Providing Rural Connectivity Infrastructure: ICT Diffusion through Private Sector Participation

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Abstract

India is vast country and traditionally an agrarian economy. Nearly 70% of India's population still resides in the villages. The penetration level of the new telecommunication tools is low in the rural areas as compared to the urban sector. New technologies and ICT platforms are evolving, featuring collaboration between the development agencies, academia and the local government. This case-study analyzes, how the technology incubated in the labs of IIT-Madras was transferred to the rural areas. Factors responsible for the success are cost effectiveness of technology, provision of value-added services, and commitment from the governmental authorities, and entrepreneurial orientation. Such initiatives along with private participation which help in bridging the technological divide and creating an opportunity for divide convergence.

Keywords:

ICT platforms, rural connectivity, diffusion of ICT, private sector participation

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"If the misery of our poor be caused not by the laws of nature, but by our institutions, great is our sin"

- Charles Darwin

Introduction

Technology change poses a challenge - especially to those in the developing world during periods when technology change is pervasive. The death of distance is an opportunity for developing countries but conventional technologies are rather highly investment intensive. Half the world's inhabitants have yet to make their first basic telephone call. Even fewer have used the Internet. The majority of the more than 6 billion people who inhabit our planet have been completely shut out of the digital revolution and the promise it holds. As the pace of the technological revolution increases, so does the digital divide. The digital divide concerns governments, the private sector, multilateral organizations, financial institutions, non-governmental organizations and everyday citizens. Together, they have the power to close the digital divide by uniting their resources under a common framework designed to foster the growth of information communications technologies worldwide. Especially the private sector participation in this area brings in the hope of flexible, responsive, efficient, market led solutions to meet national, social and economic policy objectives such as education and training, health care and e-governance. The private sector is also able to quickly and accurately respond to the information age skills of higher order reasoning, problem solving, effective communication, teamwork and high productivity. In addition, the private sector has a strong understanding about the appropriate environment needed to enable the cost-effective and large-scale distribution of infrastructure programmes using information and communication technology [1].

India has a large number of rural villages that do not have telephone connectivity. Within India the digital divide between rural and urban India is rather large. Bridging the digital gap requires considerable investments in the normal situation. A new technology that uses Wireless in the Local Loop has the potential to reduce the cost and thereby increasing the number of villages that are linked. Digital Convergence is emerging as an opportunity and this concept could be used for ensuring lower cost in ICT. This project exploits the network for a variety of services using the convergence of computing, telecom and media has expanded the window of opportunity for entrepreneurs. Further, designing kiosks as delivery points using the concept of 'shared services' bringing down the cost as kiosk become delivery points for multiple services or e-hubs a point at which consumers and suppliers meet and transact [2]. This case study is an analysis of one such project that has

been implemented using private participation as the organizational form for an Internet based shared services kiosk. Private participation shifts the focus of service provisions from a government-supported network to self-sustaining private network model. The success comes from designing the network for low cost using economies of scope.

Idea Initiation

In 1991 both India and China had about 5.5 million telephones. A decade later, India had about 35 million telephones over a six-fold increase in a decade is no mean achievement in the conventional sense. But in the same period the number of telephone lines in China has grown to about 200 million; and it is adding about 30 million lines every year. China's mastery of manufacturing probably has a lot to do with this.

The Internet has emerged in the last few years, not just as another communication means, but as sheer power. Access to Internet provides access to a whole lot of information. It enables one to quickly reach out to a variety of training and education. It helps one close deals and carry out transactions and it enables one to perform tasks which otherwise required a lot of travel. India has less than 3 million Internet connections today. Lack of access to the Internet is going to create strong divides within India.

It is imperative that India catches up with changing time getting higher telephone and Internet connectivity and usage at the earliest. This talk focuses on what needs to be done to get there. Getting there is important, but equally important is the process of getting there, as this requires:

- technology which is most suitable to a country like India where large part of the population is poor and lives in villages
- mode of technology delivery with low delivery cost and maximum reach in the interiors of the country

What made Indian Cable TV Industry grow so rapidly?

There are not many areas of activity where rapid growth has taken place in India in recent times. Cable TV is however an exception. From zero in 1992, the number of cable TV connections today is believed to have grown to over 50 million. What has enabled this?

The first reason for such rapid growth is simple economics. While a cable connection in India costs only about Rs.100 per month, the cost in the USA for a similar cable connection would vary from $15 to $30 per month. While a new colour television may cost as high as Rs.15,000, second hand colour TVs are available at Rs.2500 and a 14" Black & White TV is sold in rural India at Rs.1200. Cable TV has been made affordable to over 60% of Indian households.

The second reason for this rapid growth is the nature of the organization that delivers this service. Cable TV operators are small entrepreneurs (at least when they start providing service). They put up dish antenna and string cables on poles and trees to provide service in a radius of 1 km. The operator goes to each house to sell the service and collects the bill every month. He/she is available even on Sunday evening if any repair is needed. This level of accountability has resulted in less-trained people providing better service using a far more complex technology, than that used by better-trained technicians handling relatively simple telephone wiring. However, what is even more important is that such a small-scale entrepreneur incurs manpower cost several times lower than that in the organized sector. Such lower costs have been passed on to subscribers making cable TV affordable.

Telecom and Internet Connectivity

In contrast to the cable TV industry, the telecom industry belongs to the organized sector with much higher costs. Further, a telephone operator today spends around Rs.30,000 per line to provide telecom services to a subscriber. Taking into account finance charges on the investment (15%), depreciation (10%), and operation and maintenance cost (10%), an operator needs at least 35% of the initial investment as yearly revenue just to break even. Add to this the license fees and taxes, and the revenue per subscriber needs to be at least Rs.1000 per month. Now, what percentage of Indian households can afford this ¾barely 1 to 3%.

Fig 1 provides the percentage of Indian households today that can afford telephones and Internet (assuming 7% of their household income is spent on communications) at various levels of investment per line. If the investment is more than Rs.30,000, barely a few percent homes can afford it. However, if one could reduce this cost to about Rs.10,000 per line, the affordability goes up to almost 50% of homes. The 200 million connections then look definitely achievable. The key is whether one can reduce the cost per line to Rs.10,000.

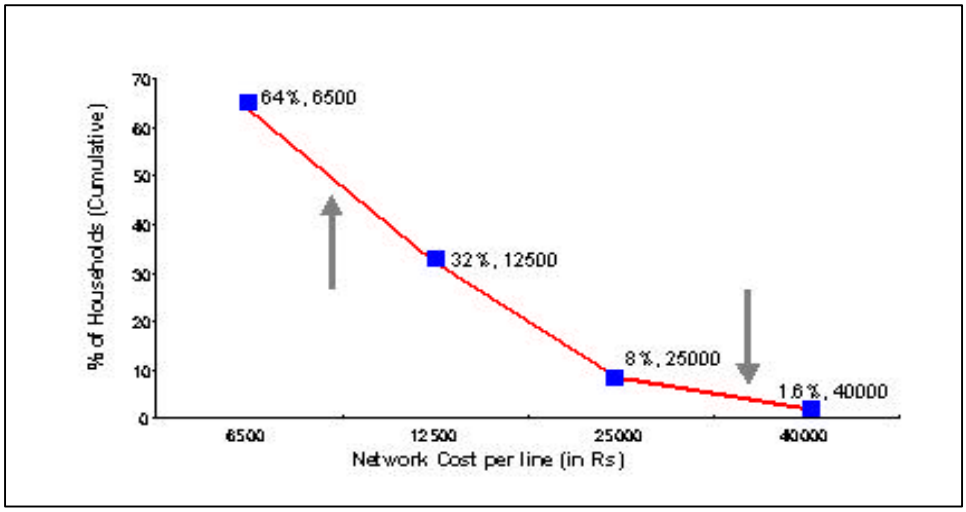

Fig 1: Telecom Affordability for Indian Households at different Network infrastructure cost

A more detailed look at costs of telecom and Internet networks around the world reveals that in the West, the cost of providing a telephone line is around $800. We use the same technology and it is not surprising that our numbers are similar. But this cost of $800 was reached in the West more than a decade back. There too, an operator needs between 35-40% of initial investment as yearly revenue to break even. However, this amounts to barely $30 per month and is affordable to over 90% of the homes. Therefore, homes in the West have been fully wired up quite some time back. Now, reducing the cost further, no longer expands the market. Their R & D focus therefore naturally shifts to the replacement market, where more and more features and services need to be provided rather than lower cost products. However, technology at this cost is hardly affordable to a few percent in a country like India. The cost needs to be reduced by a factor of three or more for telecom (and Internet) to be widely affordable in India. Such cost reduction is not easy. Coming up with a disruptive technology that could reduce cost by a factor of 3 would require total mastery of current knowledge in the area and a lot of innovations. But then R&D efforts are always a challenge. But above all, such telephone and Internet connectivity can start changing the lives of people. Using Internet, resources can be deployed more efficiently. With telecom and Internet connectivity, Indian villages would have the necessary infrastructure to stand up in the world. It could make our agriculture more remunerative and give our home-based industries a potential market for their wares at fair prices. Besides reduction of equipment cost, which reduces the investment required to provide telecom and Internet connectivity, one has to develop technologies that lead to reduction of the operation cost. Conventionally, a large initial investment (of the order of several tens of

millions of rupees) is required to start providing connections. It is possible today to come up with small access systems, which could be connected to a backbone telecom network. Such access systems would require low initial investment and could be operated very much like cable head-ends. A small entrepreneur could then serve a neighborhood (either a few streets in an urban area or a few blocks in a rural area) and provide low-cost service in an accountable manner.

Of course, for this to take place, one would require not only technology, but also appropriate policies, which would enable such decentralized operation.

Origin of the Project

With the objective of taking the power of Internet and the benefits of telephony to the majority of country's population residing in rural India using low cost and affordable communication technology a group of faculty members at IIT Madras belonging to the Telecommunication and Computer Networking (TeNeT) group, took upon itself to pursue such R&D. The goals were clear to develop telecom and Internet systems which would cost about Rs.10,000 per line to develop decentralized access infrastructure technologies which would not only function in a harsh environment (high temperature and power fluctuation), but would also have low initial investment requirement.

It was obvious that such tasks cannot be successfully undertaken without totally mastering the technologies, turning them upside down and innovating upon them. The first task was therefore not only mastering the existing technologies, but also acquire an understanding of the directions in technology development and the costs associated with each element. While IIT faculty understood the concepts and theory and had some idea about implementation, the task at hand required significant industrial expertise. After toying with several ideas, the group decided to give a call to their alumni working in industry around the country. These alumni would come together and form companies that would work jointly with IIT to take up such R&D tasks.

This was however only the first step. One would require manufacturing tie-ups, funding and tie-ups to make world-class components. The group sold its vision to several Indian industries, carried out advance licensing of its technology, and raised the funds (government funding was eschewed — the vision was large and since industry would benefit from it, the belief was that industry should fund it). Similarly, tie-ups with International

Component industries were established (such industries did not exist in India) based on an understanding that the products could have a large market in developing countries. In other words, the principle was that the large potential Indian market can and must be used by us to get done what we want.

The process resulted in the setting up of several R&D companies including Midas Communications, Banyan Networks, Nilgiri Networks, AdventNet Inc., and the task for developing world-class technology and products aimed towards the market of the developing countries began.

On investment of considerable efforts, time and money the group came up with number of innovative products like Fibre Access Network (optiMA), Wireless in Local Loop system (corDECT), Direct Internet Access System (DIAS), CygNet Network Management system and a host of protocol stacks. The products are aimed at significant reduction in access cost and at the same time enable large-scale usage of Internet. These products take into account that the future access network should separate the telecom and Internet traffic at the Access Unit and that the connectivity from the AU to subscriber could use any of the several media.

The focus of the case is on Wireless in Local Loop system, which is the most cost-effective technology in the world. This uses the DECT standard as the base and has been indigenously developed by the TeNet group of IIT Madras. The technology, better known as 'CorDECT Technology' is currently being deployed in many developing countries through another IIT Madras incubated company, Midas Communications. The key advantages of the system are:

- Wireless deployment in the last mile
- Very competitive cost/line
- Internet and telephony both can be offered simultaneously
- Fast deployment in difficult terrain and
- High 35/70 kbs throughput.

Project Objectives

This project was envisaged as in experiment to try out and evolve low cost connectivity creation options and some of the major objective envisage are:

- To research and develop appropriate access devices for rural Internet and Telephony
- To research and source other supporting technologies like alternate sources of power, etc
- To research and facilitate the development of applications that will be of utility to the users of the service in these villages
- To provide Internet and Voice connectivity to the rural India.

Project Conceptualization

Developing a disruptive technology enables one to the best technological skills and cater to a large market which is otherwise deprived fruits of technological advancement [3]. But this in itself doesn't make India achieve its goal of high telephone and Internet connectivity. Even though one masters design there are two critical aspects need to be worked on reach the goal of high telephonic and Internet connectivity.

One, to come up with an appropriate model for technology delivery, which is affordable, sustainable and far-reaching to the rural poor of the country.

Two, to look for the most appropriate agency to disseminate the technology. In this case a small sized private firm was used as it would have smaller overheads and would be interested in creating and expending business quickly. But to reduce risk, the firm will have to work with many partners rather than working as a single monolithic unit. This was logic of creating 'n-Logue'.

Creation of n-Logue

Even though the market for Internet and telephony in rural India is huge but as the demands are latent the benefits are not instant. Any activity done in this direction will take some time to shape up into something meaningful. Also there are several hurdles to be cleared in this way. The 30 million telephone connection that I had talked earlier are mostly in urban India constituted by top 150 cities of the country where resides $3/10^{th}$ of India's population. So most of the telecom companies focus on this market which have active

users. Where the other see obstacles, Indian start-up n-Logue Communications Pvt. Ltd. (n-Logue) sees opportunity. n-Logue has been established to provide connectivity in every village in India so that the power of Internet and the benefits of the telephony can reach every person in rural India. The Telecommunication and Computer Networking (TeNet) Group of the Indian Institute of Technology (IIT) incubated n-Logue in Madras as the agency for dissemination of the new communication technology to rural poor.

Technology Delivery Model

To disseminate the technology n-Logue has fashioned a franchisee-based business model on the belief that delivery and management of the Internet service should devolve to the level of the supply chain that comes closest to the user of the service. In this decentralized model of operation, there will be three levels of interdependent networks – n-Logue, Local Service Provider (LSP) and Kiosk Operator and all three must thrive for operation to succeed.

At the foundation-level, n-Logue forges and facilitates relationships among a wide-range of organizations—hardware and equipment providers, non-governmental organizations, content providers, and government—that enable and support the businesses of franchise owners. At the next level, n-Logue maintains a regional network of franchised Local Service Partners (LSP). The LSP works in tandem with n-Logue to set up an Access Center or node to which individual kiosk operators will be connected.

At the highest level of the business model, local entrepreneurs are recruited by the LSP to establish village-level kiosk franchises that provide Internet and telephone access to the local population. Through the LSP, n-Logue offers low-priced "kiosk packages" consisting of a subscriber wall set (that connects the kiosk to the Access Center), a computer, printer and backup battery. The kiosks essentially function as combination rural Internet cafes and pay phone booths. While n-Logue provides kiosk owners with training, support, and technical assistance, local franchise owners themselves are responsible for developing additional product and service offerings (e.g., computer courses) and marketing strategies.

Project Coordination

The project started as a pilot project with the name SARI (Sustainable Access to Rural India) in Madurai District of Tamilnadu. This phase was sponsored by the following organizations:

1. Center for International Development at Harvard University (CID)
2. Media Lab at the Massachusetts Institute of Technology (MIT)
3. TeNeT Group at the Indian Institute of Technology-Madras (TeNeT)
4. Internet Business Capital Corporation (IBCC) / I-Gyan Foundation

The complete project management activities i.e. planning, execution and control of the project is taken up by n-Logue Communications (P) Ltd., Chennai. In order to do so, it will select the appropriate partners for the various activities that have to be carried out **Table 1.** given below gives the primary roles and responsibilities of the participants of the project.

Table 1: Primary Roles and Responsibilities

Participant	Role	Responsibilities
SARI Sponsors	Project Sponsorship	▪ Initial Funding ▪ Project Review and Oversight ▪ Development of appropriate Evaluation Methodologies ▪ Research and Development
n-Logue	Project Management	▪ Selection of Location ▪ Selection, purchase and commissioning of Access Centre and Subscriber Equipment ▪ Selection of an Project Partner in Madurai to assist in performing the following: ▪ Appointment and training of Local Service Partner to run the Access Centre ▪ Selection of sites for Village Information Centres and training of persons to operate them ▪ Selection of appropriate applications for the subscribers ▪ Interfacing with all government and other regulatory bodies in the area ▪ Management of the various participants and sub-contractors to ensure completion of project as per objectives

Project Implementation

n-Logue started with a pilot project, which aimed to show that a viable market exist for information and communication services in rural poor areas by inventing and deploying innovative technologies, assessment and business models. This project better known as SARI (Sustainable Access to Rural India), part of the Digital Nations Consortium of the MIT Media Labs and Harvard's Center for International Development, was formally launched on January 25, 2001. The other key partners to the project includes IIT, Madras and Boston based Internet Business Capital Corporation (IBCC) / I-Gyan foundation.

The ultimate goal of this project is to link these activities to sustainable human development objectives. Through the development and introduction of appropriate and enabling technologies and applications, SARI will foster economic development and improve health and learning. It will do so in a financially sustainable way, even as it reaches into the poorest and most disadvantaged communities. SARI's decided to start with a large number of villages that will help it to derive benefit from the Network Effect, which will be far more empowering than a few connections placed only in urban areas. The large number of users provide financial viability by aggregating demand, develops richer content and community by integrating and aggregating people, and provides a powerful environment for research.

SARI Pilot Phase

The Pilot Phase of the SARI Project will cover the short distance charging areas (SDCAs) of Madurai and Batladunda districts initially providing Internet and voice services to 50 villages in the Madurai District of the Tamil Nadu State. New applications and highly localized content will be collaboratively developed. Once the initial 50 villages are finished, a further 1000 connections within 350 villages in Madurai District will be realized. Internet ready telekiosks will provide villagers with applications and services in local languages (such as Tamil, Malayalam, and Hindi) that are geared towards entertainment, health, education, and economic development. SARI thus created an ICT platform using low cost technologies as using network architecture for business sustenance involving variety partners.

Infrastructure for the Project

n-Logue employs a unique, TeNet-designed Wireless Local Loop technology as the basis for its village-level communications package. This CorDECT technology consists of a fixed wireless local loop (WLL). CorDECT operates on the same principles as regular wireless technology with voice and data communication moving through radio frequency rather than wires. With WLL a fixed unit emits the originating signal. The corDECT system provides voice, voice band FAX/DATA transfer and Internet connectivity at 35-70 kbps to 1 gbps when digitized. The subscriber wall set (WS-IP) can transmit both voice and data signals simultaneously to an access center, which must be located within a 25km, line of sight distance.

CorDECT technology effectively and inexpensively addresses the problems of distance and lack of infrastructure in rural areas. Installing a fixed wireless local loop does not require expensive digging, and the system consists of only 4 major components. Because the central base station/ direct interface unit (CBS/DIU) handles traffic from 200-1000 subscribers, it works ideally in small, dispersed markets and does not require the large subscriber base that traditional landline or cellular systems require for profitability. This low infrastructure investment, combined with low usage costs, makes the proposition affordable both for suppliers and customers in capital-constrained economies.

The infrastructure required to employ this technology is:

- An Access Centre (AC) at the hub town with a Base Station that can cover 12 km radius. The Access Centre will have
    - A leased Internet connection to the nearest Internet gateway
    - Radius, NAT and DNS servers
    - Software to bill customers on a monthly basis and track the payments

  This central facility will be installed by n-Logue and managed by the LSP. The LSP will be able to provide the following facilities to his customers (who include the kiosk operators):

    - Email
    - Hosting customer's web pages
    - Hosting customer's servers

- A set of Repeater stations in and around the town, which will enable coverage of 25 km radius from the hub town. This essentially means that each access center would cover approximately 2000 sq. kms. Based on the national level data, there are 5.2 lac villages in 3.2 million sq. kms. This means about 350 villages per access center and about 1-2 small town.

- The Village Kiosk consists of a standard PC with a WallsetIP and antenna. n-Logue provides a complete Village Kiosk Kit (which provides 35/ 70 kbps Internet connections) consisting of :

    - corDECT Wireless System
    - a pentium PC with color monitor, speakers, monophone and sound card
    - a 4 hour power back-up for computer
    - an application suit consisting of word-processing, browsing and e-mail software all in local language as well as English
    - An 80 column Dot matrix printer, Web camera and a CD-Rom drive

The first Access Center was established at Melur Taluk, which is located in Madurai District, 28 kms from Madurai city. To this Access center are linked around 40 Information Kiosk at various villages around this Taluk. All these information Kiosks are fairly doing well.

The series of activities undertaken for the implementation of the project are listed in the **Fig 2** given below.

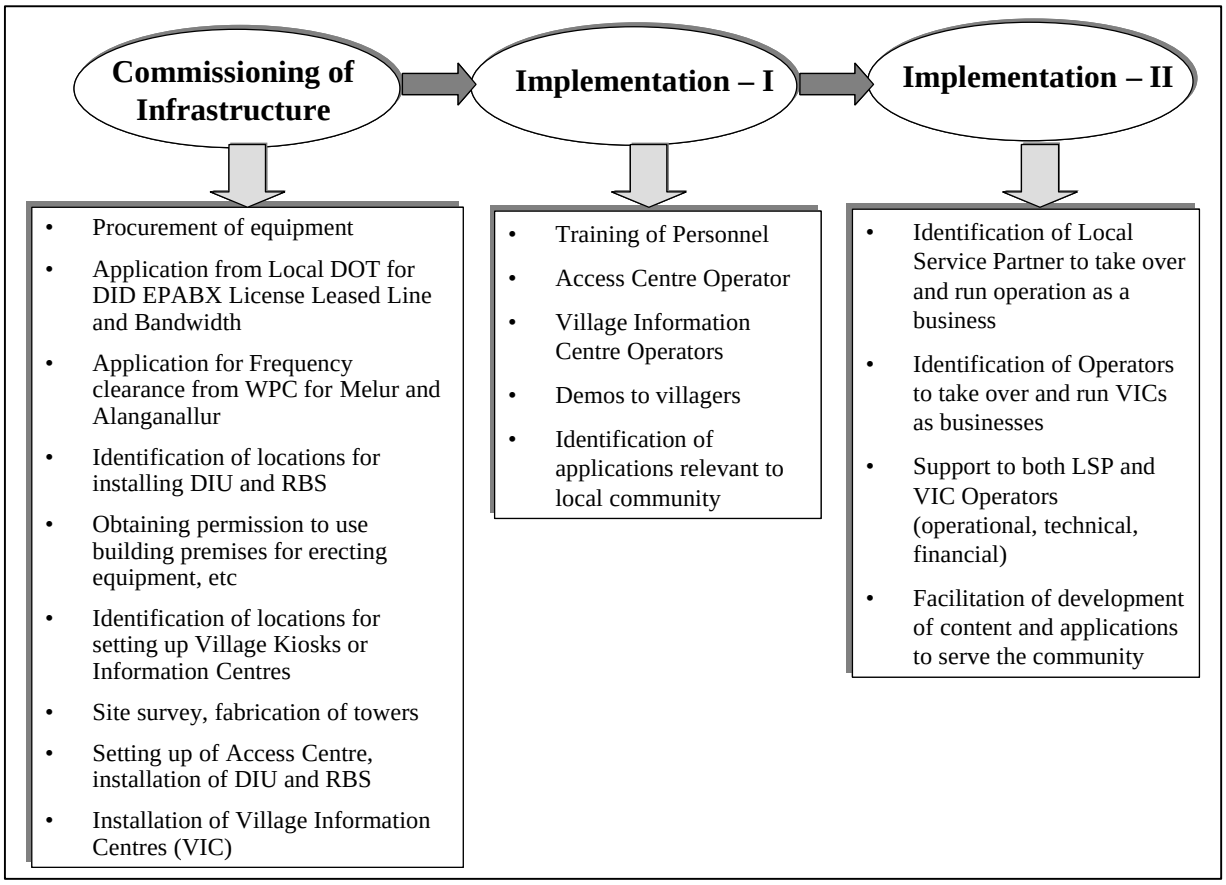

Fig 2 : Project Implementation Flowchart

The Partners of n-Logue

n-Logue created an ICT platform by involving four partners who could provide the technology's for creating the platform, as well as an network provider, financing partners, and application providers. In essence, n-Logue helped in the creation of a large network IT service providers and IT service providers and IT users directly through the elimination intermediaries.

The organizations that partners with n-Logue are:

- **Technology**
    1. Midas communication (www.midascomm.com) for all corDECT based technologies
    2. Banyan Networks (www.banayannetworks.com) for products like RAS, H Connects, DIAS, etc.
    3. Nilgiri networks (www.ooty.tenet.res.in) for the Minnow which is a Small ISP Software, the very critical billing software – BlueBill Network Management Systems. etc.
    4. The Research Division of the TeNet Group (www.tenet.res.in) for Local Language applications, Text-to-Speech etc.

- **Bandwidth through Satyam Infoway**
- **Others**
    1. Financial Organizations involved in micro-credit and rural lending programmes
    2. Application developers and content providers with a rural focus

Revenue Model for Sustainability of the Project

In every place it wishes to operate, n-Logue will identify and partner with a local entrepreneur (also called a Local service Partner or LSP). Then along with the LSP, n-Logue will sell connections to Kiosk Operators. The Village Internet Kiosks run by these operators, will be the actual interface between n-Logue and most of its customers.

This business model bases itself on “entrepreneurship”. All the players in this business has to part with some money as initial investment or capital which they can recover over a period of time by selling the services offered by them.

Firstly, the kiosk operator needs to part with Rs. 50,000 as an initial investment for getting all equipments and initial setting up. The kiosk will buy Internet access at a per hour rate from the LSP and sells it per service. As per the company’s projections, Kiosk operator will reach a break even in 8 months with a conservative internet usage of 1.1 hours daily in the first year. Actual experience so far shows that this will exceed.

Secondly, the LSP needs to invest Rs. 10 lakhs in the project plus Rs. 2 lakhs as further security deposit. As per company's projections, the LSP selling its services to Kiosk Operator at a fixed hourly rate breaks even when the usage is about 300 Internet hours per day. This is expected to reach in about 16 months of set up at an average of 1.1 hours a day.

Finally, the company needs to invest Rs. 30 lakhs for equipments and initial set up of the access center, part of which (Rs. 9 lakhs at an average) is funded by the security deposit of LSP. The investments are spread over 4 years of the start. The total gross revenues obtained at the LSP less some common shareable costs gives the Net Revenue. This is shared 50:50 with the company and the LSP.

Monitoring and assessment

A research team, consisting of groups from the Harvard's Center for International Development, IIT Madras and the MIT Media Laboratory, is assessing the impact and the need for information and communication technologies, applications and services in poor rural areas. The team's contact with villagers and entrepreneurs continues to identify new prospects for poverty alleviation through the removal of barriers to information and communication.

Opportunities exist to increase employment among agricultural and construction laborers, raise the status of women, and overcome barriers of caste and the burden of corruption. Furthermore innovative business models for financially viable and self-sustaining access will be created.

The Technology Selected and Used

n-Logue uses the CorDECT WLL Technology developed by Tenet Group to produce the access. CorDECT is an advanced Wireless Access system designed keeping the economic realities of a country like India in mind. Midas Communication Technologies and IIT, Madras has developed it, in association with Analog Devices, USA.

It provides a complete wireless access solution with seamless integration of voice and internet services, providing simultaneous toll quality voice and 35/ 70 kbps Internet access to wireless subscribers. CorDECT is based on the DECT air interface standard specification from the European Telecommunication Standards Institute (ETSI).

The CorDECT air interface supports 10 kms of line-of-sight connectivity and has the provision to extend this to 25 kms.

The components of the corDECT Wireless Access System are:

- **The DECT Interface Unit (DIU):**
  This is fully redundant subscriber radio exchange with 2 OMC PC Consoles. It can also act as a voice PBX with up to 8 E1 connections (using R2-MF or V5.2 protocols) to P5TNA/Voice. It switches voice traffic to the telephone network using the V5.2 protocol to connect to an exchange. It also switches Internet calls to a built-in Remote Access Switch (RAS), which then routes the traffic to the internet network. System reliability is guaranteed by redundant hot stand-by architecture. The OMC (Operation and Maintenance Console) allows real-time monitoring and management of the entire corDECT system. A fully configured DIU consumes less than 600 W power.

- **Wall Set with Internet Port (WS-IP):**
  This is the equipment at the subscriber premises. It has 2 ports, one a standard 2 wire RJII interface for connecting to a DTMF or decadic telephone, FAX machine or modem. The other is an RS232C Internet port for connecting to a computer obviating the need for a modem. The PC establishes a dial-up Internet connection using a standard dial-up utility. This means that voice and internet can be used simultaneously. The power to the Wall Set is provided by a 12V adaptor connected to the mains, or by a solar panel connected in parallel. It has a built-in battery charger providing 16 hours standby and three hours talk time for voice calls.

- **The iKON Remote Access Switch (RAS):**
  The iKON RAS terminates the connections from the subscribers and is connected to the DIU using 2 E1 ports. It does IP routing for 60 simultaneous corDECT Internet calls. The RAS has a 10 basT Ethernet port to connect to the Internet. It supports RADIUS for accounting. PAP for user authentication and is managed using SNMP.

- **Network Management:**
  CorDECT provides comprehensive operation and maintenance through the corVIEW OMC Console. The features include hardware and software configuration, subscriber

administration, accounting, fault notification and traffic. The functions range from a bird's eye-view of the operational status of a network of corDECT systems to probing the internals of an individual wall set. CorVIEW supports the SNMP protocol and can be connected to the corDECT system by any IP network.

The Wall Set can be connected to the DIU through

1. The Compact Base Station (CBS), for distance upto 10 km
2. The Remote Base Station (RBS), for distance upto 25 km
3. The Base Station Distributor (BSD), for distance beyond 25 km

- **The Compact Base Station (CBS):**

This provides the radio interface between DIU and Wall Set. It is connected to the DIU through 3 pairs of twisted pair copper wires. The DIU feeds both power and signal to the CBS. A DIU can be connected to up to 20 CBS and each CBS supports up to 12 simultaneous voice calls. The following **Fig 3** shows the working of CBS

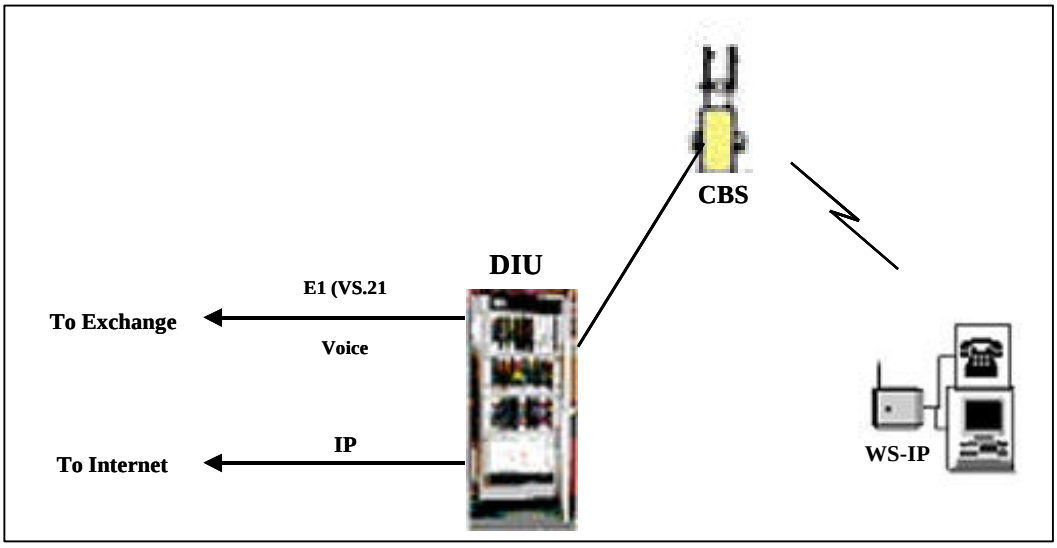

Fig 3: CorDECT Wireless Local Loop

- **The Remote Base Station (RBS)**

  DECT pockets between the CBS and subscriber units through a two-hop DECT wireless link one between WS-IP and RBS and the second between RBS and CBS. It can handle 11 calls simultaneously. **Fig 4** depicts RBS

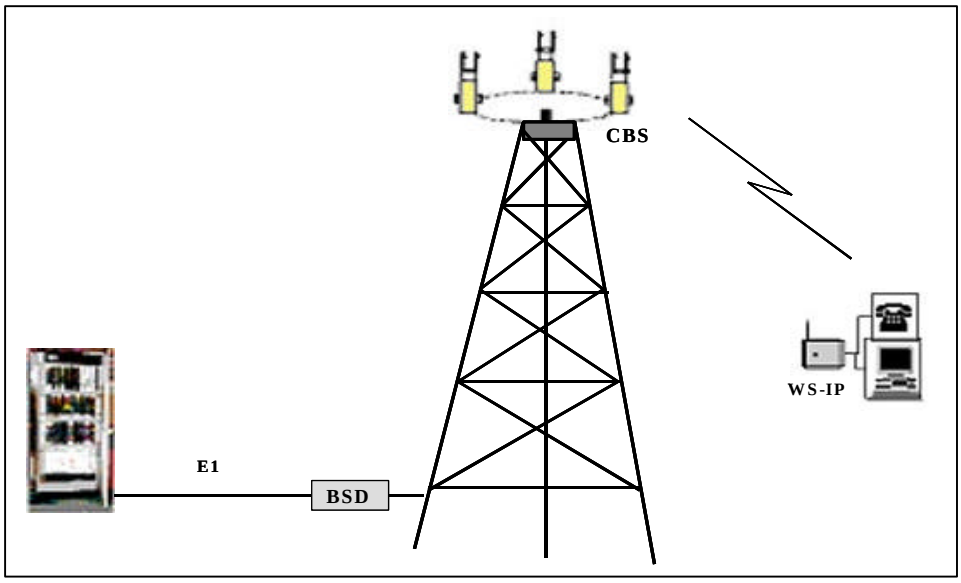

Fig 4: CBS remoted to DIU through BSD

- **The Base Station Distributor (BSD)**

  The BSD is a compact remotely located, locally powered, rack-mountable unit that supports up to 4 CBS. It connects on an E1 interface to the DIU, which may be on copper, fibre or radio. The link distance depends only on the link design. It is designed to connect pockets of subscribers located far away from the DIU. **Fig 5** shown below depicts BSD

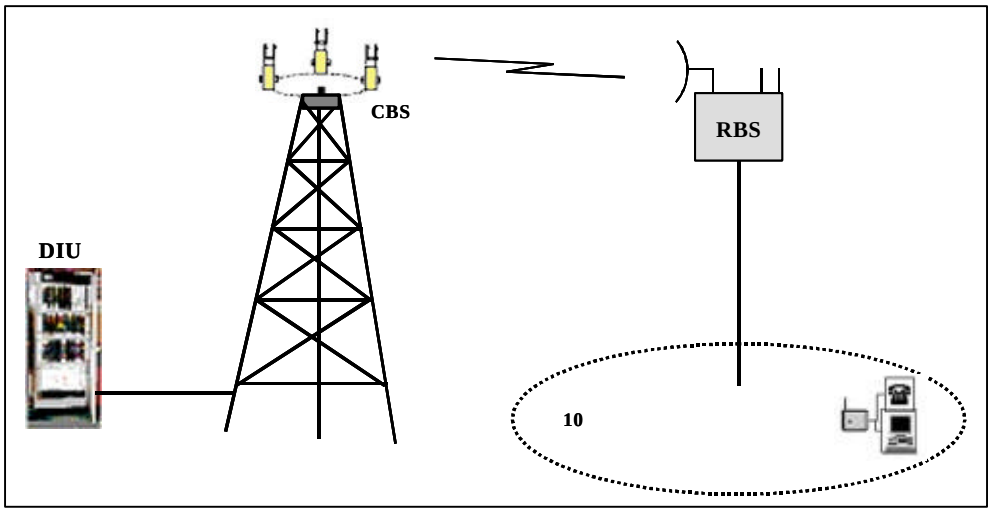

Fig 5: WS-IP connected to DIU using a two-hop radio link through a Relay Base Station

The advantage of this technology is that it addresses the networking needs of both densely populated cities as well as sparsely populated villages. It supports 10 Kms of line-of-sight connectivity and has the provision to extend this to 25 Kms using Relay Base Stations.

Marketing Practices

Innovating a new product/ service is different from making that a popular one. To make people aware of new product/ service a lot of marketing and product promotion efforts are required. As this ICT project is based on a business model than a general development project it also involves a lot of marketing activities to make its services popular among the rural community. As the services offered by the Information Kiosks are completely new to the rural people they need to be educated about the utility and benefits of that. For this project marketing at two levels:

1. Village Information Kiosk level

   Here, the kiosk operator directly meet to the local residents of the village, make them aware of the new facility and educate them about the various services offered, their uses and benefits to them. Also as an entrepreneur they keep coming with various schemes for the increased usage of the kiosk like

- On every usage of any service some number will be given to the user and after a fixed period of time (say a month) lucky draw is done and the winner is given some gift

- Users are awarded points for the usage of any service and these points are cumulated till a pre-decided level. On reaching to this level the user is offered few services free of cost.

2. Company (n-Logue) level along with the LSP
   Here the n-Logue supports the marketing efforts made by the local kiosk operators in following ways:

   - Putting Chirag posters all over the village
   - Advertising through cable TV
   - Conducting Auto show all around the village
   - Conducting door to door campaign
   - Giving T-shirts with brand name 'Chirag' along with its logo to the students

The company is trying to brand these Information Kiosks under the brand "Chirag Internet Illeam". At each Information Kiosk there is a board displaying the brand name with its logo.

Services Offered

Every Information Kiosk offers a wide range of services, which are very new and benefiting to the rural community. Mainly the services are segregated under five heads as given in the **Table 2**.

Table 2: Services offered by Village Information Kiosks

S.No.	Heads	Services Offered
1.	**e-governance**	▪ Birth Certificate ▪ Death Certificate ▪ Old Age Pension ▪ Encumbrance Certificate ▪ Petitions to CM, Collector, BDO etc. ▪ Complains for water, street light etc. ▪ Guideline Value of land as per government department ▪ Information of all Government department
2.	**Health**	▪ Associated with Arvind Eye Hospital ▪ Online appointment with the doctor ▪ Online registration for eye check-up and operation ▪ Details of the eye problem along with the picture of the infected eye is sent to doctor through e-mail
3.	**Entertainment**	▪ Browsing ▪ Playing computer games ▪ Cartoon shows for village kids ▪ Movie show for villagers
4.	**Agriculture**	▪ Provides with the market prices prevailing nearby markets ▪ Provide with canal timing for the purpose of irrigation ▪ Gives rain status ▪ Gives Reservior level information ▪ Online agricultural query resolved by logging on to associated sites
5.	**Education**	▪ For giving computer education and training ▪ Checking examination results ▪ Enquiring for higher studies in town and cities
6.	**Others**	▪ Lottery results ▪ Astrology ▪ DTP work ▪ Foreign Currency Rates ▪ Selling insurance policies – agreement with Royal Sundaram Finance ▪ Using scroll bar advertising on company's website

The company has worked on with the government and fixed the fees for the various majorly used services at the Village Information Kiosk. It has kept these charges to the nominal side so that it doesn't hinder the public usage. Also it has been made mandatory to display the price list at a prominent place the Information Kiosk.

Benefits to the Beneficiaries

Enhanced economic opportunities:

Electronic commerce through the Internet opens up substantial new areas of trade and commerce. Two sectors with great potential to benefit are service industries, many of which are becoming tradable commodities for the first time, and small and medium enterprises, which benefit from the low cost of access to the larger marketplace. These Information Kiosks provide wide range of services using the Internet medium which were provided to the rural community for the first time. Also it enhances the opportunities to increase the trade activities of the small and medium enterprises operating the region through faster and cheaper communication.

Reduced time wastage:

ICT services can substantially reduce the costs of distance and isolation borne by poor, especially rural, households, whose members must often travel long distances to communicate, and obtain vital information. Their isolation causes them to miss out on employment and other economic opportunities. For example – Before establishment of any Information Kiosk, a villager had to make number of visits to the nearest taluk, waste lot of time and money and also loose earning opportunity during this time, if he had to get any certificate from the government. But now he can online apply for the certificate giving all the relevant information. The concern government department acknowledges the receipt of the application and also keeps updated with the status of the application processing. Once the application is processed and the certificate is ready the villager can go to the taluk and collect his certificate. In this way it only takes one visit to get the required certificate saving the time and money.

Improving government and public services:

ICT offer powerful tools to improve the efficiency, quality, and reach of public services that are important for poverty alleviation, such as education and health. ICT can also broaden political participation and increase the transparency of government. Second, private sector initiative in this sphere can be constrained if governments do not provide the complementary policy environment. The e-governance services offered by these Information Kiosks that is one of the major benefits of this project. This has also increased the transparency of the working of the government department.

Promoting Entrepreneurship:

Based on the franchisee model this ICT project is promoting entrepreneurship. It provides ambitious members of the rural community, opportunity to take up Information Kiosk operation business moving away from old and traditional businesses and to prosper. This requires only a modest amount of capital investment. All technology and training is provided by the project.

Connecting People:

ICT is transforming our everyday world into a global network: connecting people, increasing understanding, and making services available at the touch of a button. The new services offered through this technology like e-mail, video conferencing, online chatting has brought people all around the world very close. Now these services are offered to the rural population of India and this has made their linkage with their relatives and friends outside the place stronger as they can now communicate to then quickly, cheaply and more often [4].

Organisational Achievements

1. Digital partners award for Social Enterprise 2002
2. Case by World Resource Institute 2001
3. Invitation by UNDP to join the GDOI (Global Digital Opportunity Initiative)

Skill Development and Application

Generally the literacy level in the rural communities is quite low so training and skill development of the people out there becomes indispensable for the effective implementation of any development project. From the very beginning of this ICT project [5], importance of personnel training and skill development was realized and a formal training program was scheduled for the Information Kiosk Operators. The local people with a minimum high school education and 3 – 12 months of computer education from ITI or a private institute were selected for being kiosk operators. They have to undergo 8 days formal training scheduled by the company. This is at present being imparted at Madurai Center for Entrepreneurship Development. The training covers:

- Basics of computers
- Use of Internet and other related services like e-mail, information search etc.
- Various applications developed specifically for this project like e-governance, local
- General maintenance of various electronic gadgets installed at the Information kiosk
- Marketing for services offered by Information Kiosk at local level

Replicating the Experience

The franchisee model of the company gives it the flexibility to evolve different partnership models selecting the best tailored to the area of operation, though the core business model remains the same. At present the company is ongoing with following similar projects:

Nellikuppam

In this project the company is partnering with EID Parry, a major business house in the Murugappa Group, that has a significant rural interests and presence. The project is being implemented at Nellikuppam, Cuddalore district, Tamilnadu. EID Parry has undertaken to provide help to Internet Kiosks in about 150 villages around its factory. The farmers in these villages are their primary raw-material suppliers. They have developed a Portal – called India-agriline.com – that is to be a one stop for all the rural people in that area, providing information to them ranging from sugar cultivation methodologies to matrimonial advertisements.

Dhar

The company is also working with the Gyandoot Foundation to provide Internet services in the Dhar District of Madhya Pradesh. The Gyandoot project which was started by the district administration has set up kiosks in Dhar to primarily provide a Government-to-Citizen website. The project was being run as an Intranet because of the lack of connectivity to the internet. With the involvement of this company and the application of this technology, Internet services are available at these kiosks. Further, the uptime of the connections is nearly 100%. Previously, with dial-up lines, the only hindrance to total profitability for the kiosk operators was the failure rate of the telephone lines.

Critical Success Factors

One of the critical success factors, probably the most pivotal in this case has been the enthusiasm and motivation of the private participants who developed a community based on trust and transparency. The model relies mostly on local entrepreneur who makes a portion of the investment and thus becomes a major stakeholder who drives for service volume. The various elements that contributed are summarized below:

1. **Reliable and cost effective technology:** Any technology that is to be used in rural areas has to be cost effective and reliable. The project used a low cost technology that needed very little infrastructure. Using a small investment they were able to cover a large number of villages. Similarly, by using the same infrastructure they covered a larger area.

2. **Value added services:** The network was used to deliver a number of value added services rather then being used us a mere telephone line. Through the network they could get access to health services, education, entertainment, agriculture and government support (e-governance). By making kiosk a shared services delivery point large customer acceptance is ensured.

3. **Government commitment:** Tamil Nadu Government initiates an e-governance programme for the transformation of Tamil Nadu in to a knowledge society. N-Logue was able to implement a number of elements of this project under that scheme. This networking helped n-Logue to develop by leveraging the government to realize the rural networking without a high cost.

4. **Entrepreneur model for Kiosks:** For establishing Internet Kiosks local entrepreneurs were used. This allowed easy establishment of credibility with the users. Second, entrepreneurs ensured the success of Kiosks sine each of them invested about Rs. 50,000 to become the Kiosk operators. Moving away from the government supported model helped n-Logue to expand its reach in a short span of time. Another factor that helped the Kiosks to operate in a commercial fashion was the training of the Kiosk operators to become effective service providers. All the operators were trained to handle the multiple applications. The main reason for the growth of this model was the freedom given to the entrepreneur to innovate and introduce new services, thereby customizing to the local needs and ensuring

maximum customer satisfaction. In services, innovativeness essentially comes from the freedom to provide new services without any adding costs.

5. **Localized Content creation:** In a pluralistic society 'content is the king'. The success of any Internet service for low-income groups will depend upon the richness of the content. Special content providers were identified and after interacting with the users the contents were developed. This ensured that contents developed were useful to the local requirements. This also allowed for bottom-up innovations to emerge. Innovation occurred both in the type of services and in the content creation.

6. **Economics of scope:** The information Kiosks are used for multiple uses by multiple users. The computers are used for a variety of purposes such as:

    - off-line applications
    - e-mail
    - entertainment based on Internet
    - on-line knowledge delivery (agriculture/delivery)
    - on-line application for certificates
    - advertisement
    - insurance applications and
    - on-line medical check-up.

Conclusion

Economies of scope and entrepreneurship together make this project sustainable. The project owes its success to the vision of an engineer/inventor who invented the delivery model. Organizing activities differently also is form of innovation [6]. Using a combination of private participation forms such as entrepreneurship and franchise relationships they are able to penetrate into rural areas that had no telephones. The ICT platform will induce social development, entrepreneurship, technology diffusion and employment generation. The Kiosks are working economically and the model is being replicated in many other districts of Tamil Nadu. Private participation can help in the rapid diffusion of ICT into rural areas and it can be seen that the networks have become sustainable as each of the kiosk operators is earning revenue for its sustenance. In rural areas technological solutions can become sustainable only when the costs are low and this is possible only when investments made are sustainable at reasonable volumes. The main lesson one can derive is that organizing economic activities that will help many sections of society can work when the local involvement and trust are high. Success essentially comes from these soft aspects such as the ability to bring entrepreneurial spirit to connect technology and organization. The connecting bridge is the vision and entrepreneurship that leverages the opportunity created by digital convergence.

The platform is used for a variety of applications. This case study illustrates the manner in which a community network was established through the use of combination of franchises and entrepreneurs. Here again, the main reason for the success of the platform has been the entrepreneurial orientation of n-logue and clear understanding of the user needs. The selection of a low cost technology has been one of the critical success factors. Though it was a new technology the reliability of the system was high and this helped in creating high levels of acceptance.

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