we discuss later, high long distance prices also can defeat the spread of universal service.

There is an important lesson to be learned from other countries' experience with pricing and the build-out of wireless networks. A significant reason for the rapid deployment of wireless in most countries is that wireless pricing is cost-based, but costs are lower because of efficiencies generated by allowing competition. As a result, wireless has become one of the most important ways of boosting network access to all regions in developing countries.

India's experience in building out rural networks also points to other dimensions of pricing and competition policies. For example, long distance prices are often as vital as local prices and the policy for interconnecting networks is critical for rural service. A Rural Telecom Foundation study in Andhra Pradesh[17] has demonstrated this point when showing that the demand for telecommunications facilities in rural areas exhibits trends uncommon to urban networks. Among its conclusions are:

1. There is no demand for services in short distance areas that are within physical reach of the client.
2. Demand for services increases largely in the range extending from 1 km. from the client's location and continues to increase till about 10 km. from the client's location – the demand diminishes thereafter. The demand in this range is largely related to the personal and professional networks of the client. It is within this area that the personal contacts and daily business-related networks of users reside. Services such as WiLL do provide access to local areas within 10 km. but if they are not connected through switches to other networks, the reach remains limited to that area and is therefore quite useless.

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language and content projects such as TARAhaat, SARI (Sustainable Access to Rural India run out of the Media Lab at MIT and the Harvard Center for International Development).

[17] Pernyeszi, Joseph with E. Madanmohan Rao, P. Yadagiri, Uday Kumar Micro-Surveys of Rural Telecom in India and USA, and their Implications for India's Public Policy (2000)

3. Demand resurfaces around the 30 km. range (variable). This demand is largely related to administrative and market-related factors. Usually, rural areas are within this range of district headquarters or major markets.[18]
4. There is a limited demand for calls to state towns and major national cities.
5. As access lines within a rural enclave increase, there is an exponential increase in the revenues generated from all the clients. There are also corresponding economies of scale in setting up access lines to client locations.
6. A vast majority of Indian citizens in rural areas do not file income taxes. Anyone owning a telephone in India needs to file taxes – it is seen that this factor acts as deterrent to people in rural areas from taking on telephone connections.

Subsidies and Universal Service

Transparency in costs and rates are needed along with a realistic discussion of more efficient ways to subsidize the lowest-income user. There are important decisions to be made both about how to subsidize these users and what range of services should be subsidized. A traditional mechanism for funding universal service objectives, cross-subsidizing one service by another (e.g., charging large sums for long distance in the hope that the profits will let a carrier charge below costs for local services), has usually proven to be highly inefficient. It rarely gets the maximum benefit for universal service and it needlessly penalizes the users of services that are charged the higher price. It also can lead to counter-productive efforts to discourage service and technology innovations that may erode the cross-subsidies. Many countries discouraged the growth of the Internet for fear of eroding the cross-subsidy schemes being promoted by traditional telephone carriers, for example. With the opening up of Internet Telephony, the pricing of communications services may change dramatically. Usage-based pricing may be economically unviable because of the abundance of bandwidth – and a price structure based on fixed charges for access to specific services may be more appropriate to calculate costs and revenues.

In terms of the funding mechanism, India is exploring how to apply the ITU recommendation that each country should create a transparent funding mechanism for universal service that is independent of the network operator (e.g., controlled by the regulator) and designed to be competitively neutral. In South America it is typical, for example, for one percent of the revenues of telecom operators to be earmarked for the new universal service funds. (Some countries are also dedicating 50% of the revenues earned from issuing new wireless licenses to the fund.) The TRAI has proposed earmarking 5% of all telecom revenues (about the equivalent of $400 million US in 2001) for universal service funding. This is a substantial sum of money if it is used efficiently. Box 5 shows why the failure to make universal service funding available to competitors is slowing rural deployment in India.

[18] Also the telecom Short Distance Calling Areas are not demarcated according to circles on which public administration is run – therefore long-distance charges apply sometimes in calling district headquarters or major markets – making a telephone an even more uneconomical investment for villagers.

Box 5. LESSONS FROM THE GRAMEEN EXPERIMENT

Following the success of the Grameen Bank system in micro credit, Grameen Telecom was introduced to encourage entrepreneurship among poor communities and to encourage access at places underserved by the existing state telecommunications network. Grameen Telecom is partnered by Grameen Phone, a licensed nationwide retailer of GSM cellular services in Bangladesh.

Grameen Phone sells fixed line telephones to village entrepreneurs with funds loaned to them by the Grameen Bank system. 95 percent of the entrepreneurs are women.

The tariff levied upon rural phones is roughly half of what is paid for by urban subscribers. The rural phone subscribers use the phones as public call offices, reselling calls at twice the rates charged to them. The system has so far worked very successfully. Rural telephones are also very profitable for Grameen Phone, bringing in revenues per phone of $93 a month in March 2001, twice as much as GP's urban mobile phones. However, rural phones represent less than 2% of the phones used on GP's network and bring in only 8 % of the company's total revenue, so that the company's profitability depends primarily on its urban business. Also, less than 5000 of Bangladesh's 65,000 villages have access to these cellular services.

In the view of Grameen Phone a key factor here is a cross-subsidy between its services. As a competitive model (and because of its public service goals) it has decided to build its network reach by a transfer of profits from the more profitable urban part of the business to the rural sector. This strategy is unavailable to such rural-only competitors as BRTA and Sheba. Given that Grameen Phone does not have the market power necessary to act in an anti-competitive manner its policy of cross-subsidizing services is a great contribution to Bangladesh's welfare. (Its rural service commitment also has long-term commercial benefits. As the British regulator, OFTEL, has argued, service in the countryside is a very valuable way of building a company's national reputation.) However, the problems of BRTA and Sheba point to the advantages of making the funds available for subsidizing to citizens of rural poor areas accessible to all carriers willing to enter into universal service commitments.

The state telecom carrier (BTTB) has been unwilling to increase its interconnection capacity, despite Grameen Phone's offer to pay for upgrading the capacity. Grameen Phone and other mobile companies have been unable to connect additional phones to the national switched network and instead have had to offer primarily mobile-to-mobile phone services. This infrastructure barrier has played a part in the resulting limited expansion of the rural phone network.

Were it not for policy and infrastructure barriers, Grameen Telecom's village phones might already serve all of Bangladesh's 65,000 rural villages. The high revenues generated by the shared-access business model suggest how powerful market drivers for such approaches can be.

Many countries have gone beyond the idea of a subsidy for serving people with low incomes. Here are merely a few of the policies that are being discussed or have been adopted:

1. **Licenses for paired regions**: The Philippines and Brazil, for example, only issued new network licenses in highly desirable urban markets if the operators agreed to build-out and operate networks in less desirable markets;[19]
2. **Auctioning subsidy monies**: Chile, for example, designates regions with low teledensity for subsidies for building out the network. Telephone companies

[19] Build-out requirements also have weaknesses. In the midst of the Asian financial crisis the Philipine. Government. insisted on adhering to the build-out schedule and did not care where the network got built. So, the new entrants tended to build in the same circle of towns in order to minimize costs during a financial crisis rather than to position their network expansion to support long-term strategy. This is a problem of build-out requirements and it is one reason why they are not the preferred option of reformers. But, compared to the status quo in most countries, they are arguably an improvement.

make competitive bids specifying how many people at what prices they will add to their networks if they receive the subsidy.

3. **Subsidizing rural operators**: Subsidies for funding rural telephone companies, such as co-ops, that make it easier for them to raise capital for network development.
4. **Subsidies given directly to individual low-income users**: This approach gives a voucher to help pay for communications services directly to the poorest citizens. This could be spent, for example, on low cost phone cards.

As noted earlier, a subsidy program in a competitive market environment must also be linked to explicit goals for spreading universal service—for example, goals for connecting villages and for the creation of telecenters featuring IT training and applications. India appears to be committed to the following objectives:

1. Provide voice and low speed data service to the balance of uncovered villages in the country by the year 2002.
2. Provide telephone on demand in urban and rural areas by 2002.

The important policy questions are what comes next in networking objectives and which IT goals should complement the telecommunications goals. As the consultation's conclusions suggest, the telecommunications goals may put too much emphasis on individual access lines for each household. Shared use of access lines by several households may be more successful.

Universal Service Policy – Working in a Competitive Marketplace

The review of policies to promote universal service must, of course, go well beyond an examination of rate structure and funding mechanisms. If competition and private investment are to promote access, then general competition and licensing policies must be reviewed.

Communications regulators in many countries often do too much micro managing of the marketplace (such as needlessly specifying which technology or standard to use) with too few powers to make and enforce rules on a few fundamental policies that will make or break competition. Certainly, there have been numerous questions raised about whether or not the TRAI (Telecom Regulatory Authority of India) has sufficient policy independence and power.

The key to creating competition is trying to reduce needless barriers to entry in the network marketplace and to preventing competitors with market power from restricting competition as a result of their control of essential market facilities.[20] Many of the needless barriers relate to government policies, such as restrictive licensing of new entrants or inadequate allocations of spectrum for new services. Competition policy has

[20] For a review of the regulatory issues see: Peter Cowhey and Mikhail Klimenko, The WTO Agreement and Telecommunications Policy Reform (Policy Research Working Paper 2601, The World Bank Development Research Group, May 2000).

to focus on the carriers who control essential facilities for the public network that cannot be reasonably duplicated for either economic or technological reasons. An example of an essential facility in most countries' policies is the transmission line connecting the central network switch to a local household. These carriers have market power that allows them to harm competition (and customers) by denying access to key network facilities to potential competitors.

As India reviews its competition policies four practices are particularly important:

1. **Licensing practices**: Should the number of licenses be limited for any reason other than managing scarce spectrum? Should there be any fee for landline licenses that is not tied to universal service? Should licenses be given for circles, roughly the size of a state, or for smaller regions? Should franchising and resale be allowed?
2. **Interconnection Policy**: Interconnection policy determines on what terms new competitors may access the facilities of established carriers with market power. Will India's rules allow setting interconnection charges fairly? Does the TRAI have the authority and expertise to enforce them reliably?
3. **Spectrum practices**: Wireless technology has great potential for underserved regions. Is enough spectrum being released to create numerous competitors? Is there enough flexibility given to companies in how they choose to use the spectrum? Are the licensing practices for spectrum pro-competitive (e.g. the prices charged for a spectrum license) and designed to award spectrum in a way that will lead to its most efficient use?[21]
4. **Technology neutrality**: Are operators given enough flexibility in the choice of network technology? While there are arguable economies of scale from unification, flexibility in choice of appropriate technology is often more conducive to encouraging new entrants into the market.

Box 6 examines the licensing of long distance competitors and the treatment of the incumbent to illustrate some of these issues.

BOX 6: COMPETITION IN LOCAL AND LONG DISTANCE SERVICES

Until now, India has opted to post many requirements on carriers who wish to operate in long distance markets. These requirements, listed below, tend to discourage entry. Unlike mobile markets, carriers

[21] To illustrate, the frequency spectrum available for Indian use is limited to the GSM 900 MHz band for terrestrial mobile services and the 824 MHz band for fixed wireless. It is possible to extended this to cover alternative technologies for providing mobility services or fixed wireless applications including, for example, the 1800 MHz bandwidth. Having determined the available spectrum, it is essential to make it available, in a transparent manner, based on international best practices, to all operators, bearing in mind the need to cater to the relative growth of market participants. Further, an appropriate mechanism for charging the operator for spectrum utilization must be determined. Charges for spectrum utilization must be payable irrespective of end application like cellular or wireless in local loop. As of now, Spectrum Charges are levied as a fixed flat rate per subscriber. Going forward, an appropriate Spectrum fee may be determined through a competitive bidding mechanism monitored by TRAI or the Communications Commission of India (assuming this is put in place).

for local and long distance terrestrial services are not using a scarce public resource (spectrum). Most countries are dropping these licensing requirements.

The requirements for a new National Long Distance License:

- A one time non-refundable fee of Rs. 100 crores
- Plus Bank Guarantees of Rs. 400 crores that are returned to the party in steps. Minimum net worth of promoters with 10 % or more stake in the company applying for NLD license to be Rs. 2500 crores.

The requirements for Local Basic Service **for the larger states (in A & B category circles) –**:

- The minimum net worth of the companies to enter range from 700 to 1000 crores
- The entry fees range from 10 to 115 crores per circle.
- Bank guarantees range from 40 crores for Haryana to 460 crores for Maharashtra.
- Revenue sharing fees range from 10 – 12%.

While the purpose of these requirements may be to ensure that the most dependable players be the only ones to gain access to the markets, it also plays a dangerous game of raising the stakes too high. The largest players may not necessarily be the most suitable – the success of small cable operators has provided ample proof of that. The licensing system effectively writes them out of the picture. In addition, the NTP '99 was the result of a lesson learnt – that high charges on corporations can fall back on the consumer, who will pay higher rates to offset the high costs of setting up telecom services. (This is especially true if a weak interconnection policy discourages the new competitor from taking lower prices to build market share.) Consequently, demand is low and the incentive to expand into rural areas and "build markets" even lower. Moreover, the steady stream of license income to DoT – Department of Telecommunications (which has far exceeded expectations for the current year) is not channeled in rural telecom.

Bharat Sanchar Nigam Ltd., the dominant incumbent, also has some clear advantages over its competition even if one ignores the effectiveness of interconnection policy.

1. License fee waiver for Rs. 2,000 Crores for its telecom operations.
2. Minimum Alternate Tax (MAT) facility for five years with retrospective effect from October 2000 from the Ministry of Finance. The MAT would mean that the BSNL would have to pay only 7.5% tax on its book profits instead of the normal 35% corporate tax.
3. Waived spectrum charges for Bharat Sanchar in its operations in uneconomical and unviable areas i.e. rural and remote India.

Building Consensus

The diversity of India – in social, cultural and economic factors – presents a tremendous challenge in arriving upon a framework for universal access for the entire nation. Consensus building will be the first step in this direction. This conference has brought together individuals representing a vast cross-section of government administrators, academic researchers, independent professionals and developmental agency representatives who bring with them wide-ranging sets of experiences in technology and telecommunications development issues from various parts of the world. It was also essential to ensure that the group represented experience in both planning and implementing, and that the understanding of ground realities in India was well integrated within the theoretical framework that will emerge from the discussions. Different sets of attendees will present their assessments at various points in the conference with a view to ensuring a comprehensive understanding of the elements involved. This will be elemental in the consensus-building process.

Identifying and Confronting New Challenges

After putting in place a framework, we need then to prioritize tasks at hand based on urgency. Particular policy and market obstacles stand in the way of ubiquitous access. These need to be definitively identified and remedied. Participants already active in policy research and implementation have approaches towards this end. Based on these approaches we hope to come up with suggested action. We hope to figure out which steps are easier and which will require more analysis and more consensus building.

There are some elements of making a country "e-ready" that will receive less attention at this conference. For example, most readiness assessments look at items like the protection of intellectual property rights. We do not deny the importance of this and other matters. But the time constraints on this consultation have focused our attention more on some other elements that we consider to be essential first steps for e-readiness.

Using Experiences from Projects in India

The current status and future opportunities posed by policy and infrastructure is critical with respect to making IT applications a viable tool for accelerating the development of the under-served. The positive and negative aspects of policy and regulation – the levels of involvement necessary or desirable from the government and independent bodies under a competitive environment- need attention. Analysis of the various field experiments with the rural and urban underserved and the effect of policy in specific cases will guide this portion of the discussions.

At the end of the conference, we hope to develop an action plan – a road map to determine the best possible approaches that can be utilized to increasing connectivity in small towns, peri-urban and rural areas. This would include the identification of innovate strategies that should be supported ands also to establish a core group that is committed to follow-up on the action plan.

Consultation Outcomes

Vigorous competition (made possible by pro-competitive policies) and private investment, along with an effective policy to promote universal service, can dramatically improve network accessibility. The $8 billion (US) market for telecommunications services in India remains overwhelmingly dominated (over 90%) by an incumbent, BSNL, that is still part of the Government of India.

In age of IT universal service policy must consider access to all Information Technology (IT) services because, in the long-term, voice services are only part of the services necessary to be interconnected to the world.

The application of networked IT can contribute significantly to the economic development of the population of rural and low income areas. As private and public agencies evaluate these applications they should emphasize applications that are sustainable, scalable, and empower the ability of users to experiment freely with networked IT to create new applications. Competition and private investment in the provision of network services and the creation of IT services are essential inputs to this goal.

The Policy Framework

The Indian Government has made major progress toward introducing a pro-competitive framework and effective universal service policy in recent years. But several serious questions remain about its policy program. Moreover, the private and NGO sectors can do much more to contribute to the achievement of effective universal access to IT applications.

During this consultation it was impossible to conduct a comprehensive review of all the issues confronting India if it is to mobilize IT for development purposes. However, thee was a strong agreement that any effective agenda would have to give further consideration to the following policy issues:

1. Licensing policy for communications service providers
2. The philosophy of network development for India
3. Interconnection policy for communications services
4. Tariff (pricing) and universal service policies
5. Principles for developing IT services for rural and under-served populations

Licensing Policies

Licensing of telecommunications service providers should not be a barrier to entry into the market. Unfortunately, the proposed policy mix may favor entry by only a few large

competitors, and this in turn will discriminate against some technological options for improving connectivity.[22] Policymakers should embrace competitive entry by small and medium sized enterprises using a full spectrum of technologies to create networks and deliver services. To avoid these risks India should:

a. Review the need for any form of license for wire-line services.[23] It would be better to replace licensing with a simple registration system.
b. If India continues to rely on a licensing system, it should drop requirements that a new entrant has to obtain a circle license (roughly a population of 50 million people) that has build-out requirements for the network. Such requirements block smaller entrants, especially those dedicated to rural service.
c. Review the assumption that interconnection rights only go to Public Switched Telephone Networks. This policy limits the ability to tap the contributions of many important technological options. Examples include:
    a. Interconnecting corporate VSAT networks to the public network flexibly so that companies can use spare capacity to support rural services.
    b. Interconnecting private wireless "wide area networks" (e.g., 802.11b systems) to public networks is a major new option for extending network coverage inexpensively.
d. Reconsider the policy of charging fees for granting a license to wire-line networks. (Revenue sharing schemes are acceptable but the level of the charges should be reviewed carefully to be consistent with strong incentives for private investment.)
e. Review the policy that blocks entry to networks relying on resale of the services of other networks. Resale facilitates entry and is consistent with the policy of ending micromanagement of the market by government. Resale lowers the price of service for consumers.

Principles Underlying Policies to Promote Network Development

The strategies for developing the network infrastructure should take advantage of the accelerating rate of technological innovation in the communications and IT industries

a. There is substantial risk that current policy choices will not take full advantage of numerous technology developments that could substantially increase the power, cost effectiveness, and reach of the network. Even though current policy embraces the idea of "technology neutrality" the details of the policy appear to work against such options as:
    i. Vsat
    ii. cable
    iii. the internet's potential to mix a wide array of services in order to deliver a more effective application—such as combining voice

[22] The continued restrictions on foreign investment in telecommunications carriers may also impede progress but this is not a focus of this discussion.
[23] India already recognizes the benefits of dispensing with licensing for Internet Service Providers and firms providing applications (like telemedicine). India has approximately 135 ISPs with 3.5 million accounts (and an estimated base of 15 million users on those accounts).

over IP telephony to provide backup help when using data applications

b. The crucial potential of wireless, both fixed and mobile, requires vigorous implementation of policies that emphasize:
    i. Release of as much spectrum as possible on a technologically neutral basis (whenever possible), and making the spectrum allocation decisions in a transparent and competitively neutral manner[24]
    ii. Adoption of international practices to encourage innovative uses of spectrum that can promote novel forms of network build-out: e.g. creation of an unlicensed band for innovative technologies (such as the national information infrastructure band in the US which is used for wireless local area networks and "Bluetooth")
    iii. Examination of policies for charging for mobile services. Policies such as "calling party pays" have promoted network development in many countries but also have implications for rural development that require careful consideration.
c. Policy should encourage the build-out of fiber backbone at national level
    i. The convergence bill is right to examine the access to rights of way for new fiber networks. Implementing regulations and further policies should look at a broad array of options for easing access to rights of ways—example: access to rights of way of national highway authority.

Interconnection Policy

Interconnection policy is contentious in every country but a strong policy is essential for the development of effective competition. The dominant incumbent carrier has a minimal incentive to interconnect voluntarily because it loses competitive advantage when it offers effective interconnection to its rivals. A sound interconnection policy allows network externalities[25] to be gained by users of all networks and cost effective, timely sharing of existing network facilities that cannot be duplicated by new entrants in the medium term.

a. Prompt implementation of pro-competitive interconnection rules is essential to the future of competition and the provision of new rural services in India. The Convergence Bill will not correct India's weak interconnection policy.
b. Interconnection rules should be set by regulatory policy, not by terms of the license. TRAI has a mandate to create an interconnection policy and it must act promptly.

[24] India has done a commendable job of creating more competition in wireless services recently. The licensing of a fourth competitor should bring down prices to consumers and make most consumer price controls unnecessary for mobile services. More flexible pricing will be better for investment and consumers.

[25] A network is more valuable to a user if it connects to more people. This is a network externality.

b. Regulation should be asymmetric – apply only to carriers with market power (usually only the former monopolist) or those with "shared market power" (e.g., many rural markets will have only two carriers in the foreseeable future)
c. The goal is flexible, seamless, cost based interconnection
    a. End barriers to seamless flexible networking, especially remove the mandatory role of DOT in interconnecting different carriers even if other options are feasible—e.g. do not require a single carrier with licenses in adjacent circles to interconnect through DOT and abolish the anomalies involving interconnection between fixed and mobile carriers.
    b. Benchmark cost decisions against best international practices in developing and industrial economies because network economics are more alike than different across countries. Do not let poor cost data about DOT block a decision on establishing efficient interconnection prices.
d. Must allow competitors to tap the network of the dominant carrier on a flexible unbundled basis. Interconnection must cover all key network elements:
    a. Example: any technically feasible point of presence
    b. Example: numbering systems, operations support systems and billing
e. Interconnection must be timely—use such devices as imposing a reference interconnection contract offer devised by the regulator if the parties do not negotiate an agreement within a reasonable period of time.
f. Use a transparent process to develop interconnection policy. Transparency allows the marketplace and competitors to provide information to regulators and it builds market confidence.
g. Make sure that the regulator has adequate powers to enforce the interconnection policy.

Universal Service and Tariff (Pricing) Policies

Universal service for rural and underserved urban includes considerations of how to increase network availability while making services affordable.

a. The benchmarks for universal service may be inappropriate:
    a. "Teledensity" goals (which measure the number of access lines per 100 people) may mislead because they do not focus on the number of households that have access to the network (e.g., many households have more than one telephone line so teledensity measures overstate network accessibility)
    b. Universal service measurements do not give proper consideration to the notoriously unreliable service in many rural villages
    c. Rural service goals emphasize a single line for each household. However, many of the most promising plans for increasing rural networking emphasize shared use of lines in villages.
    d. Universal service goals do not yet have a realistic plan for IT accessibility. For example, is the emphasis on networking schools the best way to set a commitment to IT accessibility in rural India?
b. Tariffs should be more flexible and cost-based in order to encourage use.

a. Rates should reflect costs. On the one hand, rural villagers are hurt more than helped by tariffs that are so low that it is impossible to build a network to provide proper network connectivity to the village. On the other hand, they are hurt severely by inflated long distance rates that are so high that they cannot, for example, afford to call district headquarters (a principal use of telephony in rural India).
b. Policy and regulation should not hamper flexible tariffing that permits costs to be covered according to market conditions. Some examples include:
    i. "Lifeline" rates that offer a lower rate for a certain number of calls per month to low income households
    ii. Flat rates that offer a single monthly price for very large numbers of minutes of service per month—flat rates have been shown to stimulate Internet use in households at all income level
c. Carriers with no market power should have great freedom of pricing. If a dominant carrier is subject to pricing controls (to prevent abuse of market power) a more flexible system (such as a price cap) is desirable.
    i. Example: Mobile carriers should be able to use tariff schedules that exceed the current price caps in rural areas if they make a commitment to achieving rural build-out. Shared use of mobile phones in villages could bolster rural access.
d. Regulation/policy should facilitate alternative business models if rural is to be served—demand is underestimated because pricing and service models are inappropriate/inadequate. This consultation revealed experiments that indicate rural India can afford connectivity given the right business and regulatory model for providing services.[26]
    i. The government cannot rely on the franchising of local rural services by circle operators to achieve adequate rural connectivity. There are complex problems about financial incentives and business implementation that make the franchising model inadequate for India's needs.
    ii. The Rural Telecom Foundation experiment shows the importance of innovative business models that stress different markets—such as shared lines---and differential pricing models
    iii. Novel sources of demand must be stimulated in order to make the economics of network build-out more attractive
        1. Telecenters find entertainment and family connections are key
        2. Hybrid models—market prices downloaded to IT access point and then delivered by megaphone

c. Interconnection policy is essential for stimulating private investment in new rural telecom services. For example, local service providers often cannot get cost

[26] The consultation showed that the cost of building out network infrastructure to rural and under-served regions of India could drop substantially if there is technology flexibility and new entrants with specialized business models (and cost control methods) could enter the market.

effective access to the national trunk network and thus cannot important services to rural services.

d. Policy is moving in the right direction for obtaining funding—transparent and competitively neutral tax on service providers.
    a. In general, cross-subsidies between services (e.g., an unrealistically high price for long distance and an unrealistically low price for local) work poorly—they discourage investment and competition and rarely are the most efficient way to help low income users.
    b. The government should consider exempting rural services from revenue sharing until an appropriate threshold of connectivity (e.g., a teledensity of 10 in the area covered by a rural exchange) is reached.
e. Separate disbursement of funds for universal service provision from the dominant network operator. This approach makes the use of universal service funds more cost effective and better tailored to the needs of particular geographic markets and users. There are several options for achieving this objective:
    a. Auctioning subsidies to the best service packages (the Chile model) would work better if licensees were not tied to the circle build-out requirement because specialized entrants could pursue the subsidies
    b. Alternative of subsidizing users directly deserves consideration instead of subsidizing service providers. If used, the subsidy should allow the user to choose freely between different services==the credit could be used for both telecom and IT telecenters
    c. Other types of incentive systems—e.g., possible revenue on incoming calls to VPTs
f. Technology neutrality—mobile networks, WLL, cable systems, and satellite can all contribute to universal service.
g. Funding technology experiments on how to improve options for "last kilometer" access is consistent with technology neutrality. The experiments can prove general feasibility and provide valuable operating data. The market can make choices about which technologies to deploy.

End user applications, IT and networking for development

The Government's policies for promoting the use of networked IT for development should emphasize approaches that are sustainable, scalable, and empower the ability of users to use networks and IT creatively. This implies attractive network pricing options (e.g., flat rate prices for telephone lines) and flexibility in technology and service providers (ISPs and rural coops as hybrid providers).

a. While there is a national backbone within 200 kms of any village, more powerful backbones at closer ranges combined with flexible "last kilometer" solutions are vital
b. Regulation/policy should not interfere with IT solutions that will often require hybrid services—electronic commerce combined with voice over internet telephony (or even multimedia services)—provided by unorthodox service n providers (e.g., rural coops).

    a. Censorship of content creates new layers of uncertainties for businesses that can hinder innovation.

c. IT applications stand a greater chance of being sustainable if they encourage two way flows of content. Examples:
    a. Smart cards can lower the costs of micro-credit lending by reducing the costs of paperwork. But smart card data flow must be two ways—from the bank to the local bank agent and customer, and from customer to bank.
    b. Rural areas can be the source of valuable data for government. Agencies should pay for this data that can be uploaded from the network.
    c. Rural businesses also need the benefits of modern supply chain management. Dual use of business networks might allow them to be extended to rural businesses—such as allowing Vsat to provide service to a rural telecenter and to a business in the village.
d. How target IT access point subsidies? Which formula should India follow—schools, libraries and hospitals? Other formulas have less clear criteria (e.g., community centers) with less certain financial implications but may be more appropriate to needs of India.
e. The policies for promoting access may (due to administrative necessity) have to be based on fairly simple operational criteria (e.g., subsidies for all users below a certain income level). But the assessment criteria for evaluating the success of these programs need to look at specific needs of target populations (e.g., women in rural areas).
f. Government policy is right to promote IT experiments and outreach programs that do not discriminate against commercial applications.
g. There is a vital role for NGOs and private sector in creating new institutional competence involving commercial and social institutions providing connectivity. Examples:
    a. Collective program for wiring target social institutions—e.g. schools.
    b. Collective program to create "facilitating institutions" for IT delivery services—e.g., create a support institution to help create and sustain telecenters in low income and rural areas (e.g., pool purchasing power, training programs etc).
    c. Vouchers for Internet service use by target user groups (e.g., social workers or women students in rural areas).
    d. Experiments related to bringing down the costs of end user equipment such as the Simputer, Local Wireless Loop, etc. should be promoted.