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CASE STUDY: INDIA

ENABLING RURAL INDIA WITH INFORMATION AND COMMUNICATION TECHNOLOGY INITIATIVES

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1 Introduction

***"So far as I am able to judge, nothing has been left undone, either by man or nature, to make India the most extraordinary country that the sun visits on his rounds. Nothing seems to have been forgotten, nothing overlooked."* --Mark Twain, from Following the Equator**

India's journey towards prosperity began post-independence in 1947 and progressed in a very lethargic pace, leaving it out of step with many other countries whose progress post World War II has been impressive. The transformation started with the liberalisation of the economy in 1991. The economy got the necessary impetus and conditions changed favourably. The service economy surged and living standards started improving. But, the improvements were predominantly urban in nature and rural India, which houses 741 million people in over 638,000 villages, was largely left undisturbed. The rural people had to confront an obsolescent infrastructure, abysmally low literacy levels, inefficient healthcare, crushing poverty in some areas and a tottering economy that left them in serious danger of irrelevance as compared to their urban counterparts.

Yet, they were not completely forgotten. Their need for solutions to address pressing problems was not overlooked either. Recent technological advancements, an astute private sector, a dedicated group of NGOs and successive governments have put the spotlight back on rural India. There have been several attempts to ameliorate the lives of rural people and empower them. Some have been driven by very altruistic motives while others for pecuniary reasons. Nevertheless, the common goal has been to improve the living standards of the rural populace. Information and Communication Technology has been used as the enabling tool while Internet-based applications and services have been effectively used to achieve this goal.

The larger questions that this case study deals with are – Is it possible to use ICT and the Internet to make a difference in the lives of millions of people? And, what can it be? What technologies would be required for this gargantuan effort? And, have these attempts made a difference in bridging the digital divide that so starkly separates urban and rural India? This case study examines these questions in depth and provides both the answers and hope for a better future.

Chapters 2, 3 and 4 provide the backdrop of the current scenario in India, specifically rural India and the state of the telecom industry. Technological advancements have brought down the cost of connectivity and thus a very crucial barrier in bridging the digital divide has been brought down. Chapter 5 discusses these various technologies and their evolution. Several applications and services that are targeted towards the rural populace in the areas of education, healthcare, animal husbandry, banking, insurance, trade & commerce and government interactions are a natural outcome of the availability of these technologies. Chapter 6 addresses these. Chapter 7 provides a glimpse in to the efforts of private, for-profit and non-profit initiatives whose attempts are key to penetrate and overcome the solid barriers hindering rural development. While these chapters portray a picture of hope for a prosperous future, the lessons learnt need to be assimilated and improved upon. Well-meaning initiatives need to be sustained and encouraged with the requisite regulatory and policy changes that have been recommended in Chapter 8.

Internet is a great leveller which helps reduce physical distances and eliminate class differences and socio-economic inequalities. This case study validates that premise and holds a promise that rural India has the potential to evolve on its own right and truly stand up to its more advanced brethren, be it in urban India or in the developed world.

2 Country Background

2.1 Geography

India lies entirely in the northern hemisphere, extending between latitudes 8 deg. 4' and 37 deg. 6' north, longitudes 68 deg. 7' and 97 deg. 25' east and measures about 3,214 km from north to south between the extreme latitudes and about 2,933 km from east to west between the extreme longitudes.

The mainland forms a natural subcontinent with the Himalayan mountain range to the north, the Arabian Sea to the west, the Bay of Bengal to the east and the Indian Ocean to the south. India borders Pakistan to the northwest; China, Bhutan and Nepal to the northeast; and Bangladesh and Myanmar to the east. Near India's southern tip, across the Palk Strait, is Sri Lanka. India occupies the greater part of the subcontinent of Southern Asia. The mainland comprises of four regions, namely, the Himalayan regions, interspersed with wide plateaus and valleys, stretching from one end of India to the other in the northernmost part of the country; the near-level Indo-Gangetic plains, formed by the basins of three rivers – the Sind, the Ganges and the Brahmaputra; the desert regions, covering the whole of Rajasthan and the Deccan plateau and peninsula, extending south of the Vindhyas.

2.2 Population

India is one of the emerging powerhouses of the 21st century. Along with China, India garners the most attention for its sheer size, the diversity of its huge population, the challenges that its complex economy poses and at the same time, for the potential of rich dividends that investors from the developed world look forward to. India is home to 1.027 billion[1] people who speak 18 official languages apart from 1,600 minor languages and dialects. This population which stands next only to China and is five times that of Brazil, lives on a land mass that is only 34 percent of China's landmass and 38 percent of Brazil's area. Of an estimated 191.9 million households, a whopping 72 percent or 138.2 million live in rural areas.[2]

India is ranked 127 among the 177 countries studied in the Human Development Index (HDI) published by the United Nations Development Program (UNDP) in July 2004. As per the latest report, India fares far worse than other developing countries like China (94) and Brazil (72). The economic growth seen since 2001 has not made much of an impact in improving India's position in the HDI with India's rank stagnating even now at the 2001 levels (127).

Life expectancy at birth in India has jumped from 48 in the 1950s to 63.7 in 2002 but is worse off when compared to China at 71 and Brazil at 68.1. Infant mortality rate has almost halved from 130 in 1971 to 67 in 2002, but still has a lot of catching-up to do to reach the levels of China which is at 31 and Brazil which is at 30. The number of physicians per 100,000 inhabitants is at 51 compared to China with 164 and Brazil with 206. The

[1] Derived from: Indian Market Demographics Report 2002, published by National Council of Applied Economic Research (NCAER) and Census 2001, published by Government of India.
[2] Table H-5 India: Census 2001, published by the Government of India.

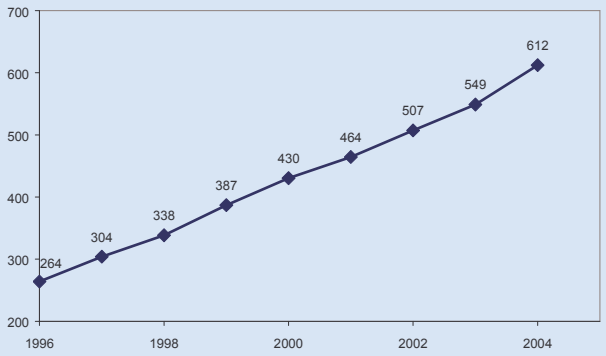
economic condition of the people is very poor with 34.7 percent of the population earning less than US$ 1 per day. [3]

Seventy two percent of the 1.027 billion-strong population live in rural areas and the remaining twenty eight percent in the 3,700 cities and towns that constitute urban India.[4] The economic liberalization policies of the Government of India have resulted in developing the services industry by leaps and bounds. However, the fruits of this growth are mostly enjoyed by an urban populace, with increased purchasing power and an array of goods and services to choose from. This has encouraged the migration of the rural populace which largely got left behind in this economic revival, resulting in a growth in the urban population from 26.6 percent in 1996 to 28.1 percent in 2002.

2.3 Economic indicators

India's Gross Domestic Product (GDP) more than doubled in the period between 1992 and 2002 from US$ 244.2 billion to US$ 510.2 billion. By 2003, this stood at US$ 572.7 billion. The GDP of India's rural populace of 741 million is estimated to be US$ 140 billion.[5]

Figure 2.1: Economic Indicators for India - GDP in US$ billions



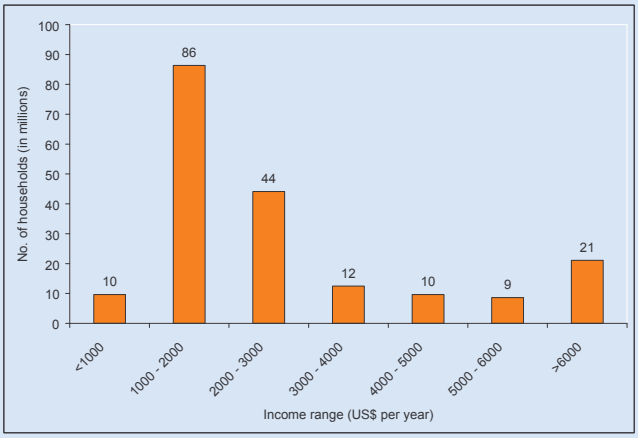
Source: Economic Intelligence Service, Centre for Monitoring Indian Economy

Powered by an average growth rate of 4.2 percent during this decade, the GDP per capita grew to US$ 539 in 2003 (*see Figure 2.1*). The per capita GDP stood at US$ 2,670 (PPP)[6] compared to China's US$ 4,580 and Brazil's US$ 7,770. This growth was fuelled predominantly by the services sector whose contribution stood at 50.7 percent in 2002, up from 42.3 percent in 1992. Interestingly, at the same time, agriculture declined from 30.9 to 22.7 percent.[7]

The income distribution is pretty skewed with the richest 20 percent of the households[8] contributing to 41.6 percent of the national income and the poorest 20 percent of the households contributing only 8.9 percent. Disparity in income distribution is very high with 73 percent of the households languishing with annual household incomes below US$ 3,000 (*see Figure 2.2 and Table 2.1*). Compare this with the per capita GDP at US$ 2,670 as given in the paragraph above.

[3] Human Development Report 2004, published by the UNDP.
[4] Urban Infrastructure, published by the Federation of Indian Chambers of Commerce and Industry, http://indiainbusiness.nic.in/languages/English/Urban percent20Infrastructure.pdf
[5] Human Development Report 2004, published by the UNDP.
[6] Purchasing power parity exchange rate is the number of units of a country's money required to buy the same quantity of goods and services as $1 buys in the United States.
[7] India at a glance, Feb 09, 2004, The World Bank Group - http://www.worldbank.org/data/countrydata/aag/ind_aag.pdf
[8] An average Indian household consists of 5 individuals.

Figure 2.2: Income distribution among rural and urban households in India



Source: Human Development Report 2004, published by the UNDP.

Table 2.1: Income distribution among rural and urban households

Annual household income range (US$)	Percentage of households	No. of households (millions)
<1000	5	10
1000 – 2000	45	86
2000 – 3000	23	44
3000 – 4000	6.5	12
4000 – 5000	5	10
5000 – 6000	4.5	9
>6000	11	21
Total	**100**	**192**

Source: Human Development Report 2004, published by the UNDP.

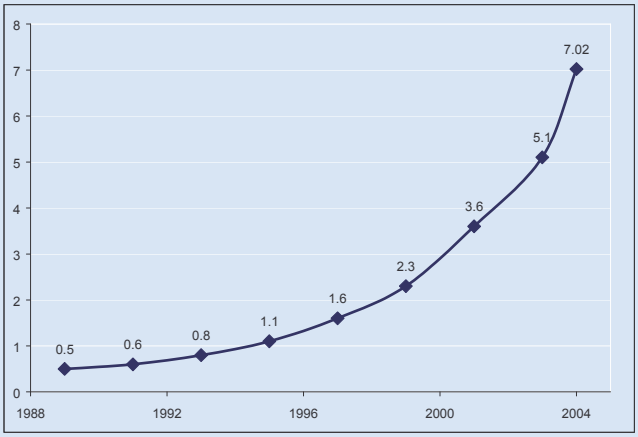
2.4 Telecommunications

Telecommunications had been the sunshine industry of the '90s in India and has since continued its dominant role in the growth of the Indian economy. It has witnessed robust growth rates boosted by an especially strong performance in the mobile telephony market, which closed at 33.7 million subscribers at the end of March 2004. At the same time, the number of wireline subscribers stood at 42.84 million. According to the Economic Survey 2003-04, India more than trebled its tele-density during the last five years from 2.33 in March 1999 to 7.02 in March 2004. However, this has been fuelled largely by a stupendous growth of 159.2 percent in mobile telephony, which has been confined to the metros and a few circles.

Though the graph below (*see Figure 2.3*) shows significant growth, the tele-density levels are still very low when compared to other developing countries like China (42.32) and Brazil (42.38). The status of the telecom infrastructure remains woefully inadequate to meet the demands of its huge population. This is despite an increase in spending on Information and Communication Technology (ICT) as a percent of GDP from 2.1 percent in 1995 to 3.9 percent in 2001.[9] The developments and the intricacies of the Indian telecom sector have been discussed in detail in *chapter 3*.

[9] Development Data Group, The World Bank Group

Figure 2.3: Tele-density in India



Source: Indian Telecommunication Statistics 2002, Ministry of Communication and Information Technology, Government of India; Telecommunication industry performance indicators 2002-03, TRAI; Telecommunications, Infrastructure, Economic Survey of India 2003-04

3 Rural India: A glimpse

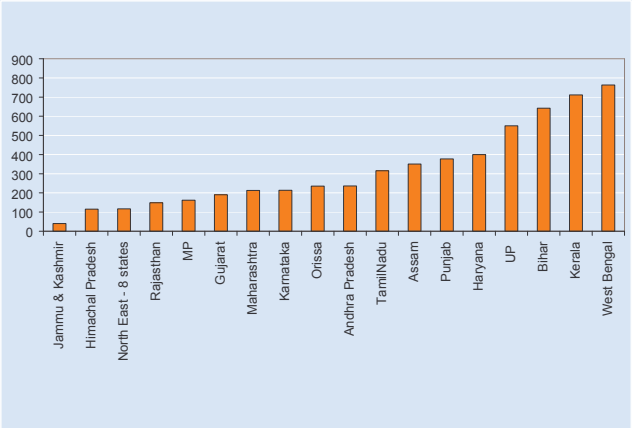
India is largely an agrarian society. Agriculture has been the mainstay of business ever since India got independence in 1947. Former Indian Prime Minister, Pandit Jawaharlal Nehru once remarked, "The heart of India lives in its villages."

3.1 Rural Population

India, the largest democracy and the second most populous country in the world, is predominantly rural in nature. Of the 1.027 billion-strong Indian populace, 741 million live in 638,365 villages scattered across the diverse terrain of India.

However, the average population density in rural India is not at all low when compared with other countries of the world; it is at over 300 people per sq km. In many states, it is much higher with the rural population density as high as 760 persons per sq km as in the state of West Bengal (*see Figure 3.1*). More than 70 percent of the rural population is concentrated in villages with an average population of 1300.[10]

Figure 3.1: Rural population density of different states of India (persons per sq km)



Source: Market Demographics Report 2002, published by NCAER and Census 2001, published by the Government of India.

3.2 Education and Literacy

Rural India is largely illiterate with the literacy rate at 49.4 percent compared to the urban populace, where the literacy rate is 70 percent. A deeper analysis of the working class reveals an even bleaker scenario, wherein 68 percent of rural males and 90 percent of rural females are either illiterate or have been educated only up to the primary level.[11]

The education system has an inherent inefficiency in the lopsided ratio of a huge number of students to a teacher at 43:1. In rural areas, more than 75 percent of schools have one teacher taking simultaneous classes for students placed at different educational levels. Many villages do not have schools or lack the proper infrastructure for running one. The villages that do have schools often cater to the needs of students of several villages nearby. Yet, access to these schools is difficult with no proper roads or transportation facilities. An alternative available to parents is to send their children to schools in bigger towns nearby leading to overcrowding of these town-schools. Invariably, the quality of education imparted suffers as a result. The dropout ratio is very high with only 40 percent of primary school entrants managing to reach grade 5 i.e. complete 5 years of education.[12]

[10] Market Demographics Report 2002, published by NCAER and Census 2001, published by the Government of India..
[11] Primary Level of Education is defined as less than 5 years of education in the Census of India.
[12] Economic Survey 2003-04 published by the Ministry of Finance, Government of India

3.3 Rural Healthcare

Rural healthcare is handled by the Government through Primary Healthcare Centres (PHCs). In 2003, there were 163,195 PHCs to provide healthcare to the 638,365 villages at an average of 4 villages per centre (*see Table 3.1*). Many villages do not even have easy access to hospitals.[13] The quality of care provided by the PHCs varies quite a lot with service levels abnormally poor in many PHCs.

Table 3.1: Healthcare in India

	1951	1981	2003
Primary Health Centres	725	57,363	163,195
Dispensaries and Health Centres	9,209	23,555	38,031
Beds	117,198	569,495	914,543
Nursing personnel	18,054	143,887	832,000
Doctors	61,800	268,700	605,840

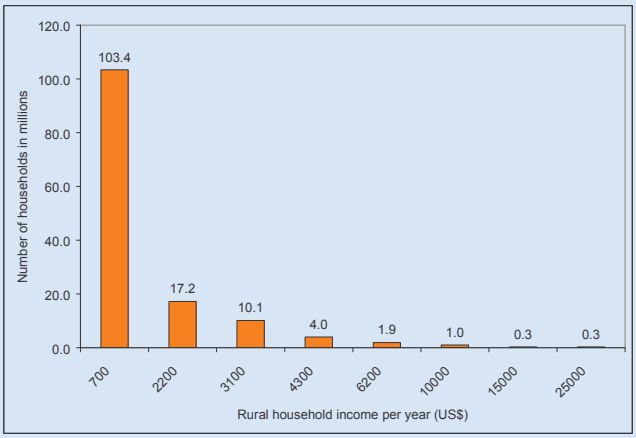
* All figures except for the number of PHCs are on an all-India basis (including both urban and rural statistics)

Source: Economic Survey 2003-04 published by Ministry of Finance, Government of India

3.4 Rural Economy

The rural GDP now stands at US$ 140 billion contributing to 24 percent of the national GDP. With 138.2 of the 191.9 million households living in rural areas, the GDP contribution is highly disproportionate. With an average of 5 people per household about 85 percent of households earning less than US$ 900 per annum, and with the per capita income at a meagre US¢ 50 per day, the heart of India remains poor to a larger extent.

Figure 3.2: Income distribution of rural households in India



Source: Income distribution-Rural Households: India Market Demographics Report (IMDR), 2002, published by NCAER

The income distribution is extremely skewed with 74 percent of rural households in the low income bracket, earning less than US$ 700 per annum, 23.1 percent in the middle income bracket earning between US$ 1,800 and 4,800 per year and a paltry 2.9 percent in the higher income bracket bringing home more than US$ 4,800 in a year (*see Figure 3.2*).

[13] Economic Survey 2003-04 published by the Ministry of Finance, Government of India

3.4.1 Source of income

Agriculture is the major economic activity in rural areas. Agriculture and allied activities employ 66.23 percent of the workforce of which 13.57 percent are landless labourers. Non-agriculture activities provide livelihood to 39.77 percent of the rural population. Working in agriculture was the primary activity for 82 percent of the young men (between 24 to 45 years of age) in 1971, dropped to 73 percent in 1982 and was at 53 percent in 1999.[14] Even though the dominance of agriculture has decreased, it still retains its importance and contributes to 23 percent of the national GDP.

The land holding pattern in the rural areas is uneconomical and inefficient. Small landholding makes it unviable to use intensive farming techniques thereby pulling down agricultural productivity. Given these limitations, cultivation of high-yield crops that would improve returns is the best way to improve rural economy. But, high-yield crops are more labour-intensive and need support for processing, storage, transport, and marketing to reduce the risk of income loss emanating from spoilage and changing market forces. With the growing share of high-value perishable crops and fisheries & livestock products, agro-processing and support services for rural infrastructure such as water, power, transport, and telecommunications assume greater importance. Education is also imperative to ensure effective use of technology to get better returns.

3.5 Infrastructure

The problems affecting the rural economy are manifold, the prime ones being infrastructural in nature. The vastly inadequate infrastructure in the rural areas results in wastage of agricultural produce, time and money. The absence of proper communication facilities results in wasted time and resources chasing information which is often either unavailable or not dependable. This affects the rural poor more than other sectors of the community. Lack of timely market information (on commodity prices, suppliers of various inputs, etc.) leads to loss of income.

In such a scenario, rural people depend on layers of middlemen who finance, buy, sell and even transport farm produce from the villages. Middlemen play a very crucial role in the rural areas in the absence of enough funds available with official sources or of fool-proof and credible initiatives by the Government to provide micro-credit.

However, dependency on these middlemen also meant that the farmers got to retain a smaller share of their potential income. Intervention from the government came in parts with banks offering finances and *mandis* facilitating regulated sales of farm produce. Yet, they could not provide all the services that the middlemen did. Thus, the problems of the rural people were still not alleviated. The infrastructure scenario has improved in the past 4 decades; however, it still leaves a lot to be desired.

3.5.1 Water and Sanitation

Basic facilities like access to drinking water are not available, with only 79 percent of the rural population having sustainable access to improved drinking water source. The sanitation scenario is even worse with only 15 percent having sustainable access to improved sanitation. Urban India is better placed with 95 percent of the population having access to drinking water and 61 percent having access to improved sanitation.[15]

Based on the availability of renewable water sources, India has enough water to meet its people's needs. But despite an estimated 2,464 cubic metres per person per year, severe water shortages are common, in part as a result of uneven availability of water. Most rainfall happens during the monsoon season, from June to September, and the levels of precipitation vary from 100 millimetres a year in the western parts of Rajasthan to over 9,000 millimetres in the north eastern state of Meghalaya.[16] While floods are common in the Ganges and Brahmaputra basins, droughts are common in Rajasthan and the Southern parts of the country.

[14] Rural Poverty in India in an era of Economic Reforms, Devendra Kumar Pant and Kakali Patra.
[15] At a glance: India, 2004, United Nations Children's Fund - www.unicef.org/infobycountry/India
[16] India - Country Paper 1992, M.S. Reddy for the International Conference on Water and Environment, Dublin.

Mechanisms for allocating scarce water are critically important as large areas of India are relatively arid. Water contributes to welfare in many ways viz., health (e.g., clean drinking water), agriculture (e.g., irrigation), and industry (e.g., hydroelectric power). India is a federal democracy and rivers cross state boundaries. Therefore constructing efficient and equitable mechanisms for allocating river flows has long been an important legal and constitutional issue. Numerous inter-state riparian disputes have erupted since independence. The Krishna – Godavari water dispute among Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh and Orissa; the Cauvery dispute between Tamil Nadu and Karnataka; and the Ravi – Beas dispute between Punjab and Haryana have caused bitter inter-state rivalry in the country. The government of the state of Punjab even went to the extent of abrogating the agreements with neighbouring states to share the water from the rivers of Ravi, Beas and Sutlej on July 12, 2004.

An ever increasing population and the unpredictable nature of monsoons have resulted in the depletion of ground water resources. Most of the water-starved states face water crises for irrigation as well as drinking. To ameliorate this difficult situation, the Ministry of Water Resources is exploring the possibility of a large scale project to interlink the rivers in India.

3.5.2 Electricity

Per capita electricity consumption of India, urban and rural inclusive has grown from 173 kWh in 1980 to 561 kWh in 2001. During the same period, China has grown from 307 kWh to 1139 kWh and Brazil from 1,145 kWh to 2,122 kWh. India consumes 497.2 billion kWh of electricity in a year and ranks seventh in the world in terms of consumption. In the last 25 years, electricity consumption has gone up by more than 6 times. Consumption growth is much faster in individual and agriculture segments as compared to industrial and commercial segments.

Yet, 13 percent of the villages (81,660 in number) are yet to be electrified. Uttar Pradesh and Bihar, the most populous and the least literate states respectively contribute to more than 50 percent of these villages. More than 18,000 of these villages cannot be electrified through conventional means due to the terrain they are in.[17] Even among the 87 percent villages that are electrified, the quality of power delivered is poor with power supply available only for a few hours in a day. Load shedding and power cuts are norms rather than exceptions. In the water-starved states where irrigation is highly dependent on ground water that needs to be drawn out using electricity pumps and motors, such erratic power supply affects agriculture adversely.

3.5.3 Roads

Roads cater to 85 and 70 percent of passenger and freight movements respectively in India. [18] But, the quality of roads including that of the major highways is poor by international standards. The average speed of a truck is between 30 and 40 km per hour and a truck typically travels about 200 km per day. The current Indian scenario looks gloomy when compared to 350 to 400 km per day which is ideally possible in better road conditions. Such inefficiencies cause inordinate delay in the delivery of goods and increase fuel consumption. The effects of these adversely impact Indian producers of goods and services blunting their competitive edge in the international arena.

More than 25 percent of villages have no road link, and about 60 percent have no all-weather road link. However, all-weather roads serve almost all villages in smaller and developed states like Kerala, Haryana, and Punjab. In contrast, only 15 percent of villages in Orissa and 21 percent in Rajasthan are connected with all-weather roads. The current estimated value of the existing rural road network, based on the value of construction work, is about US$ 54 billion.[19] Maintenance of the existing rural roads alone would need US$ 1 billion of which only 20-30 percent is available.

[17] Development and Climate: An Assessment for India - http://developmentfirst.org/india/report/chapter1.pdf
[18] The Ministry of Road Transport and Highways, Government of India - http://morth.nic.in/
[19] India's Transport Sector: The challenge Ahead, volume 1: Main report, Ashok Kumar, Zhi Liu, Piers Victors, May 10, 2002.

The Government of India launched a national program called "Pradhan Mantri Gram Sadak Yojana" (Prime Minister's Rural Road Program) aimed at providing all-weather road access to all habitations with a population of 1,000 and above by the year 2003, and those with a population above 500 by the year 2007. Besides providing connectivity to about 100,000 habitations, the program also aims to upgrade about 500,000 km of existing rural roads.

The Government of India has created a fund – Central Road Fund (CRF) to meet the challenges of accelerated funding requirement for all categories of roads in the country. The Government has levied a cess of US¢ 2 on each litre of petrol and diesel sold and 50 percent of the cess on diesel has been apportioned for the development of rural roads.[20]

Rural telecommunications, the core of this paper is discussed as a part of the following chapter.

[20] Ibid.

4 Indian Telecom Industry: Background

The Indian telecom journey had a modest beginning with the setting up of the first experimental electric telegraph line between Calcutta and Diamond Harbour in 1851. Subsequently, telephone services were offered to the general public from 1881 onwards. Until the mid '90s, telecommunication in India was controlled by the state-run operators, Bharat Sanchar Nigam Limited (BSNL) and later by the Mahanagar Telephone Nigam Limited (MTNL) in the cities of Delhi and Mumbai. The state-owned Videsh Sanchar Nigam Limited (VSNL) launching Internet Services in August 1995. The state-owned organizations held a monopoly over their sectors for a long time till the National Telecom Policy 1994 (NTP 94) allowed the entry of private players into the telecom sector.

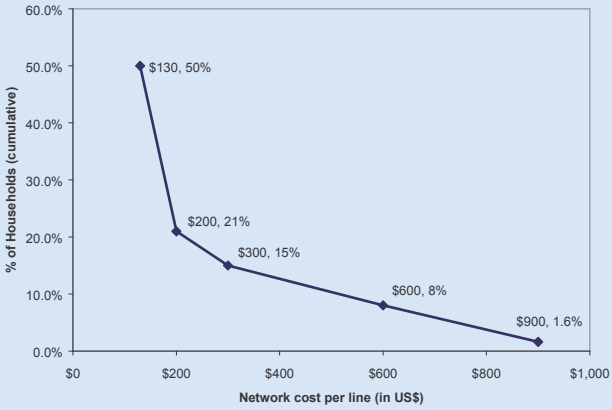
4.1 Mobile

NTP 94 paved the way for the introduction of mobile telephony in India. According to NTP 94, India was divided into 23 telecom Circles or Service Areas and two Cellular Mobile Telecom Service (CMTS) licenses were offered in each Service Area based on competitive bidding to operators. The first mobile service was launched in Kolkata in 1995. The mobile industry hyped to be the sunrise industry of the 21st century could manage only 1 million subscribers by 1998.

The reasons are multi-fold. The consultants and foreign partners of the Indian operators ignored ground realities and over-hyped the potential of the Indian middle class and its purchasing power. Chasing this non-existent middle class money, operators bid for licenses at exorbitant rates in 1994. With the cost of mobile handsets at approximately US$ 500 and mobile tariffs at US¢ 30 per minute, the projected growth and return on investments remained a mirage. Further, the infrastructure costs including Capital Expenditure (CAPEX) and Operating Expenditure (OPEX) were very high, leaving the telecom industry on the verge of bankruptcy in 1998.

Figure 4.1: Telecom affordability for Indian households at different Network infrastructure costs

In the 1990s, telephone operators had to spend around US$ 700 per line as infrastructure cost. At such investment levels, operator needed to get a return of US$ 25 every month which is steep for a country where the per capita income is a mere US$ 50 per month. The chart illustrates the percentage of Indian households that could afford telephony and Internet connectivity, assuming 5 percent of their household income is spent on communications at various levels of investment per line. If the investment was more than US$ 700, hardly any Indian could afford the services. However, if the cost of network infrastructure could be reduced to about US$ 100 per line, telecom services could be easily affordable to more than 50 percent of households.



Source: Challenges in Rural Connectivity for India, Prof. Ashok Jhunjhunwala, May 15, 2002, http://www.bytesforall.org/9th/html/challenges_ashok.htm.

The tide turned for the mobile industry with the introduction of National Telecom Policy 1999 (NTP 99). The Government of India made a revolutionary gesture (*see Box 4.1*) attempted by none else across the world. It waived off the license fee obligation committed by the operators through open bidding and migrated to a revenue share regime. It also paved the way for an increase in the number of mobile operators in each telecom

circle. By December 2002, there were 78 mobile licenses owned by 25 companies with a maximum of 4 licenses in each service area.

Box 4.1: Revolutionary steps by the Government

NTP 94 envisaged the rollout of GSM-based mobile service by private operators with licenses being awarded on open bids. The license bids for the 23 Service Areas were cumulatively worth US$ 15 billion. The private operators over estimated the potential of the market and bid for such exorbitant sums. However, the projected revenues never happened, crippling most of the operators badly. Many operators either missed to pay the license fee installments or delayed the payment of dues. This distressed state of affairs led to hoards of litigations against the government. Assessing the gravity of the situation, the Government of India came up with a revolutionary solution that could potentially rectify this situation. The Fixed License Fee regime which was causing an unsustainable financial drain for the operators was withdrawn and a Revenue Share regime was introduced through NTP 99.

Migration to the revenue share regime came into effect on August 01, 1999. This migration package was accepted immediately by the operators but cost the exchequer approximately US$ 3.33 billion. Yet, in its bid to improve the state of telecom affairs in India, the Government went ahead with this proposal and paved the way for the subsequent booming of the Telecom market. This move was unprecedented across industries in the country and also in the world.

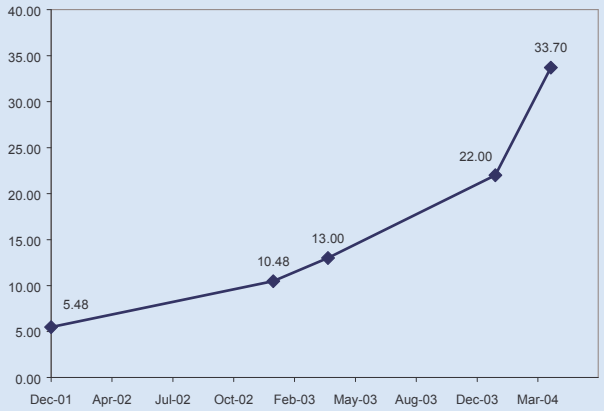
The license fee paid by operators up to July 31, 1999 was considered as entry fee. And from then on, 15 percent of the gross revenues of operators were passed on to the Government under the revenue sharing model.

In the post NTP 99 scenario, with the maturing of mobile technologies and standardisation which lead to economies of scale, the cost of infrastructure also came down. The cost of mobile handsets also headed south from the earlier levels of around US$ 500 to approximately US$ 40. Thanks to increased competition and reduced cost structure, mobile tariffs dropped by over 90 percent in 4 years - a feat unparalleled by any other sector or industry in India. The average airtime tariff in 2003 prevailed at around US¢ 3 per minute as against the peak ceiling tariff of US¢ 30 per min in 1998.

Yet again in 2003, the Government of India introduced Calling Party Pays (CPP) regime and thus, played a key role in further increasing the affordability of mobile services.

All these factors resulted in a surge in the subscription of mobile services and mobile operators were able to venture into more cities and towns of the country. Currently, mobile services are available in almost 1400 cities and towns of India. The Indian mobile sector has been growing at a Compounded Annual Growth Rate (CAGR) of 85 percent. The mobile subscriber population zoomed from 1 million in 1998 to 33.7 million in March 2004 (*see Figure 4.2*).

Figure 4.2: Mobile Subscribers in India (in Millions)



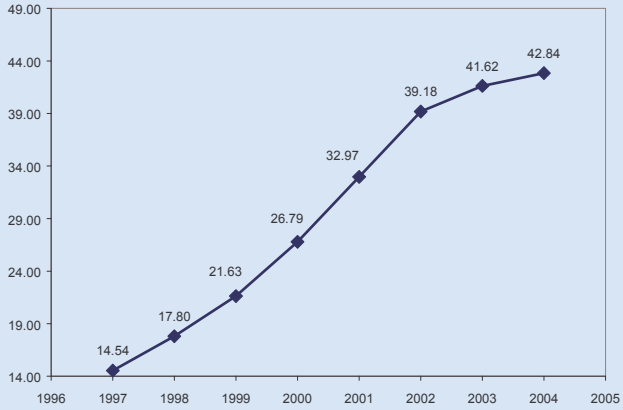
Source: Cellular Operators Association of India

4.2 Wireline

Ever since India gained independence in 1947, state-owned companies held undisputed monopoly over wireline telephone services. Private participation was allowed post-NTP 94. But the growth in this sector was driven predominantly by the state-owned BSNL and MTNL.

The wireline subscriber population which was at 4.2 million in 1989 stood at 42.84 million in March 2004 (*see Figure 4.3*) with private operators contributing to 2.36 million. The growth has largely been in the urban areas. As part of the license conditions of the private players in basic services, the NTP 94 mandated that 10 percent of their coverage be provided in rural areas. Even the state-owned BSNL has only 1.75 percent of its total coverage in rural areas signifying the dismal state of affairs in rural India.[21]

Figure 4.3: Wireline Subscribers in India (in Millions)



Source: Annual Report 2002-2003 published by Department of Telecommunications, India

Telecommunications in rural areas is provided through Village Public Telephones (VPTs) and Direct Exchange Lines (DELs). Rural connectivity was predominantly handled by the state-owned BSNL. The number of villages provided with VPTs increased from 0.48 million in March 02 to 0.52 million in March 04. The private sector has provided a paltry 8000 VPTs. The total number of Direct Exchange Lines (DELs) provided in rural areas was at

[21] A Framework for Assessing Universal Service Obligations: A Developing Country Perspective, Rekha Jain and Pinaki Das.

10.67 million as on December 02. An estimate by the Government of India projects that 726 million of the 741 million rural people have access to telephone services.

4.3 Long distance

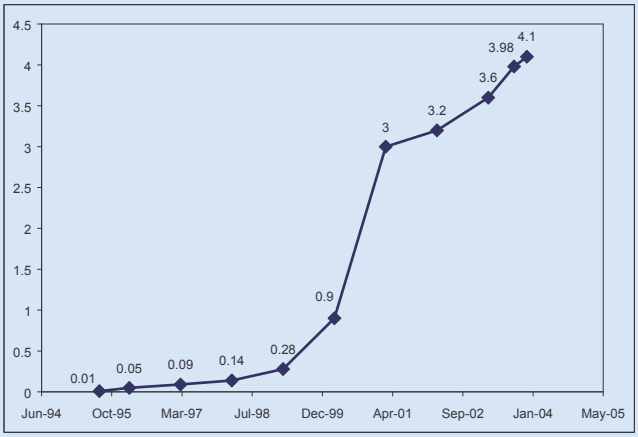
The monopoly enjoyed by the state-owned BSNL and VSNL in National and International Long distance sectors was dismantled in 2000 and 2002 respectively. VSNL was bought over by the TATAs (a leading Indian business conglomerate) and competition stiffened with the entry of Bharti Tele-Ventures Limited (in partnership with SingTel) and Reliance Infocomm post its acquisition of Flag Telecom. Increased rivalry in this sector has resulted in a significant drop in tariffs. According to the Economic Survey 2002-03 report released by the Government of India, call tariffs for national long distance dropped by 56 percent, international long distance by 47 percent and mobile-to-mobile national long distance by 70 percent making telecommunications extremely affordable to the masses.

4.4 Internet

Internet was brought to India by the state-owned VSNL in 1995. VSNL enjoyed a monopoly till the Government decided to allow private players to be Internet Service Providers (ISPs) in November 1998. More than 590 licenses were issued since 1998. Of the 590 licenses issued, 200 have been surrendered and only 189 are operational currently.

India currently has 1.7 Internet users per 100 persons compared to a global average of 12.2. The Internet penetration is inadequately low compared to other developing countries like China (6 percent) and Brazil (10.8 percent). The population of Internet users stood at 18.48 million as of May 2004.[22] The phenomenal growth experienced in the late 1990's in the number of Internet subscriptions has since tapered in the last couple of years.[23] The number of Internet subscribers in India was at 4.1 million in 2004 (*see Figure 4.4*). The Internet growth is predominantly an urban phenomenon with the capital cities (New Delhi and other state capitals) accounting for 79 percent of Internet connections in the country.

Figure 4.4: Internet Subscribers in India (in Millions)



Source: Internet Service Providers Association of India.

The broadband scenario is even worse with 0.02 broadband connections per 100 persons compared to China with 1.4 and Brazil with 0.28 connections per 100 persons. The reasons for the dismal performance are the high

[22] http://www.Internetworldstats.com/stats.htm
[23] The Indian Telecom Services Performance Indicators Oct – Dec 2003, Telecom Regulatory Authority of India (TRAI), March 2004.

costs of infrastructure, bandwidth and service; lack of viable options in providing the last-mile access and the lack of suitable applications and services.[24]

In light of the above, the Government of India has identified "providing broadband connectivity at the most reasonable prices" as one of the key objectives in its recently released ten-point agenda for communications in India.

4.5 Tele-density

The telecom boom, which swept through the Indian telecom industry is predominantly urban in nature and has left rural India in the lurch. Also, the more developed and industrialized states received a lion's share of attention of the operators while the others clearly got left behind. There is a huge discrepancy in the subscriber density of rural areas as compared to urban India ranging from 44 subscribers per sq km in urban areas to less than 3 in remote rural areas.

According to the Indian Telecommunication Statistics, 2004 released by the Department of Telecommunications (DoT) of India, almost half of India, with as many as 13 out of the 27 circles, have missed the telecom revolution, having a much lower tele-density than the pan-Indian average of 7.02 as on March 31, 2004. The telephone penetration per 100 inhabitants in these 13 circles ranged between 1.5 and 5. The tele-density growth in the less developed predominantly agrarian states has been dismal.

Of the 27 circles in India, 11 circles, including Assam, Bihar, Jharkhand, Orissa, the North East (comprising of 6 states and union territories), West Bengal, Rajasthan, Madhya Pradesh, Jammu & Kashmir and Chhatisgarh account for a meagre 6 percent of the total number of telephones (*see Table 4.1*).

Table 4.1: Lost in the telecom revolution

States	Tele-density on	
	31-Mar-03	1-Jan-04
Chhattisgarh		1.58
Bihar	0.53	1.59
Assam	0.84	1.97
Jharkhand		1.97
West Bengal	1.68	2.53
Northeast –II		2.57
Uttar Pradesh east	1.08	2.74
Orissa	0.97	2.81
Jammu & Kashmir	1.14	2.9
Northeast-I	1.41	3.16
Madhya Pradesh	1.25	3.76

Source: Department of Telecommunications (DoT), India

[24] Broadband India: Recommendations on Accelerating Growth of Internet and Broadband Penetration, published by the TRAI on April 29, 2004.

4.6 Regulations and Policies

The Telecommunications industry has been highly volatile and complex in the recent past. Thanks to the regulatory seesaw act by the Indian Government, this sector has gone through a lot of changes.

4.6.1 Regulations

In 1993, the tele-density was at an insignificant 0.8 per hundred persons as against a world average of 10 per hundred persons. It was also lower than that of many developing countries of Asia like China (1.7), Pakistan (2), Malaysia (13) etc. There were about 8 million lines with a waiting list of about 2.5 million. Telephone connectivity was available only for 21 percent of the villages in India.[25]

NTP 94 envisaged the rollout of eight Cellular Mobile Telecom Service (CMTS) operators in the four metros (Delhi, Mumbai, Kolkata and Chennai), 14 CMTS operators in 18 state circles, 6 Basic Telecom Service operators (BTS) in 6 state circles and to paging operators in 27 cities and 18 state circles. NTP 94 was introduced with an objective to make affordable telecom service available for everyone. In order to achieve the target of providing connectivity to all villages by 1997, the policy mandated the basic service providers to maintain a balance between rural and urban coverage in their footprint.

In 1998, as against the NTP 94 target, penetration of telecommunication services remained pathetic at less than 50 percent of the villages getting connectivity. At the same time, the mobile industry, which was projected to be the sunshine industry, was tottering on the brink of bankruptcy.

The National Telecom Policy 1999 (NTP 99) was introduced to address the inadequacies of NTP 94 and to create a regulatory framework that would address the convergence of technology and markets happening elsewhere in the world. Some of the objectives set by NTP 99 were, to make rural communication mandatory for all fixed service providers, to increase rural tele-density by 10 times to 4 by 2010, to achieve telecom coverage of all villages in the country and to provide reliable media to all exchanges by 2002.

As per the policy, the Government laid great emphasis on universal service to basic service providers, in order to achieve certain objectives. They were – to provide voice and low speed data connectivity to the remaining 290,000 uncovered villages in the country by the year 2002, to achieve Internet access to all district headquarters by 2000 and to achieve telephone on demand in urban and rural areas by 2002.

In 2002, the Government did give quite a few concessions to ensure the viability of the mobile industry and also for the basic service operators by withdrawing the universal service obligations. It was hoped that thereon the government-run incumbent would share much of the burden of providing services in the rural areas. This is discussed in detail in the following section.

4.6.2 Universal Service Obligation (USO)

The rural economy remained unaffected by the developments in the telecom sector, thanks to the private operators who for a long time resisted fulfilling their rural (universal) service obligations mandated by the policy in spite of warnings from the Department of Telecommunications. The DoT and the Telecom Regulatory Authority of India (TRAI) also could not do much in this regard as the rural coverage of even the state-owned BSNL was at 1.75 percent of its total coverage. Even though the connectivity of rural India improved on paper, the effectiveness of the facility was always in doubt. [26]

[25]National Telecom Policy 1994, published by the Department of Telecommunications, India

[26] Discussions with a few experts from the telecom sector have revealed that most of the Village Public Telephones (VPTs) existing in these villages were not working. These VPTs had been installed on the multiple access rural radio (MARR) technology which was nascent and relatively unproven. This further compounded the woes of low penetration of telephones in the rural areas.

As the private operators were reluctant to fulfil their rural (universal) service obligations the Government of India diluted the Universal Service Obligation and introduced the Universal Service Obligation Levy on April 01, 2002. This levy was calculated at 5 percent of the adjusted gross revenues of all operators offering services under various licenses. The levy collected accrues to the Universal Service Obligation Fund (USOF), a special fund instituted by the Government of India for subsidising rural telephony. The cost incurred by operators in offering telecom services in the villages is estimated and reimbursed by the USOF. The USOF also monitors the status of this infrastructure through regular audits.

A substantial sum of US$ 368 million and US$ 476 million was collected in 2002-03 and 2003-04 respectively. A sum of US$ 67 million and US$ 45 million was allotted to USOF for the year 2002-03 and 2003-04 respectively. This has been utilized for extending the universal service subsidy for more than 0.5 million Village Public Telephones (VPTs), uneconomic rural Direct Exchange Lines (DELs) and the replacement of 0.2 million Multiple Access Rural Radio (MARR) based VPTs to improve their quality of service. According to the Economic Survey of India 2003-04, 0.52 million of the 0.64 million villages have been provided with VPTs.[27]

All these developments have made minimal impact on the status of telecom infrastructure in the rural India. The tele-density is low and Internet in rural India is largely unavailable. The IT and Telecom revolution which has done wonders in the urban areas seems to have bypassed the rural India. A better penetration of IT and Telecom infrastructure has the revolutionary potential to empower the people of rural India. It can help improve the standards of literacy, healthcare and livelihood of the rural people; moreover, with IT and telecom shrinking the physical distances, the hardworking and talented rural lot will get a chance to compete with those in the urban areas and the developed world.

But, is it possible that IT and Telecom do reach rural people and make a significant impact in their lives? This paper explains the options available for extending the reach of IT and telecom to rural areas and puts forward a case of what is being done and what more needs to be done to get the 630,000 plus villages connected. For this to happen, each and every initiative should be scalable, be able to reach out to far flung areas; for without them, the efforts would be futile. Technologies to provide connectivity also help with scaling operations. More importantly, sustainable business models and organisations that drive changes are also crucial.

Chapter 4 discusses various technologies that may prove viable and cost-effective for implementation especially in the rural areas.

[27] Economic Survey 2003-04, Government of India.

5 Technologies to connect rural India

Providing connectivity to 600,000 plus villages is no doubt a mammoth task. But, how can it be achieved? This chapter focuses on the various technologies available to accomplish that task and also elaborates on the evolution of these technologies.

5.1 Fibre goes deep in India

Fortunately, the Department of Telecommunications, the Government of India and Bharat Sanchar Nigam Limited (BSNL), the state-owned incumbent, have made a significant contribution towards connecting rural India over the last 15 years, by laying fibre to almost all *taluka* (country) headquarters and towns. These fibres have a bandwidth capacity of over 10 Gbps and even more if required. Differently put, it is equivalent to the widest possible highways connecting such towns.

Almost 85 percent of Indian villages lie within 15-20 km radius of these *taluka* towns. Thus, a wireless system with a radius of coverage of about 20 kms, deployed at such towns would be able to connect most of these villages. The telecom need of the remaining villages which lie in areas where fibre does not go deep would be addressed subsequently in section 5.4.

5.2 Wireless Systems for rural connectivity

Today, it is possible to design inexpensive wireless systems that cost anywhere between US$ 300 to 400 per line to provide telecom and Internet connectivity within 20 km radius. Early systems had limited capabilities. But, over the past 15 years, they have evolved and are now capable of providing scalable and robust infrastructure.

5.2.1 Multi Access Rural Radio (MARR) Systems

In the early 90's, India introduced analog wireless systems referred to as MARR or 2/15 fixed radio systems[28] to provide voice connectivity. Two wireless voice channels were shared by 15 subscribers located in villages nearby. Such systems, even though expensive at close to US$ 1,000 per village, were widely deployed but were difficult to maintain. While power supply was often erratic in rural areas, power consumption of the subscriber units was also quite large. These systems performed satisfactorily in the beginning. However, the performance deteriorated gradually and they were rendered non-functional over a period of time. Attempts to rectify them proved too costly, and they were abandoned soon.

5.2.2 TDM-TDMA PMP System

In the mid-nineties, a second system was introduced, ***Time Division Multiplexed – Time Division Multiple Access Point to Multi Point*** system often referred to as the TDM–TDMA PMP wireless system.[29] The digital system allowed a base station to be deployed in a town and up to 32 Fixed Wireless Remote Terminals deployed in villages within a radius of 25 km. Each of these remote terminals could cater to as many as 32 subscribers in the village connected on copper wire. The subscribers could get voice as well as data connectivity at 64 Kbps. The system was highly cost-effective on a per-line basis even if only 16 subscribers were connected in each village; but the cost escalated dramatically if the system was utilized where only one or two telephones were required in a village. These systems were not deployed widely.

[28] http://www.dotindia.com

[29] This system uses fixed bi-directional radio connections (line of sight) between a master station and a number of peripheral stations, in order to enable connectivity between a data network and users' premises. The communication between the master station and the peripheral stations is based on a TDM/TDMA scheme in downlink/uplink direction: both the downlink and uplink data streams are a sequence of bursts, each one allocated in a Time Slot of the multiplexing scheme. The downlink data stream will be a continuous sequence of bursts broadcasted to all peripheral stations and the uplink a discontinuous single-burst point-to-point transmission from each peripheral station to the master station.

5.2.3 Current Systems

It was only in the late nineties and the early part of this decade that extremely cost-effective wireless systems became available. This was also boosted in great measure by the deeper penetration of fibre in many more *taluka* towns than ever before.

5.2.3.1 corDECT Wireless in Local Loop

corDECT, a Wireless-in-Local-Loop system,[30] is one of the most cost-effective solutions that was developed by a research group at the IIT Madras[31] in India, in collaboration with a Chennai-based company, Midas Communication Technologies Pvt. Ltd.[32]

With a radio exchange and base station located in a *taluka* town, corDECT, using a fixed wireless system enables simultaneous telephone and Internet connectivity (at 35/70 Kbps sustained rate) in villages within a 25 km radius (using Relay Base Stations). The system is extremely cost-effective with the total deployed cost including that of the subscriber unit being under US$ 250 per line. Interestingly, the system is extremely versatile in its ability to scale up and also to be deployed under even harsh conditions. A 1000 line radio exchange and base station works even at 55^0C, requiring no air conditioning and has a total power requirement of only about 1 KiloWatt (KW) which could be easily provided by a small diesel / petrol generator. The start-up cost for the system is only US$ 20,000, at which the first subscriber can be connected.[33] Currently, infrastructure for over 2.5 million corDECT lines is being deployed by all major telecommunication service operators in India and as well as in more than 10 developing countries.[34]

5.2.3.2 GSM and CDMA (IS-95/3G-1X)

Other mobile wireless technologies such as 2G and 2.5G have also made an enormous impact in rural India. These technologies are mature and costs are low. The cost of GSM infrastructure today is close to US$ 70 per line for urban deployment, assuming subscriber traffic to be at 0.05 Erlangs per subscriber. This cost does not include the fibre infrastructure and the infrastructure required to host the Base Station Controllers and the Mobile Switching Centres. The cost of CDMA (or IS-95) infrastructure is only marginally higher. The cost of GSM handsets have also plummeted to roughly about US$ 60.

If GSM or CDMA systems are deployed in all *taluka* towns which have fibre, mobile telephony could be extended to most villages in India. However, the deployment is very urban-centric and the fringe benefits are enjoyed by only the villages near the urban areas or those near the major highways.

Telephony aside, GSM/IS-95 is capable of providing SMS and MMS messages using low bit rate (9.6 Kbps) data links. Even though GPRS and 3G-1X evolving out GSM and CDMA technologies[35] do promise Internet connectivity with a higher bit rate, the focus is on connecting handheld devices. Thus, they at most provide 100 Kbps *shared* connection to all subscribers in a sector. Once several subscribers are connected, the speed is far inferior to that provided by a simple dial-up connection (which is capable of providing 33 Kbps or even up to 56 Kbps (unshared or sustained) connection to each subscriber. Thus, even in its 2.5G form, GSM and CDMA are incapable of providing Internet connection at acceptable speeds to computers in rural areas.

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[30] WLL is a system that connects subscribers to the Public Switched Telephone Network (PSTN) using radio signals as a substitute for copper for all or part of the connection between the subscriber and the switch. This includes cordless access systems, proprietary fixed radio access, and fixed mobile systems. Its is also called Radio In The Loop (RITL) or Fixed-Radio Access (FRA).

[31] http://www.iitm.ac.in

[32] http://www.midascomm.com

[33] Sourced from internal documents of Midas Communication Technologies Pvt. Ltd.

[34] India, Sri Lanka, Honduras, Bhutan, Tunisia, Brazil, Nigeria, Madagascar, Fiji, Argentina, Russia and Congo to name a few.

[35] General Packet Radio Service (GPRS) is a new non-voice value added service that allows information to be sent and received across a mobile telephone network. It supplements Circuit Switched Data and Short Message Service. GPRS can offer theoretical maximum speeds of up to 171.2 kilobits per second (Kbps). 3G 1X is a radio transmission technology with 1.25 MHz channels. This technology can support peak data speeds up to 144 Kbps, and up to a doubling of voice capacity.

5.2.4 Tomorrow's wireless connectivity

Wireless technologies are evolving very rapidly and can make a significant difference to Internet connectivity in rural areas, especially in areas where fibre has been taken deep. The Internet bit-rates available on wireless are likely to continuously increase over the next few years. corDECT 2.5G technology, to be launched in the next few months, promises 100 Kbps and even 200 Kbps sustained Internet connection to each user and a 2 Mbps shared download in each 60^0 sector. It is interesting to note that even with these enhanced features, the cost is likely to remain at as low as US$ 250 per line for a fully deployed system. The EV-DO and EVDV technologies (evolved from CDMA)[36] also promise about 800 Kbps shared data rate to all subscribers in a sector. EDGE which, evolved out of GSM[37] could also provide similar data rates. If the price of these systems is right, they could be useful alternatives too.

The technologies described above would be commercially available either this year or early next year. Trials of these systems are currently going on in India and several operators have plans to use them. n-Logue Communications as well as HFCL Infotel have plans to widely deploy 2.5G corDECT by October 2004. Meanwhile, Reliance Infocomm and Tata Teleservices have done a few trials of the EV-DO technologies, although only in urban areas. Bharti Tele-Ventures Limited's Airtel[38] has already launched EDGE in its New Delhi and Punjab circles and has plans to introduce it in all metros (Mumbai, Kolkata and Chennai) as well as Bangalore and Hyderabad circles.

Higher bit rate Internet on mobiles is being promised by the 3G mobile technologies. The IS-95/3G-1X has evolved in to the CDMA2000 standard[39] which has now come up with High Data Rate (HDR)[40] systems promising 2.4 Mbps peak download in 1.25 MHz spectrum. Meanwhile, the GSM world which adopted the W-CDMA standard[41] has now evolved the High Speed Downlink Packet Access (HSDPA) technology[42] which promises 14 Mbps peak rate download using 5 MHz spectrum.

Both HDR and HSDPA, based on mobile standards widely deployed today, will find easy acceptability. The right price would be an important consideration. However, the data rate specified is the peak rate and the peak rate will not be available to all users, but only to a very select few, located close to a base station and in the centre of a sector. The data rates are likely to fall by a *factor of ten* as one moves closer to the sector or cell boundaries. Both the standards are based on CDMA technology which appears to have reached its saturation point. It is unlikely to be able to provide higher data rates as too many multi-path signals get resolved as the chip rate increases.

Higher data rate wireless communications would be possible using newly emerging techniques like Orthogonal Frequency Division Multiplexing (OFDM) or Orthogonal Frequency Division Multiple Access (OFDMA),[43] which may be combined with multi-carrier CDMA for uplink data transmission. Combined with Multiple Input

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[36] EV-DO (EVolution, Data-Only) and EVDV (EVolution, Data and Voice) are 3G standards in CDMA, based on High Data Rate (HDR), developed by QUALCOMM Incorporated. The international standard is known as IS-856. They offer data rates up to 2.4 Mbps.

[37] **E**nhanced **D**ata **GSM** **E**nvironment. EDGE is a faster version of GSM wireless service. EDGE enables data to be delivered at rates up to 384 Kbps on a broadband. The standard is based on the GSM standard and uses TDMA multiplexing technology.

[38] http://www.bharti.com

[39] CDMA2000 is the 3rd Generation solution based on IS-95. It supports 3G services as defined by the International Telecommunications Union (ITU) for IMT-2000.

[40] High Data Rate (HDR) technology developed by Qualcomm is a high speed, high capacity wireless Internet technology optimized for packet data services.

[41] Wideband Code Division Multiple Access (W-CDMA) is a 3G wireless standard adopted by the ITU under the name "IMT-2000 direct spread." WCDMA is the technology used in UMTS, and with data rates up to 2Mbps it has the capacity to easily handle bandwidth-intensive applications such as video, data, and image transmission necessary for mobile Internet services.

[42] High Speed Downlink Packet Access (HSDPA) is an enhancement to the UMTS specifications for W-CDMA and can offer up to 10MB/s data rates.

[43] Orthogonal frequency division multiplexing (OFDM) is a communications technique that divides a communications channel into a number of equally spaced frequency bands. A subcarrier carrying a portion of the user information is transmitted in each band with each subcarrier is orthogonal with every other subcarrier. Orthogonal Frequency Division Multiple Access (OFDMA), a flexible orthogonal multiplexing scheme for time and frequency division multiplexing.

and Multiple Output (MIMO) systems, these technologies can support high bit rate data communication in rural areas.

Early systems employing OFDM and OFDMA, like those developed by Flarion Technologies[44] promise data rates which could be 2 to 3 times the bit-rate provided by HDR or HSDPA systems for the same channel bandwidth. These systems known as Flash-OFDM are being commercially deployed by Nextel at Raleigh, North Corolina, USA and the early results are promising. The technology was proposed as a standard in Institute of Electrical and Electronics Engineers (IEEE) 802.20 committee but the committee appears to have lost steam in recent months.

The other major proposal on OFDM is with the IEEE 802.16 committee.[45] The committee has been in the process of defining the standards, initially for fixed wireless systems (in the form of 802.16a and 802.16d) and more recently for high bit-rate mobile systems (in the form of 802.16e). The former two standards have already been finalized, while the latter is expected to get ready by early next year.

A forum called WiMax Forum[46] has been constituted to standardise the profiles of systems based on 802.16. Intel Corporation[47] has taken a lead in the forum, driving standards as well as developing the Integrated Circuits for the systems. Many other companies are participating and a large number of technology start-ups have come up to nurture this technology. WiMax is likely to make a major impact in the years to come.

Intel along with Alvarion Limited[48] has announced trials of an early version of the 802.16 system (802.16a Point to Multi Point system) with Reliance Infocomm in urban India. They hope to conduct trials in rural India fairly soon.

5.3 What do rural areas need?

Questions are often raised about bit-rates that are commercially sustainable for Internet connectivity in an Indian village. Today, most experiments show that it takes considerable effort for the villagers to pay for even a 33 Kbps sustained, Always-on connection. Fortunately, even this low bit-rate links have been widely used to provide video conferencing and tele-education. Thus, a 64 Kbps sustained (non-shared) connection to a village will be a big boon.[49] This connection would also be adequate for even 4 to 5 computers to share the access. However, as usage grows in the villages and new applications emerge, the need for 100-150 Kbps (sustained) connection will be felt. Within a few years, when the Internet pipe gets shared by 20 to 30 computers in a village, there may be a demand for even 1 Mbps (sustained or unshared) connection to each village. Fortunately, various OFDM technologies are targeting just that. It is quite conceivable that within two years, wireless technologies which leverage the fibre deployed to each *taluka* (country) towns could provide 1 Mbps (sustained) connection to each village at a total deployed cost of under US$ 300 per line. It is assumed that 300 such connections would be required in about 25 km radius around the town. Costs however, may be higher in sparsely populated areas or where the number of connections required within an area is lesser.

Technologies would continuously evolve in the years to come to satisfy the communication needs of the villages around the towns connected by fibre. The only need that is unlikely to be satisfied would be broadband video services.

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[44] http://www.flarion.com
[45] The IEEE 802.16 committee develops standards and recommends practices to support the development and deployment of broadband Wireless Metropolitan Area Networks. IEEE 802.16 is a unit of the IEEE 802 LAN/MAN Standards Committee, the premier transnational forum for wireless networking standardization.
[46] The WiMAX Forum™ is a nonprofit association formed by equipment and component suppliers to facilitate the deployment of broadband wireless networks based on the IEEE 802.16 standard by helping to ensure the compatibility and inter-operability of broadband wireless access equipment.
[47] http://www.intel.com
[48] http://www.alvarion.com
[49] Task Force Report on Rural connectivity Mission 2007: Every Village a Knowledge Centre, Prof. Ashok Jhunjhunwala, May 2004.

If a village does need bit-rates over 5 Mbps, it may be prudent to lay a fibre right up to the village itself. The cost of laying and installing fibre in each village may average between US$ 10,000 to 30,000 per village depending upon the distance from the towns or major roads. Such broadband connectivity is unlikely to be sustainable except in a few Indian villages in the next five to seven years.

5.3.1 Other Technologies

A few other attempts have been made to use different technologies to provide connectivity to villages. Point-to-Point Digital Microwave links have occasionally been used, but connectivity to a single village using such point to point link is expensive and non-scalable. One such experiment[50] has tried to use low bit-rate modems on analog wireless systems. Most of these systems use outdated technologies and data communication capabilities do not justify the costs.

Recently 802.11 or WiFi[51] has emerged as a versatile Wireless Local Area Network (WLAN) technology, widely used to provide connectivity to mostly laptops in buildings, campuses and in some public places like restaurants, airports and railway stations. In fact, some cities have wired up a large number of 802.11 access points to provide wireless coverage. In all these cases, a fibre or copper using DSL or Cable backhaul runs deep into buildings, restaurants, airports and stations and the 802.11 access points are connected to it to provide wireless coverage in a radius of 50 to 100 meters. WiFi is emerging as a powerful and highly cost-effective wireless technology to connect the last 50 to 100 meters where fibre backhaul infrastructure does exist.

Enamoured by the power of this WLAN technology, there have been suggestions towards a possible use of WiFi for rural connectivity. In fact, Media Lab Asia (MLA), Kanpur[52] centre in India has set up 802.11b multi-pop link connecting Kanpur to Lucknow, a distance of about 100 kms using 40-45 meters high towers and highly directional (30 dB gain) antennae. 802.11 links have been deployed for distances as large as 35 kms.

Another attempt is being made at MLA, Chennai to create a 802.11b mesh network with neighbouring villages for a distance of 5 kms. While such long distance links can indeed be set up using highly directional antenna, the fact is that WiFi is a LAN Technology, designed for shorter distances and for reuse of spectrum for every 100 meters. When used as a larger link, 802.11b wireless technology is far more spectrum inefficient as compared to other contemporary technologies. Its medium access protocols are not designed to provide significant throughput on such links. Also, with high-gain antennae and towers, WiFi systems in rural areas turn out to be far more expensive as compared to other systems.

Where WiFi technology can work well is in providing wireless distribution within a village provided, alternative means (fibre or wireless) can be used to connect the village to the Internet backbone in the nearest *taluka* town. In other words, once a village is connected to the backhaul, the connectivity to various points within a village (over 500 meter radius) can be ideally provided by WiFi. Alcatel has already used such solutions in France[53] while MLA, Chennai at IIT Madras is working on a solution to provide such connectivity. The systems will be deployed in the field in next few months.

5.4 Sparse Rural Areas – where there is no fibre

As mentioned earlier, about 15 percent of the villages in India are in those areas where the presence of fibre is low. These would be hilly, forested or desert areas. Even the population density in these areas is very low and the average income is lower than that in the plains.

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[50] Information Village Research Project by MS Swamination Research Foundation, http://www.mssrf.org
[51] 802.11 or WiFi is a family of specifications developed by the IEEE for wireless LAN technology. 802.11 specifies an over-the-air interface between a wireless client and a base station or between two wireless clients.
[52] http://www.medialabasia.org
[53] Providing Always-on Broadband Access to Under-served Areas, C. Boscher, N. Hill, Ph. Lainé, A. Candido, 2004, from http://www.alcatel.com

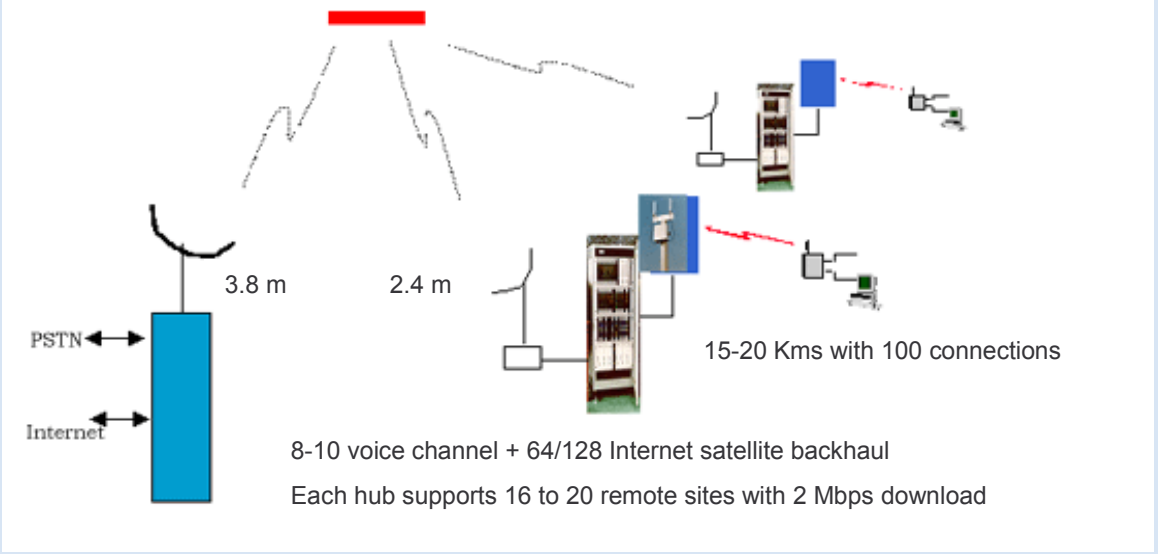
Laying fibre in these areas is difficult and extremely costly. In a number of places, Point to Point Microwave Links have been used to provide backbone connectivity. It is possible to upgrade these microwave links to provide bit-rates as high as 155 Mbps, when the cost for such equipment comes down. The spectrum charges for the microwave links (paid yearly) would however be a dampener.

Wherever such microwave links exist, it is possible to use terrestrial wireless in about 20 Km radius around the end points of the microwave links. These would be similar to the ones discussed in section 5.2, except that these systems would now serve sparse areas or far lesser number of connections. The cost per village could therefore climb up to about US$ 500 or even US$ 700.

But even microwave links are not always prevalent in these sparse areas. The terrain and vegetation may sometimes render it difficult to put such links. Under these circumstances, satellite connectivity could be the suitable alternative. However, providing satellite connections to each village is expensive, especially if a reasonable sustained bit-rate (e.g. 33 Kbps each way) is required at each village. The capital cost may be upwards of US$ 20,000 per village and the recurring cost (due to the satellite segment) would also be as high as US$ 500 per village per year.

Sparse Area Communication System (SACS) which combines satellite and terrestrial wireless systems could be an option. Here, a satellite remote terminal with 128 or 256 Kbps dedicated connection (both ways) is installed in an elevated area, like the top of a hill. A terrestrial wireless system would now provide connectivity from this remote terminal on a hill to about 50 to 70 villages within a radius of 15 to 20 kms. At the satellite remotes, content will be cached sufficiently to provide reasonable services required in these villages. Since the satellite remote terminal and recurring costs associated with the satellite segment would now be shared by 50 to 70 villages, the cost may not work out to be as high – the total cost is estimated to be US$ 800 per connection with recurring costs of approximately US$ 40 to US$ 60 per year per village.

Figure 5.1: Sparse Area Communication System (SACS)



Such a Sparse Area Communication System (SACS) is being developed at IIT Madras along with the Indian Space Research Organization (ISRO)[54] and is expected to be ready in a few months.

The combination of terrestrial wireless with microwave links and SACS systems may serve most of the 15 percent of the villages not served by traditional means. However, one percent of Indian villages may still be located too far from each other and would not be covered by any of these methods. Direct Satellite Communication to the village may be the only option in such cases.

To sum up, suitable technologies to connect every village in India and to provide Internet and telecommunication services in a cost-effective manner do exist. These technologies are also rapidly evolving to cater to rural needs even better in the future.

[54] http://www.isro.org

6 Business Models and Applications

The availability of cost-effective and robust technologies provides the platform for villagers to launch themselves in the pursuit of better lives and economic prosperity. However, there needs to be further support in the form of services that are tuned to the special conditions and circumstances of rural people. This chapter details some of these services and applications.

6.1 A possible business model

Even though it is technologically possible to provide connectivity to most villages at a reasonable cost, access to the Internet will be mostly unaffordable in Indian rural areas. The cost involved (including that of the computer, power supply and software) is too high and would not be affordable to any but a few rural homes. Rural people can enjoy the benefit of the Internet only if demand is aggregated and shared connections are made available.

The lessons learnt from providing telephony to urban middle and lower middle classes in India in the late eighties are too important to be ignored. Public Call Office (PCO) booths owned by the Post and Telegraph (P&T) Department of the Government of India did exist before 1987, but were not widely used.

In 1987, operator-assisted PCOs called STD PCOs[55] were introduced. Typically these STD PCOs were installed and managed by entrepreneurs who kept the PCO shops open for up to 16 hours a day practically throughout the year. PCOs sprang up in every street corner so much so that that no person needed to travel more than 50 meters from his/her home to make a telephone call. The PCO operators usually lived in the same neighbourhood as their PCOs giving them familiarity with its residents. This helped them play the crucial role of messengers often handling incoming calls and messages that were passed on to the residents. As of end-March 2004, there are 1.76 million such PCOs[56] with about 200,000 PCOs located in rural areas clearly demonstrating their growing popularity. Twenty five percent of the total telecom income of the country can be attributed to these PCOs till very recently[57] and almost 300 million people, who do not have telephones at homes use them regularly.

The operations of STD PCOs clearly demonstrate that the most viable option in rural areas would be to aggregate the demands for Internet and telephony and to provide them both through Internet kiosks in villages. As with the PCOs, these kiosks are best served when owned and operated by local entrepreneurs whose primary responsibilities are to drive services and to push for increased usage. The success of the kiosks is dependent on the factors given below:

1. The investment and associated running costs of the kiosks should be so low as to enable the entrepreneur to recover his/her costs within a short time span, say 6 months.
2. The kiosks should be located conveniently in the middle of each village to offer a proximity of less than 500 meters from the residences of all local inhabitants.
3. The kiosks should serve the entire population of the village, irrespective of differences of gender, caste or economic status.
4. Most importantly, the applications and services offered at the kiosks should be relevant, timely and cost-effective for the residents.

[55] Subscriber Trunk Dialing refers to national long distance calling.
[56] Section 9.31 from Economic Survey of India 2003-04 released by the Government of India.
[57] Drivers of Telecom in India, Dr. Ashok Jhunjhunwala, IETE Technical review, Vol 20, No.4, July-August 2003, pp279-287

6.2 Multiple services make the Kiosk economically viable.

The viability of the kiosks will be improved with cheaper infrastructure cost and increased revenue streams. Some of the revenue earners are standard telephony, Internet connectivity and other serviced offered from applications on the computers. Each of these makes a significant contribution to the profits of the kiosk owners.

6.2.1 Agriculture support and trading

Agricultural support services promise substantial revenues. However, online or email support is far less useful than online video-conferencing between an agricultural expert in the town and a farmer, as demonstrated by n-Logue Communications Pvt. Ltd. (n-Logue) in many of its kiosks. Video-conferencing does require a minimum sustained bit-rate of 33 Kbps on the Internet, though sustained connection of 64 Kbps is desirable.

The e-Choupal initiative by ITC, a leading Indian company, dealt with in section 7.3.1 has shown that agricultural trading through the Internet can bring substantial revenues for farmers, especially in areas where cash crops are grown. Though access to the Internet is mandatory, the bit-rates offered for access itself is not too important. It has already been articulated in earlier sections that even with low bit-rates, it is possible to provide essential services required in rural areas.

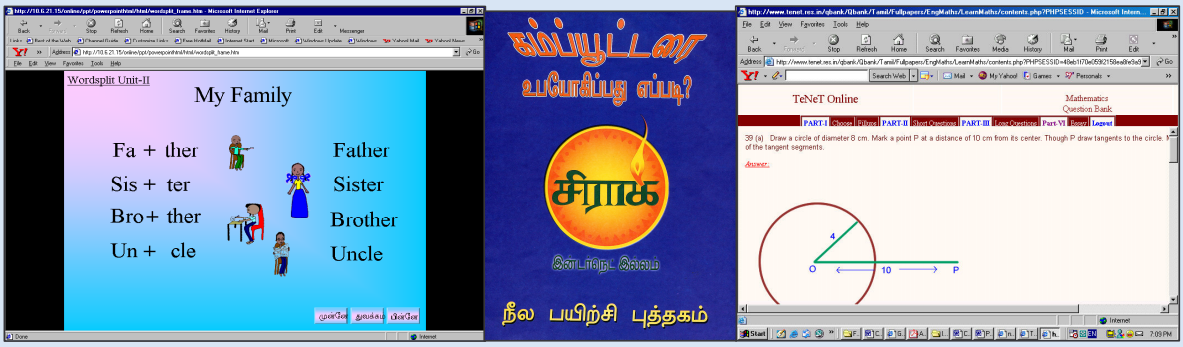
The Internet could also be used for the buying and selling of goods at rural kiosks. Even though ITC's e-Choupals do enable buying and selling of crops, fertilizers and pesticides, the same cannot be said of other goods in rural India. Although instances are known where kiosk operators have sold tractors, farm equipment and even handicrafts, trading on Internet is still in its infancy. But the progress is unbearably slow, primarily due to non-availability of logistical support in the form of organized movement of goods. Obviously, the infrastructure for Internet has to be complimented by an efficient transport system for these types of trading systems to flourish.

Agricultural trading and support services do have a lasting impact on the lifestyle of the rural populace which is predominantly dependent on agriculture. But as other efforts in India have demonstrated, the kiosks can be leveraged to do much more than what has been done so far.

6.2.2 Education and Training

Education is probably the biggest revenue generator in most rural kiosks in India today. A very popular perception in rural India is that the future of children graduating from schools is much better than those that do not. At the same time, vocational training, including computer education is equally valid as it could enable children to get better prospects of jobs in towns leading to a more secure future.

Figure 6.1: Computer training manual in local language and Online tutorials



Source: n-Logue Communications Pvt. Ltd.

n-Logue has developed several basic computer training modules and computer-based training modules for children of different ages and adults. These modules are widely used and contribute significantly towards the gross revenues of the kiosks. The Telecommunication and Computer Networking (TeNeT) group at IIT, Madras has developed several tutorials (*see Figure 6.1*) that would help students in passing examinations in subjects like English, Mathematics, Science and Social Sciences. The use of these modules in some villages helped to dramatically improve the percentage of children clearing their Secondary School Leaving Certificate (SSLC) examinations in certain subjects in 2004.[58]

Another widely used module is the *Spoken English* course prepared by the TeNeT group. There is a great urge in rural India for children to learn English and this module caters to that need effectively. Other courses are being designed to teach web design, audio-video/multimedia content creation & editing and courses on CAD – CAM. These target rural youngsters training them to seek suitable employment opportunities.

6.2.3 Healthcare

Even though Public Health Centres (PHCs) exist in every three to four villages (see Section 3.3), many of these PHCs function rather poorly. Healthcare is a major concern for the rural populace as qualified and good quality doctors are available only in towns in most parts of the country.

In May 2002, an enterprising kiosk operator at Melur, Tamil Nadu took the initiative of sending a picture of an eye of an old woman complaining of severe eye pain, to n-Logue. The pictures were forwarded to doctors in Aravind Eye Hospital, a leading eye care hospital in Madurai, Tamil Nadu.[59] The doctors used Internet-based video-conferencing to examine the patient. And thus was born, a revolutionary video-conferencing based eye care facility in rural areas. Nowadays, it is common for ophthalmologists or eye specialists to examine the eyes of village-based patients over Internet video and suggest appropriate remedies.

A multi-party video-conferencing product developed by Object Oriented Programming Services Pvt. Ltd.[60] is commonly used to connect multiple villages to doctors in the towns. Typically, doctors examine patients in different villages in full public view[61] and suggest immediate remedies to their problems. Patients are advised to come to the town only if their condition is serious.

The focus has now shifted to delivering healthcare of a higher level which necessitated inputs like body temperature, blood pressure and heart beats of patients. Recently, Neurosynaptic Communications Pvt. Ltd.[62] has launched an interesting low-cost remote diagnostic kit (*see Figure 6.2*).

Figure 6.2: Remote eye care, online diagnostic kit and an online clinic

Source: n-Logue Communications Pvt. Ltd.

[58] From internal documents of the TeNeT Group, http://www.tenet.res.in
[59] http://www.aravind.org
[60] http://www.oops-india.com
[61] Privacy is not a major concern; with some of the villagers even saying that this mode of public consultation increases accountability.
[62] www.neurosynaptic.com

The kit, placed in a kiosk, enables doctors to measure temperature, blood pressure, pulse count and ECG of patients remotely and also to listen to heart-beats using remote stethoscopes. Combined with video-conferencing, it enables doctors to effectively deliver medical treatment remotely. The kits are being deployed in several kiosks by n-Logue.

6.2.4 Veterinary Care

Animals like chicken, hen, goats, cows, bulls and pigs are an integral part of many a rural family and the livelihood of these families is dependent on these animals. Veterinary care for these animals is rarely available in the villages as veterinary doctors typically live in distant towns and taking animals to the towns is extremely difficult for rural people.

Figure 6.3: An online veterinary clinic

The goat shown in the adjacent picture had a wound near its mouth and was unable to eat for over a week. Doctor's advice delivered through Internet-based video conferencing helped cure the goat in just two days.

Source: n-Logue Communications Pvt. Ltd.

Video-conferencing and email with video or picture attachments is now extensively used to provide remote veterinary care to animals in rural areas (*see Figure 6.3*). In times to come, this could significantly help in improving the healthcare of rural animals and positively impact the rural economy.

6.2.5 E-governance Services

Services enabling interaction of rural citizens with the government using computers and Internet are of great importance as it eliminates the great distances between the two. However, this depends on the availability of computerization in the back offices of the government and also on the commitment of the government to deliver the services online.

The type of e-governance services offered varies across the country depending on the extent of computerization that has already taken place. While filing and processing of applications for birth, death and caste certificates are widely offered, services critically needed by a large number of people like certification of land ownership (*more details are provided in Box 7.1*) and issuance of widows' pension certificates etc., are offered only in certain areas. In some areas, payment of phone and electricity bills and taxes through kiosk operators is also being offered.

Another service that is currently being enabled is the reservation and purchase of railway and bus tickets. Online booking could be a big boon to people in rural areas who would not need to trudge the great distances to do the same in larger towns.

6.2.6 Banking and Insurance

Thanks to the efforts of ICICI Bank[63] and n-Logue, few banking services are being offered at rural kiosks in India. The bank has started offering term deposits and has enabled buying and selling of some bonds and securities through the kiosks. Insurance services including group insurance for cattle and life insurance are also available. In a country where much of the irrigation needs are met by monsoon rains an innovative rainfall insurance scheme, where a farmer buys insurance assuring certain rainfall in the district indirectly ensuring the crops output is being introduced (*see Box 6.1*). Thanks to the efforts of self-help groups, micro-finance is also already available in several parts of rural India. The Internet kiosks are being leveraged to extend the reach of micro-credit facilities.

Box 6.1: Piloting Weather Insurance in India

ICICI Lombard General Insurance, a leading insurance company in India, in association with the Government of Rajasthan, The World Bank Group, the International Finance Corporation and BASIX (a leading organisation in the area of micro-credit) has announced the launch of a comprehensive weather insurance scheme for the farmers growing oranges, to compensate them for losses due to deficit in rainfall. ICICI Lombard is the first insurance company in the country to get approval from the Insurance Regulatory and Development Authority (IRDA) to launch weather-linked insurance products.

Orange cultivation is subject to two principal weather perils - unavailability of effective shower for initiation of flowering and the presence of dry spells during flowering. Orange trees require an effective shower of at least 60 mm of rainfall on any three consecutive days to initiate flowering. The flowering period is typically between June and September during which the trees are extremely vulnerable. A dry spell of 10 to 15 days could lead to flower drop and consequent loss of yield.

The insurance cover as devised by ICICI Lombard starts from June 15 effective till July 30 against dry spells and till September 28 against flower drop. The insurance premium is decided on a case-to-case basis depending on the geography and the associated risk.

To get reliable data, ICICI Lombard has tied up with the Indian Meteorological Department to obtain the latest weather reports and historical charts.

Commenting on the product, ICICI Lombard's Chief Executive Officer and Managing Director, Mr Sandeep Bakhshi, said: "Weather insurance does not suffer from the usual moral hazard and adverse selection and high administrative costs of traditional crop insurance, and it is therefore better suited even to small farmers in rainfall-dependent countries such as India."

Source: "ICICI Lombard weather cover for orange growers," The Hindu Businessline, June 14, 2004.

6.2.7 Judiciary and Police

One of the areas where rural kiosks can make a difference is in making judiciary and police systems accessible to the rural folks. Thanks to the long drawn judicial procedures, the rural folk end up wasting a lot of their time and money commuting to the courts for the hearings on their cases. With many of the rural folks involved in some case or the other linked to land records, e-enabling the Judiciary would prove very effective. Posting of the dates of hearing, proceedings of the court, judgements, etc., on the Internet would prove very useful to them.

The police system is not much different from the judiciary for the rural folks. Filing a First Information Report (FIR) itself takes a considerable effort. Enabling online complaint registrations and tracking would save a lot of time and effort for the rural folks.

6.2.8 Photography

Another interesting application with wide usage is photography services at the kiosks. A web-camera or a low-cost digital camera connected to computers enables kiosk operators to provide photography services in the villages (*see Figure 6.4*). Photographs are regularly taken for use in identity cards, passport application forms and other documents. These prints are usually taken on photography paper using low cost ink-jet printers.

[63] ICICI Bank is India's second-largest bank with total assets of about Rs.125,229 crore and a network of over 450 branches and offices and about 1790 ATMs. http://www.icicibank.com

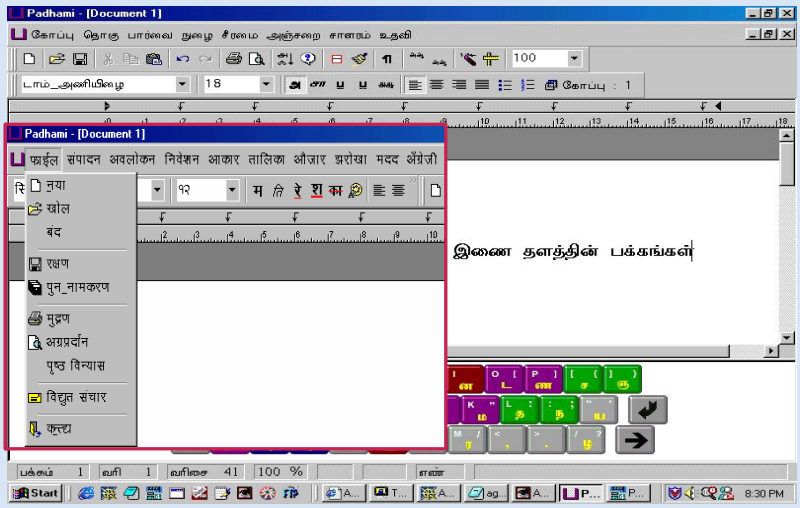
Figure 6.4: Photography at a kiosk

Source: n-Logue Communications Pvt. Ltd.

6.2.9 Email and Browsing

E-mail is one of the simplest applications to be used on the Internet and is also used by some people in rural kiosks. However, with the level of English literacy being abysmally poor in rural India, email needs to be in the local language to gain wide acceptance and usage in villages. Chennai Kavigal Private Limited[64] developed a local language "Office" package which eliminates the language barrier and enables the penetration of email in rural areas (*see Figure 6.5*). Many people in rural areas, especially the youth have started using local language emails effectively. However, voice-mail and video-mail (email with voice or video attachments) are used more widely.

Figure 6.5: Local language packages from Chennai Kavigal



As explained in Section 2.2, there is a significant amount of migration of rural people to the urban cities and towns of India and often to even distant lands such Singapore, Malaysia and countries of the Middle East. For these people, any mode of quick and cost-effective communication is highly welcome. In this context, even a 60 second video-mail is of great value and people are willing to pay up to even US¢ 50 for this.

[64] http://www.chennaikavigal.com

Browsing the Internet or web-surfing is not widely prevalent in rural areas. If at all, it is used predominantly by the youth only. This is primarily due to the lack of relevant content in local languages needed by the rural populace thus hampering the growth of browsing as a widely used service.

6.2.10 Entertainment and Games

Entertainment and games available in computers and content from the Internet are a good source of revenue for kiosk operators. n-Logue runs a radio service named Chiraag in some districts it operates in. n-Logue also conducts a number of quizzes and competitions from time to time to encourage participation (*see Figure 6.6 for Chiraag radio*).

Figure 6.6: Entertainment through a Chiraag Radio

Source: n-Logue Communications Pvt. Ltd.

A very popular competition is based on prediction of cricket score of matches in which India plays.

6.3 Micro-enterprises – The Future

Rural India is just beginning to get a flavour of Internet and computers. The Internet is being used to work around the traditional bottlenecks in accessing basic facilities like healthcare, education, trading, etc. For the impact of Internet to be felt in the rural hinterland, it needs to facilitate drastic improvement in the living standards of the rural populace. It should morph itself from a facilitator to wealth creator for wider acceptability.

The Internet can become a wealth creator through micro-enterprises which harness the potential of applications and services as explained earlier. Each rural household can house a number of micro-enterprises in various domains like food processing, cash crop cultivation, fishery, agriculture, handicrafts or even IT based services. Urban India leveraged its abundant qualified manpower to garner the business of outsourced IT-enabled services by the western world. With computers and connectivity, rural India can similarly offer services to urban India. While the non-availability of electricity is in itself a major constraint impeding the growth of micro-enterprises; even power generation and distribution could be viable business propositions for micro-enterprises.

Various inputs are needed to nurture and develop such micro-enterprises in the villages.

6.3.1 Finance

Finance is the most critical input to any enterprise. Banks are being encouraged to use the kiosks in rural India to extend their services to the villages. Vortex Engineering Ltd has developed a rural ATM, which costs only a fraction of a regular ATM. This ATM can be installed along with an Internet kiosk and is designed to withstand the harsh climatic conditions in the rural areas. With technology evolving to enable services at the rural areas,

the onus lies on the banks and financial institutions to create innovative schemes that would serve the needs of the micro-enterprises (*see Figure 6.7*).

Figure 6.7: Rural ATM

With the support of the TeNeT group at IIT, Madras, Vortex Engineering Ltd. has developed a low cost ATM specifically for rural applications. The ATM will make use of an existing network of Internet kiosks that currently access hundreds of villages in India. Capable of dispensing both new and used notes, the ATMs will also offer non-cash transactions, micro-deposits, credit and a number of other services tailor-made for rural areas. The machine can be used with ATMs or SmartCards and also has the option of using fingerprint identification. The machine costs around US$ 1,000, just a fraction of the US$ 20,000 it takes to install an urban ATM.

Source: Vortex Engineering Ltd.

6.3.2 Training and support

Training, another critical input needed to enable a successful micro-enterprise can be delivered through Internet. Technologically, all that's needed is a 64 Kbps sustained (not shared) connection to offer Internet based training. The success of such initiatives depends on the quality of the training material to encourage entrepreneurship in rural India.

6.3.3 Buying, selling and associated logistics

Trading through Internet is the soul purpose of existence of an enterprise. Internet-based trading of goods and services is a reality now with the recent dotcom boom showing the way. But, for this to be effective, the logistics of movement and delivery of goods needs to be smooth enough. With the condition of transport infrastructure in rural India (*see section 3.5.3*), online trading of goods remains a non-starter.

6.3.4 Risk taking

The ability and will to take risk are the basic ingredients of entrepreneurship. People in rural India are averse to taking risks due to the magnitude of the stakes involved. Innovative insurance schemes which mitigate the risks involved are absolutely essential to allay the fears of rural people. Group-insurance schemes are an effective tool and they can be distributed through the Internet kiosks.

6.4 Conclusion

Currently, the most shining example of micro-enterprises is the Internet kiosks. They need to have the right kind of infrastructure, equipment and facilities. Two critical questions need to be answered and they are given below.

What kind of equipment is required in such kiosks?
A multimedia Personal Computer (PC) e.g. one with a 2 GHz processor, 128 MB memory, 40 or 80 GB hard disk, CD-ROM drive, 15-inch colour monitor, speaker and microphone system, a camera which can be used to take off-line pictures and also serve as a web camera, an ink-jet printer and a reliable power back-up.

What is necessary to make the kiosk operations successful?
Adequate power back-up to support extended hours of operations in a day (14 to 16 hours), telephone (that would add to the revenue), Internet connectivity with 64 Kbps sustained (not shared) bit-rate, photography software, appropriate local language office packages, video-conferencing equipment, and other application software. Costs should be low enough to help kiosk operators to achieve break-even within the first six months of operations. The kiosks should be operational for 14 to 16 hours a day.

There is every reason to believe that Internet kiosks in each village can aggregate the demand of the village and quickly become profitable. As more and more services come to be provided by the kiosks, they can become the key infrastructure in the village. Tomorrow's kiosks could be centres that impart knowledge education and training, support and nurture entrepreneurship, and serve as banking and micro-finance outlets, trading centres, agricultural support centres, medical centres and much more.

7 Efforts to connect Rural India

The success story of the Indian IT industry has benefited only urban India. But rural India, afflicted with problems like inadequate transport, inefficient power supply, non-existent information infrastructure, underdeveloped business practices and an under-trained workforce, is languishing. There is a vast disparity in access to education and opportunities between urban and rural India.

These constraints, along with many others, have dissuaded several companies from taking on the challenge of providing Internet and telecom services in rural India. Yet such an engagement can serve a dual agenda: bridging rural isolation and the resulting disparities of education and economic opportunity while at the same time, creating opportunities for potentially large profits for organisations willing to tackle the challenge posed by inefficiencies in rural areas.

The key question is how modern resources and methods can be practically deployed to profitably overcome rural constraints. Also important are the social impacts of such an engagement. There have been a host of initiatives towards developing the rural economy with the help of modern technologies. Information and Communication Technology (ICT) initiatives by profit and non-profit organisations are significant as they have tried to bridge rural isolation from urban areas. In this context, these organisations look up on the Internet as the most powerful tool.

7.1 Existing Models - A Brief Overview

A sizeable number of organisations have undertaken a variety of initiatives which leverage Internet and Internet driven applications to reach rural markets more effectively and efficiently. These e-initiatives can be classified into two categories – those driving telecom infrastructure development and those that focus on applications and the delivery of content.

Traditionally, organisations funded by grants and aids have felt the need to create rural-oriented content while using existing telecom infrastructure to reach the rural masses. The content primarily focuses on essential services like education, health, e-governance and agriculture, the mainstay of livelihood in rural areas. For example, Bhoomi, Warana and Gyandoot are examples of successful e-governance initiatives while the MS Swaminathan Research Foundation and ITC's e-Choupals have focussed on activities related to agriculture. Meanwhile, n-Logue concentrates on building the infrastructure for providing connectivity, even while creating relevant applications to attract more users.

A further classification can be made based on the presence or lack of pecuniary motives in the running of these initiatives. The two broad categories are described below:

a. The not-for-profit initiatives

- Initiatives started through government agencies, Non-Governmental Organisations (NGOs), and those funded by charity or grants from developmental agencies and trusts fall under this category.
- They believe in the social changes that access to education and vital services bring about and hence have adopted the approach of funding localised initiatives.
- A few examples include – Akshaya,[65] Warana,[66] MS Swaminathan Research Foundation,[67] Bhoomi[68] and Rural e-seva (e-services).[69]

[65] www.akshaya.net
[66] www.mah.nic.in/warana
[67] www.mssrf.org
[68] http://www.revdept-01.kar.nic.in/
[69] www.westgodavari.org

b. The for-profit initiatives

- Initiatives of organisations that treat the rural market as a viable business opportunity belong to the second group.
- They believe in the benefits that a larger scale of operations provide and hence treat the national rural economy as one single market.
- ITC's e-Choupal, n-Logue and Drishtee[70] are some of the projects under this category.

7.2 The Non-profit initiatives

The common thread which runs through all these initiatives is their single-minded focus on rural communities and enabling their livelihoods. The rural areas covered by these networks have benefited tremendously from the availability of services hitherto largely inaccessible and this was made possible by access to Internet connectivity. The services provided have also enabled increased empowerment and gender equality, thus making the efforts laudable from a social perspective. A network of rural entrepreneurs has been successfully created and it is hoped that employment opportunities would be created in a widespread manner to narrow the rural – urban divide.

Box 7.1: Bhoomi

Bhoomi is a project started by the government of Karnataka to computerise the state's land records. The state identified land revenue as a key state resource and sought to bring transparency and clarity in terms of ownership and pricing. The State Government therefore mandated that Bhoomi - Computerisation of Land Records would have to be undertaken and finished in all sub districts by March 2002.

Though a pilot project towards computerising land records was started in the Gulbarga district as early as 1991, several delays in the system meant that the effort was diffused. The coffee town of Sakleshpur and the rural centre of Maddur were the early towns in the land record project. The first kiosk was launched in February 2001. Under this project, all 20 million land records of 6.7 million land owners in 176 taluks of Karnataka have since been computerised. The project cost is around U$ 5.3 million and has been funded largely by the Government of India and some critical components by the State Government.

"Bhoomi" uses a very comprehensive software designed by NIC, Bangalore and a state-of-the art bio-log on metrics system designed by Compaq. This software provides for printing of land records as and when required and ensures online updation to ensure currency of records maintained on the computers. The bio-logon system authenticates various users on the Bhoomi software on the basis of fingerprints and prevents hacking by imitation. These features guarantee total transparency, security and reliability in land records administration.

The government has positioned Bhoomi as a Government to Citizen (G2C) service and Bhoomi's database can be accessed by users through a network of rural kiosks at a nominal charge of US¢ 30 only. In the month of June 2004 alone, 911,980 farmers had utilized the services of Bhoomi. Since inception, over 19 million users have provided revenues of close of US$ 6.5 million to the state government on user charges alone.

Bhoomi has recently tied-up with n-Logue to offer their services in the rural areas of Mandya district in Karnataka.

Extracted from http://www.revdept-01.kar.nic.in/Bhoomi/Home.htm

Thanks to a focussed approach, most initiatives have met with initial success. However, in the long term, their success depends purely on the sustainability of these efforts and that can be done only if the following are made possible - economic returns and success guaranteed for the entrepreneurs and gradual scaling of efforts to gain mass momentum and acceptance. It is critical therefore, for the non-profit initiatives to ensure profitability of their end users.

[70] http://www.drishtee.com

7.2.1 The Warana "Wired Village" Project

In 1998, the state government of Maharashtra in association with the National Informatics Centre (NIC) started the Warana Nagar project. The objective was to increase the efficiency and productivity of the existing co-operative societies by providing a state-of-the-art computer communication network and the latest database technology. This was done by linking a group 70 villages under the Warana area using computerized facilitation booths that linked up the central computer network of the Network for Information and Counseling (NICNET).[71]

The project identified 6 highly populated villages, located within 10 kms from Warana Nagar to house access centres. Each of these centres was equipped with 8 to 10 computers and connected through VSAT connections, along with dial-up links. The Project was jointly executed by the NIC, Planning Commission, Government of India (NIC); the Directorate of Information Technology, the Government of Maharashtra (GoM) and the Warana Sahakari Dudh Utpadan Prakriya Limited (WSDUPL) at a cost of US$ 600,000.[72]

The access centres were used as interfaces to provide education and training to various co-operative societies and to provide tele-education to both primary and higher educations institutes. The project also provided for a Geographic Information System (GIS) mapping of the Warana area and the creation of a database of the population of the 70 villages. Information was also provided in the local language on crops, agricultural market prices, employment and educational opportunities.

This project was financially unsustainable and n-Logue took this project over in 2003.

7.2.2 Gyandoot

Gyandoot was started in the state of Madhya Pradesh in Central India in 2000, by the state government with a vision of creating a district intranet to offer a range of services at village centres called *Soochanalays*. Gyandoot, which means Messenger of Information, was first rolled out in the Dhar district which had a 1.7 million strong population.

This project offered a wide range of services – information on rates prevailing at agricultural produce auction centres, online redressal of public grievances, rural email and also served as the village auction and online matrimonial sites. Local youth were recruited as entrepreneurs or soochaks for running the kiosks and were expected to earn a net income of US$ 800 per annum by conservative estimates. The project made an impressive start with 21 village centres, each covering 20 to 30 villages, roughly covering over half a million people in the district. The project was awarded the Stockholm Challenge IT award in the "Public Service and Democracy" category in June 2000. However, these initial successes could not be sustained and could not be scaled up to cater to a larger population. Gyandoot was taken over by n-Logue in 2002 and has continued operations under its management and guidance.

7.2.3 MS Swaminathan Research Foundation (MSSRF)

The MS Swaminathan Research Foundation (MSSRF) believes that information and communication technologies can play a major role in environmentally sustainable rural development, not only reaching the poor but also helping them to achieve food security and social justice.[73] The Information Village Research Project (IVRP) was started in 1998 in Villianur in the Union Territory of Pondicherry, about 160 kms from Chennai. The 11 villages around Villianur had a population of 22,000, with annual household incomes of less that US$ 350 and a pathetic tele-density of only 0.2. The project was funded by the International Development Research

[71] www.nicnet.org

[72] http://www.eapf.net/sourcebook/chapter3.asp Of this total cost, 50 percent has been borne by the Central Government of India, 40 percent by the Government of Maharashtra and the remaining 10 percent by the Warana Group of Societies or the Warana Vibhag Shikshan Mandal. NIC was responsible for the design, development and implementation of the Warana Wired Village Project. They were also responsible for the user-level training on application software.

[73] http://www.mssrf.org/index.html

Centre, Canada (IDRC) and the Canadian International Development Agency (CIDA). It is also supported by the Canada Ford Foundation and the Department of Science and Technology, Government of Pondicherry. The IVRP was implemented by the MSSRF.

The MSSRF assists in setting up Village Knowledge Centres that maintain, update and disseminate information to the rural communities. These centres are run by young, women and men volunteers from within the community. While the community owns the centres, the IVRP provides the necessary equipment, data and training. Initially, connectivity was through analog radio technology, but has since been converted to dial-up connections. The project uses existing connectivity networks and only relevant content has been developed in-house. A host of services are provided - including weather reports, agricultural commodity prices, information on government schemes and programmes, agriculture, veterinary care, health, education and other useful information. This project won the Motorola Gold (Despatch Solution) Award for the year 1999 and won the Stockholm Challenge Award under the Global Village category 2001.

The JRD Tata Ecotechnology Centre, a department of the MSSRF, has been working on 12 projects in villages in Tamil Nadu. The projects are based on participatory research to develop grassroots-level institutions and employ simple adaptations of sophisticated laboratory technologies. The Technology Research Centre (TRC), one of the national institutions supported by the Union Government's Council for Advancement of People's Action and Rural Technology (CAPART), helps the Ecotechnology Centre with training and capacity-building in rural areas. The Ecotechnology Centre helps identify the technology, adapt it to suit local needs, demonstrate it, train participants, market the product and, finally, manage the system.[74]

The MSSRF in conjunction with the TATA National Virtual Academy for Food Security and Rural Prosperity is now trying to spearhead a "National Alliance for Mission 2007: Every Village a Knowledge Centre," which aims to be a movement that will help provide livelihood opportunities in the village communities of India.

7.2.4 Akshaya – an IT dissemination project

Akshaya is an initiative of the state government of Kerala that started in 2002. The primary objectives of the project are as follows:[75]

- To develop over 6,000 networked, multi-purpose community information centres (Akshaya Centres) to provide ICT access to the entire population of the state
- To make at least one person in each of 6.5 million families in the state IT literate
- To enhance the quality of available IT infrastructure in the state
- To extend the IT infrastructure to the rural parts of the state and
- To accelerate the development of local content relevant to the population.

The three corner stones of this project are the facilitation of access to technology, the development of skill sets to enable widespread use of IT and the development of relevant content in the local languages. Akshaya has been brought about through the partnership of the Kerala State IT Mission, the Science and Technology Entrepreneurship Development Board (STED), the Centre for Development of Imaging Technology (C-DIT), and the local self-governments in various parts of the state.[76]

Akshaya has set up 582 community information centres across the state known as Akshaya Kendras, all run by local entrepreneurs. Each Kendra is expected to cover approximately 1,000 families within a radius of 3 Kms radius and requires an initial investment of around US$ 4,500 per Kendra to cover the cost of computers, printers, fax machines, photocopiers etc. Connectivity is through a mix of wireline and WiFi access.

[74] Thrust on Ecotechnology, Asha Krishnakumar, Vol. 15, No. 18, August 29 - September 11, 1998, Frontline.
[75] http://www.akshaya.net/akshaya/overview
[76] www.keralaitmission.org, www.stedkerala.org, and www.cdit.org.

The pilot project was implemented in Malappuram district and the rollout to the other parts of the state is planned to be completed in two phases by April 2006. The Kerala government funded the US$ 300,000 that was the initial cost for implementation and a consortium of banks provided soft loans to the entrepreneurs. To improve viability, the Kerala government has now invited private sector companies to offer their products and services through these Kendras.

7.2.5 Project Rural eSeva (e Services)

eSeva is an initiative of the government of Andhra Pradesh started to promote Government to Citizen (G2C) and Citizen to Citizen (C2C) transactions. It made a modest beginning in 1999 in Hyderabad and its sister city Secunderabad as Twin Cities Network Service Project (TWINS). It was later renamed as eSeva when the government desired to extend services to major towns and municipalities of the state. By 2003, there were 36 centres in the twin cities and 70 more in different municipalities covering 13 districts offering close to 113 different services. Another 144 were to become operational by the end of December 2003.

Rural eSeva began in Eluru, the headquarters of the West Godavari district in Andhra Pradesh. The project aimed at setting up a network of rural Internet kiosks called Seva Kendrams to provide e-governance services, transaction services (payment of electricity bills, land records, auctions and bidding for produce), agricultural commodity prices from local markets, e-learning and other such relevant applications.

The kiosks were linked through a dial-up connection to a server located at the district administration office. Costing approximately US$ 2,150 per Seva Kendram, the project was funded by the government of Andhra Pradesh. It is through user charges that are often as low as US¢ 10 for multiple applications. Apart from the Seva Kendrams, some PCOs were also upgraded to offer a limited range of services. These centres were called the Rural Service Delivery Points (RSDPs).

eSeva Kendrams have been set up in all 46 Mandal (sub-district) head quarters of the district. 15 Self Help Groups (SHG) and 21 rural youth (called nirvahaks) trained and supported by the district administration run these centres. Around 150 Kendrams and RSDPs were set up under this project. Through a tie-up with the Azim Premji Foundation,[77] it provides children in the age group of 6 to 14 with suitable curricular and co-curricular software content with potential to enhance the quality of learning.

Inefficient connectivity jeopardised the project and made it neither scalable nor sustainable. Hence, n-Logue was requested to create the infrastructure in Eluru, and has since been managing the project.

7.2.6 Issues with non-profit initiatives

Most of the non-profit initiatives appear to suffer from similar malaises – the projects are rarely scalable to serve a larger section of people, costs are high, the management depth required to run projects is low and often there are contentious issues on project ownership. The government-run initiatives have some specific issues –

1. The ownership of initiatives is diffused through different levels of the administration and thus leading to slow implementation in some areas.
2. The lack of an economic or profit making agenda leads to high cost models being embraced.
3. The non-profit culture also seeps down the chain to the kiosk operators hampering their revenue model and profitability.
4. The services offered are focussed on government initiatives and thus other critical needs are ignored.
5. With focus on content, projects are rolled out on any available infrastructure. This leads to the use of non-standardised technologies at various places and resulting in cost over-runs and poor quality of delivery.

[77] The Azim Premji Foundation is a non-profit organization whose vision is the universalisation of elementary education. http://www.azimpremjifoundation.org/downloads/Eluru percent20Story.pdf

Due to some or all of the above issues, the projects have not generated widespread usage as envisaged. Some of these initiatives have been absorbed by n-Logue. In the case of Akshaya, the Kerala government-run initiative, the government is understood to be looking to the private sector to drive the creation of applications and services and for further expansion of the network. However, the high cost of the Akshaya Kendras is a big deterrent and hence a sustainable revenue model becomes critical. The MSSRF stands out as an exception thus far. The foundation has done significant work in terms of building support services to enhance the livelihood of rural citizens and is now seriously considering running its programs on a larger scale.

7.3 The For-profit initiatives

While on the one hand the government and some NGOs saw connectivity as a tool to bring in social changes in rural India, there were also some companies which saw this as an opportunity to create a sustainable business model.

Box 7.2: TARAhaat

TARAhaat Information and Marketing Services Ltd., was launched in Bundelkhand, Madhya Pradesh in Central India in late 2000. TARAhaat is a venture of Development Alternatives (DA), a leading NGO, which funds the kiosks. And is named after haat which means, "a village bazaar." TARAhaat positions itself as an ICT marketing company which brings information on products and services to the rural people using the Internet.

TARAhaat is accessible though village Internet centres called TaraKendras. There are several subsidiary units including TARAdhaba, TARAbazaar, TARAvan, TARAdak, TARAguru, etc. each of which focus on the provision of specialized services including connectivity, access to products and services, transportation of goods, communication media, mentoring and counseling to village business ventures etc. Connectivity is provided primarily through VSATs and alliances with local telecom companies.

TARAhaat has now extended its presence to Uttar Pradesh, Punjab and Haryana and currently 31 centres in operation. TARAhaat earns its revenues from multiple sources including from payments received for services, sales commissions, royalties and other fees. These revenues are used to maximize incentives for all the stakeholders in the TARAhaat venture.

The high cost of deployment of TARAkendras has been a major constraining factor with break-even set at a steep US$ 15 per day. They are also designed to serve as a hub for multiple villages and thus restricting presence to only a few larger villages. TARAhaat also faces the limitation of being only a portal and requires strong partnerships with companies to make it a viable and scalable business model.

Extracted from http://www.digitalpartners.org/tara.html

Two of the largest initiatives are e-Choupal[78] and nLogue.[79] Other initiatives include TaraHaat[80] (*see Box 7.2*) and Drishtee[81] (*see Box 7.3*).

7.3.1 e-Choupal

e-Choupal is a rural engagement initiative started by the International Business Division (IBD) of ITC, one of India's leading private companies. ITC-IBD procures and exports raw or processed agricultural commodities and is among the largest exporters of agricultural produce from India. Started in the late '80s, the division saw its initial success being eroded by the opening up of the Indian agriculture markets in 1996-97, with the entry of other large low-cost suppliers like Brazil, United States etc. The company identified that a significant portion of its costs was on account of inefficiencies in the procurement mechanism.

In 1998, ITC-IBD developed the concept of e-Choupals that places computers with Internet access in rural farming villages, as a means of improving procurement efficiencies. The e-Choupals serve as both a social gathering place for exchange of information (choupal means gathering place in Hindi) and an e-commerce hub.

[78] www.echoupal.com
[79] www.n-logue.co.in
[80] www.tarahaat.com
[81] www.drishtee.com

ITC's motive behind this whole initiative was to re-engineer the procurement process for soy, tobacco, wheat, shrimp and other crops in rural India. This has also created a highly profitable distribution and product design channel for the company - an e-commerce platform that is also a low-cost fulfilment system focused on the needs of rural India. The e-Choupal system has impacted rural transformation by increasing transparency for farmers and improving their productivity and incomes.

Through the e-Choupal network, ITC managed a savings of 2.5 percent in its procurement costs for soya translating to savings of US$ 6 per metric tonne. In the first year of operations, ITC-IBD estimated that it had saved around US$ 280,000 on just a single crop, soya. As the system expands in size, additional efficiencies are expected to increase the savings, making the model hugely attractive. As on March 31, 2004, ITC covered 24,000 villages through 4,137 e-Choupals in the states of Madhya Pradesh, Rajasthan, Kerala, Andhra Pradesh, Karnataka, Uttar Pradesh and Maharashtra and plans to reach 100,000 villages in the future.

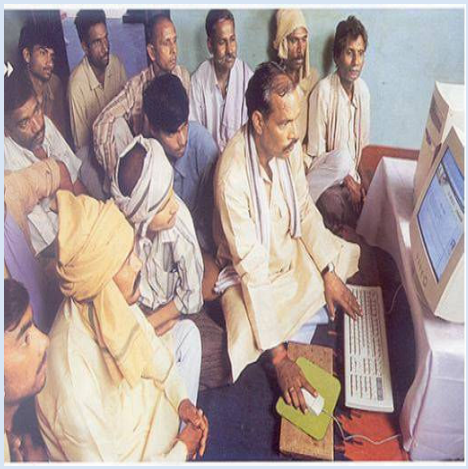
Enthused by the success of ITC with e-Choupals, several other companies like Hindustan Lever Limited and Godrej Industries are attempting to create alternate networks and models along similar lines.

7.3.1.1 How it works

ITC enrolls a host farmer called *sanchalak* and places a computer in the *sanchalak's* house. The computer is provided with Internet connectivity via phone lines or through VSAT connections. Thus the *sanchalak's* house starts functioning as an e-Choupal (*see Figure 7.1*). Each e-Choupal costs between US$ 3,000 and US$ 6,000 to set up and about US$ 100 per year to maintain. A typical e-Choupal serves an average of 600 farmers in 10 surrounding villages within about five kms radius. The *sanchalak,* bound by a public oath to serve the entire community incurs some operating costs but, benefits from increased prestige and gets a commission for all e-Choupal transactions.

Figure 7.1: Farmers in an e-Choupal kiosk

Farmers use the computers free of cost in e-Choupals, to access daily closing prices on local *mandis*, as well as to track global price trends or find information about new farming techniques. They also use the e-Choupals to order seeds, fertilizers, and other products such as consumer goods from ITC or its partners, at prices lower than those available from village traders. The *sanchalak* helps illiterate farmers in accessing information and ordering goods. The *sanchalak* typically aggregates the village demand for these products and transmits the order to an ITC representative.



Post harvest, ITC buys the crop directly from the farmers at the previous day's closing price; At the ITC processing centre, the quality of the crop is assessed and is weighed electronically. The farmer gets the price of the crop and the cost of transportation is reimbursed to him. Farmers get "Bonus points," for crops with quality above the norm. These points can be exchanged for products that ITC sells. Thus, e-Choupals are a very enriching alternative to the government-mandated trading *mandis*.

7.3.1.2 Benefits for everybody

The e-Choupal system has impacted rural transformation by increasing transparency for farmers and improving their productivity and incomes. Being a very efficient system, it has brought about true empowerment of the farming community and the social gains have also been impressive. ITC, having pioneered the roll out of e-Choupals has gained enormously, both in economic benefits and in stature among the business community.

Benefits for the farmers

Despite difficulties from the unreliable telephone and electric power infrastructure that limits the hours of use, e-Choupals give a host of benefits to the farmers, viz.,

- √ Accurate weighing, faster processing time, and prompt payment at the ITC processing centres.
- √ Access to information like, accurate market price, market trends, etc. that help the farmers to decide on the time and place to sell.
- √ Higher price for the crops compared to the *mandis (*about 2.5 percent higher).
- √ Lower price to buy agricultural inputs and other goods.
- √ Access to services like soil testing and expert advices to improve crop quality.
- √ Ability to reach goods to the right markets at the right time.

The e-Choupal system has had a measurable impact on what farmers chose to do. In areas covered by e-Choupals, the percentage of farmers planting soy has increased dramatically, from 50 to 90 percent in some regions, while the volume of soy marketed through *mandis* has dropped as much as half.

Benefits for ITC

ITC saves about 2.5 percent of its procurement cost in the form of commission fee and transport costs it would otherwise pay to traders who serve as its buying agents at the *mandi.* This system provides direct access to farmers and first-hand information about the on rural market dynamics thus helping ITC in planning and managing supply better. The company gains additional benefits from using this network as a distribution channel for its products and those of its partners. This has further evolved in to an interactive feedback channel and is also becoming a source of product innovation for ITC. *Sanchalaks* often aggregate village demand for some products and place a single order, lowering ITC's logistic costs. The company reports that it recovers its equipment costs from an e-Choupal in the first year of operation and that the venture as a whole is profitable.

ITC is exploring the possibility of partnering with banks to offer farmers access to credit, insurance, and other services that are not currently offered or are prohibitively expensive. Some *sanchalaks* even track futures prices on the Chicago Board of Trade as well as local *mandi* prices, and village children have used the computers for schoolwork, games, and to obtain and print out their academic test scores, resulting in a overall rural development.

7.3.1.3 Business Model: a Critical view

The e-Choupal's economic benefits are not based on the usage of the Internet or allied transactions but due to efficiencies in the procurement chain. At present, the procurement chain is restricted to soybean, but ITC plans to extend it to other crops like wheat etc., which its food division could use. While this will help the company sustain operational efficiency in the medium term, market forces are bound to catch up with ITC in the long term, reducing these benefits along with its competitive advantage. If and when it does happen, ITC will need to revisit its cost structure (both installation plus operational) for the e-Choupals. The current satellite-based system used is very expensive and ITC will soon need to find low-cost alternate mechanisms for the e-Choupals. Most importantly, multiple services will need to be offered to create a lasting benefit for the company and its users.

7.3.2 n-Logue

While ITC used rural connectivity in the e-Choupals to strengthen its existing business, n-Logue is the innovative company which saw rural connectivity as a business in itself. After ITC, n-Logue is the second largest player in the rural connectivity market. n-Logue today covers 30 districts through a network of around 1,800 kiosks. It is planned to increase this network to around 10,000 kiosks over the next 6 to 8 months.

n-Logue is a for-profit corporation, with majority ownership residing with a non-profit company, the TeNeT group. This group has been responsible for a stream of hardware and software innovations that enable rural IT-based service delivery, through connectivity and applications. The core innovation at the heart of n-Logue's operations is corDECT, the WLL technology (*see section 5.2.3.1*), which provides simultaneous wireless Internet and voice connectivity.

n-Logue's approach is to create a robust connectivity backbone for rural Internet access. In creating this infrastructure, it has been largely supported by the 12 odd companies incubated by the TeNeT group which have developed complementary products specifically relevant to rural India (*See Table 7.1*). These products have been integrated by N-Logue for connectivity and the deployment of applications in rural markets.

Table 7.1: Application provided by various companies

Technology/Application	Offered By
corDECT WLL system and Web terminal	Midas Communication Technologies Pvt. Ltd.
Relay Access System (RAS) and Routers	Banyan Networks
Minnow ISP in a box and billing system	Nilgiri Networks
Network Management	NMSWorks
Indian language 'Office' package	Chennai Kavigal
Multi-party, multi-rate video conferencing software and live lectures	Object Oriented Programming Services Pvt. Ltd.
Rural ATM machine (to be deployed)	Vortex Engineering Ltd
Medical diagnostic Kit	Neurosynaptic Communications Pvt. Ltd.
Online eye testing and fingerprint detection for rural ATM	HP-IIT, Madras
LCD Projection System and Sparse Area Communication System (Under trial)	TeNeT

7.3.2.1 The Approach

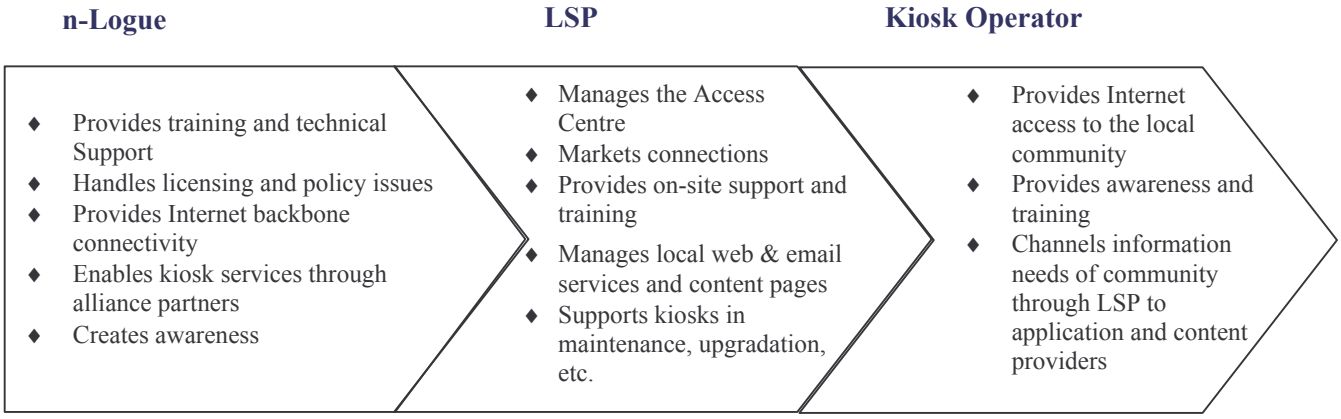
The challenge in rural India has always been to find technologies that offer connectivity in a cost-effective manner and applications that are relevant to local needs. Given that the vast majority of India's population still lives in its rural hinterland, a model that is easily scalable and would reach 100,000 villages was considered a critical need.

As already explained in Chapter 5, while fibre connectivity has reached most *taluka* towns and wireless hubs at the headquarters with a range of up to 20 kms could provide connectivity to most villages. Today's wireless technologies are relatively inexpensive and new developments promise higher bit-rate connectivity for each village. corDECT is the chosen technology used by n-Logue to meet its objectives. With rugged design (that can work at 55^0C), low power requirement of the central unit (at less than 1 KW) and a cost of only US$ 250 per village, corDECT promises 35 to 70 Kbps (sustained or unshared connectivity). An upgrade in the near future could take this up to 100 or 200 Kbps (dedicated connectivity).

While the technology was addressed by the use of corDECT, a sustainable business model needed to be created and the key issue was demand. N-Logue drew inspiration from a revolution in the '80s which aggregated telephone demand into PCOs that were manned by small local entrepreneurs. This approach made connectivity viable and pervasive while also creating a stream of empowered and self-employed people. This same **Demand Aggregation** approach was used to create village kiosks known as Chiraag (Chiraag in Hindi means lamp or light). The kiosk was to be the hub of the rural connectivity providing communication services (e-mail, chat, browsing), as well as other much needed applications like education & training, healthcare, agriculture consultancy and e-governance.

7.3.2.2 Business Model

Inspired by the effectiveness of the decentralized model of cable TV operations in India, n-Logue employs a three-tiered business model. There are up to three business entities involved in the operation - n-Logue, Local Service Providers (LSP) and kiosk operators. *Tier-3* is constituted by the local village kiosks, which provide services and information aimed at the rural market. The LSPs whose prime responsibility is to find subscribers, provide services and collect payments constitute the *Tier-2.* The LSPs are local investors who are recruited by n-Logue to provide services in designated geographical areas. n-Logue constitutes the *Tier-1.* n-Logue provides equipments, training and support to the LSPs and kiosks, and also takes care of regulatory and connectivity issues.
With the help of n-Logue, the LSPs recruit local entrepreneurs who set up the kiosks. All three must work together as seamless components to provide the range of services required by a village and must thrive for the operation to succeed.



Operations of the kiosks

Each kiosk costs approximately US$ 1,200 to set up. If voice telephony is to be made available in the project area, the cost of the kiosk increases by US$ 110, and includes an STD-PCO meter and all related telephony equipment. The kiosk-level hardware is relatively inexpensive, and adds only marginally to the overall cost of a kiosk (*see Figure 7.2*).

The cost associated with providing connectivity through Wireless in Local Loop (WLL) requires a substantial density of kiosks within a particular radius of the tower. The n-Logue model is designed to achieve this density, with kiosks generating returns from fairly small user populations. n-Logue is the second largest organization in this field, supporting over 500 rural-IT kiosks each geared to handle around 500 to a 1,000 customers in a radius of 25 km (around 2,000 sq km).

Figure 7.2: Chiraag kiosk in a village

Source: n-Logue Communications Pvt. Ltd.

The close links with the IIT Chennai group has given n-Logue access to a range of software innovations for delivery and implementation of various applications in the fields of education, health and agriculture. For example, web cameras have been used for remote diagnostics for diseases of people, animals and plants. Local language software has also been created to enable effective communication for the rural populace. Some of these applications and companies have been mentioned in chapter 6.

n-Logue has also been able to leverage its university connections to build strong partnerships with both government and private players. The Government of Tamil Nadu has been strongly supportive of n-Logue's operations in Madurai district, where numerous innovations have been piloted and showcased. Media Lab Asia, a venture seed funded by the Government of India has also been involved in the initial stages of these initiatives.

ICICI Bank, a leading private sector bank is piloting various financial services and products in n-Logue kiosks in Madurai. In Nellikuppam (about 175 km from Chennai), n-Logue has partnered with EID-Parry, (belonging to a South Indian business conglomerate) to improve access to information for sugar farmers, and reduce their transactions costs in dealing with Parry's large sugar factory in the district, through improved tracking and settlements of payments.

7.3.2.3 Services offered

n-Logue offers a host of services through these kiosks.

E-governance

- √ Kiosks provide access to government portals that contain online forms and applications for documents such as birth and death certificates, land records, etc.,
- √ They also organize videoconferencing sessions between village kiosks and local government officials.
- √ Digital photographs are taken and touched up at the kiosk for government documents, such as passport applications.

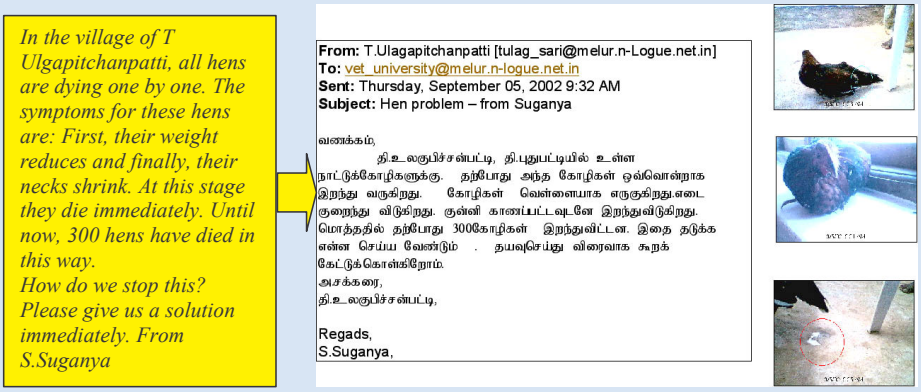
Agriculture

- √ Expert advice on better farming techniques and solutions to crop and animal diseases via email and videoconferencing through a partnership with the Tamil Nadu Agricultural College and Research Institute.
- √ Sales of tractors and spare parts through partnerships with farm equipment manufacturing companies.
- √ Online veterinary advice for livestock in areas with no access to veterinarians (*see Figure 7.3*).

Other Services

- √ Browsing, email, voice mail, video mail, chat and video chat.
- √ Advisory services for the rural educated and unemployed in making professional resumes and cover letters.
- √ Coaching centres for the rural children - for a nominal membership fee, village children are allowed to use the kiosks and learn the use of computers. In some places, these kiosks double as libraries for the children.
- √ Astrology services providing personalized astrological predictions and horoscope charts and matrimonial services.
- √ Village entertainment centres - villagers use the computers to watch movies, listen to music or play video games.
- √ n-Logue is also exploring the possibility of introducing other services including soil testing, online farming "schools", early warning systems on disease outbreaks, and long-term predictions on crop prices, demand, and rainfall.

Figure 7.3: Remote veterinary care through email.



Source: n-Logue Communications Pvt. Ltd.

7.3.2.4 Benefits from Chiraag

n-Logue's primary revenue sources are its franchise network (LSPs) and usage revenues from the operations of the kiosks. Therefore, it is highly conscious of the need to ensure the survival of the kiosks to make its business model robust. With this in mind, n-Logue has managed to create and source multiple applications that will help in the long term and sustained usage of the kiosks. The heart of the n-Logue model is its low cost approach. As a result, kiosk operators need revenues of approximately US$ 70 per month for break-even in a village of approximately 1,000 people. Normally, kiosk operators achieve break-even over a period of 6 to 8 months and recover their total initial investment over a period of 3 years. However, this period varies. This figure however varies depending on the community networking skills and marketing efforts of the kiosk operators and LSP's.

Kiosk operators earn revenues from the various services offered including browsing, email, video mail, education and consultancy services. Apart from the online education programmes, offline content such as books and reading material are also available, adding to the revenues of the kiosk operators. Since the project is still in its infant stages, n-Logue currently does not charge for these services. However, once a critical mass in terms of size and usage is reached, n-Logue will augment its revenues from these operations directly or through revenue-sharing with third parties who provide the content. n-Logue earns approximately US$ 21 per month for unlimited usage from the kiosk operators. 50 percent of this amount is shared with the LSPs, who are co-investors in the business.

The social benefits of n-Logue's kiosks are extremely significant, especially in the empowerment of women. Women operate several of these kiosks and have thus gained a greater degree of economic freedom, hitherto not very common in the rural areas where they are usually crushed under age-old prejudices and practices. Access to primary healthcare and education is easily the next biggest benefit to the rural populace. These services have been made affordable and easy to reach. A welcome incidental benefit is that it has reduced the burden on other existing infrastructure. Villagers no longer need to trudge the miles to city or town schools, hospitals and government offices, thereby reducing the burden on these institutions as well as on the transport services. These kiosks have generated employment opportunities and paved the way for localised income generation, reducing the disparity with urban needs and reducing migration to over-crowded cities.

7.3.2.5 Business Model: A critical overview

n-Logue's long term sustainability is dependent on the success of the village kiosks. Computers are a fairly new phenomenon in rural areas and often there is only a grudging acceptance of services through computers. Thus, the adoption and embracing of services offered through the kiosks is a fairly slow process. n-Logue has also faced several constraints including the limited availability of content in local languages and the lack of co-operation from support services in healthcare and e-governance. It needs to build lasting partnerships with the providers of allied services to continuously enhance the user experience at the kiosks. In tandem with the LSPs and kiosk operators, it needs to involve the local communities to actively participate in, contribute to and utilise all its services.

Box 7.3: Drishtee

Drishtee, started in the year 2000 by a private entrepreneur in North India, is now present in 6 states and covers a total of 7 districts, with 300 operational kiosks. The objective of the project has been to establish community-owned, innovative and sustainable information technology projects in the most poverty-stricken and tribal-dominated rural areas throughout India.[1] Local villagers own the kiosks costing about US$ 1,350 whose funding comes through a mix of government bodies, venture capitalists and other funding agencies.

The Drishtee centres are known as *Soochanalayas*, run by local youth known as Soochaks who could earn up to US$ 135 per month. Since 2000, about 40,000 people have accessed the variety of services offered at the *Soochanalyas*. Drishtee has enabled better organization of rural self-help groups, increased literacy of rural youth and greater access to e-governance and e-commerce applications.

The kiosks use dial-up connectivity through local exchanges on optical fibre or UHF links. Connectivity is, therefore, low-bit rate, expensive and also not always reliable. Lack of dependable power supply and other infrastructural issues have hampered the use of a wider range of applications and also a faster expansion of the kiosks.

7.4 Summary

All ICT initiatives, both non-profit and for-profit are driven by lofty ideals that see rural India educated and empowered with access to transparent mechanisms for better economic prospects. The success stories too, all share a common vein – they encourage local initiative and enterprise, provide economic returns to all the participants and are highly scalable. Some of these initiatives have brought the governments closer to its citizens through e-governance applications while some others have been the bedrock of private initiative. Bhoomi, eSeva and Akshaya are examples of the first variety while e-Choupal and n-Logue stand for the latter.

All efforts have clearly demonstrated the rich rewards that have been reaped by rural people. However, these noble intentions of providing Internet connectivity and relevant local applications and services can be truly meaningful only if they reach across to a wider cross section of people. India's rural population is scattered across 638,365 villages and the challenge would be to reach at least 100,000 of these within a short frame of time.

8 Regulation, policy and other issues

In its 10-point agenda released in May 2004, the Government of India has outlined the use of Information and Communication Technology to improve literacy through distance education and the quality of healthcare services through telemedicine and internet in the remote rural areas. Regulations and policies to ensure execution of the vision are very critical and the government must play the role of a facilitator to ensure a sustainable model where competition and open market dynamics drive quality, relevance, affordability and acceptance of services. Policies that allow a free and fair play for the rural operators are essential. Policies that enable infrastructure sharing for the rural operators would help them reduce costs and offer customised services. Shared infrastructure is imperative at least until the rural markets attain sustainable levels of maturity and are able to provide economic returns in line with their urban counterparts. This chapter discusses the history of telecom regulation, suggests policies for improvement and also highlights some issues that need urgent redressal.

8.1 Neglect of rural telephony

Telecom operators in most countries historically concentrated on building telecom networks in urban areas and have generally considered provided rural connectivity as a liability. Telecom operators in India are no exception. Providing rural telephony and Internet connectivity has always been dismissed as a loss making proposition. If at all, attempts to venture into rural areas have been done only under obligations imposed by regulatory or license conditions. When the Indian telecom sector was opened up for competition through policy initiatives by the government as part of NTP 94 and NTP 99 (*see section 4.6.1*), private basic service providers were given licenses to operate in the lucrative urban areas only on acceptance of the obligation to provide a certain level of connectivity to rural areas. Further, a significant part of the license fee charged by the government consisted of a levy towards the USOF, which was used to provide connectivity in these rural areas.

Not withstanding all these, the new private operators barely ventured into rural areas, failing to carry out their obligations. Acceptance clearly did not translate into implementation of any of the conditions. The state-owned incumbent, BSNL also expanded only reluctantly in some rural areas, albeit only while complaining loudly and bitterly about the burden they had to shoulder. Yet, for its part of the burden, BSNL was indeed compensated to a certain extent by government grants in lieu of license fee and spectrum charges paid by them and also by Access Deficit Charges (ADC) levied on all calls.

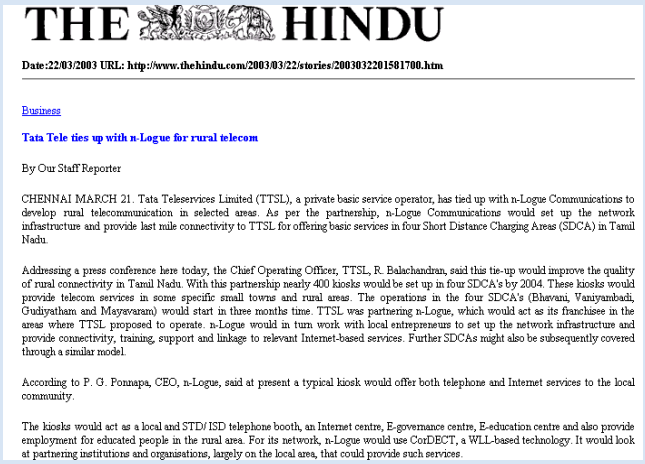
In other words, all major telecom operators competed only for urban business and avoided getting into rural telephony as much as possible. Telecom companies would rather pay penalties than roll out services in the un-remunerative areas. Therefore, most of the existing rural connectivity is either because BSNL provided it under pressure from the Government or because it exists simply as a spill-over from the infrastructure created to cover urban areas or highways. It is under these trying circumstances that the USOF had called for tenders[82] from operators to provide rural connectivity. While private operators largely ignored the tender, even the incumbent was reluctant to bid for the tender on the pretext that the maximum bid amount stipulated by the USF was too low and they stood to lose money in connecting rural areas even with the maximum amount of subsidy provided.

As mentioned earlier, NTP 99 required private operators to provide certain amount of rural connectivity as part of their license conditions. Since the operators had failed to meet most of these conditions, in 2002 and again in 2003, they were threatened with the imposition of heavy fine or the cancellation of their licenses. Acting under such pressure, some operators did take some minimal initial efforts (*see Box 8.1*).

Strangely, in December 2003, while resolving the dispute on *Limited Mobility* and *Full Mobility*, the DoT acting on the advice of the TRAI, had removed the rural obligations of the operators. Rural connectivity thus got relegated to the background in one go.

[82] Tender No. 30-130/2003, the Universal Service Fund

Box 8.1: Tata Teleservices serves universal service obligations



THE HINDU

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Business

Tata Tele ties up with n-Logue for rural telecom

By Our Staff Reporter

CHENNAI MARCH 21. Tata Teleservices Limited (TTSL), a private basic service operator, has tied up with n-Logue Communications to develop rural telecommunication in selected areas. As per the partnership, n-Logue Communications would set up the network infrastructure and provide last mile connectivity to TTSL for offering basic services in four Short Distance Charging Areas (SDCA) in Tamil Nadu.

Addressing a press conference here today, the Chief Operating Officer, TTSL, R. Balachandran, said this tie-up would improve the quality of rural connectivity in Tamil Nadu. With this partnership nearly 400 kiosks would be set up in four SDCA's by 2004. These kiosks would provide telecom services in some specific small towns and rural areas. The operations in the four SDCA's (Bhavani, Vaniyambadi, Gudiyatham and Mayavaram) would start in three months time. TTSL was partnering n-Logue, which would act as its franchisee in the areas where TTSL proposed to operate. n-Logue would in turn work with local entrepreneurs to set up the network infrastructure and provide connectivity, training, support and linkage to relevant Internet-based services. Further SDCAs might also be subsequently covered through a similar model.

According to P. G. Ponnapa, CEO, n-Logue, said at present a typical kiosk would offer both telephone and Internet services to the local community.

The kiosks would act as a local and STD/ ISD telephone booth, an Internet centre, E-governance centre, E-education centre and also provide employment for educated people in the rural area. For its network, n-Logue would use CorDECT, a WLL-based technology. It would look at partnering institutions and organisations, largely on the local area, that could provide such services.

Tata Tele to tap Gilat Satellite Network for AP circle

Tata Teleservices ties up with Gilat Satellite Networks to provide 1,000-site fixed rural satellinge telephony network to service basic customers in Andhra Pradesh. This new network, based on Gilat's DialAw@y IP(TM) VSAT product, will serve public payphone and fax kiosks, supporting the needs of agricultural workers and other inhabitants of Andhra Pradesh. Ajay Pandey, chief operating officer of Tata Teleservices, said: "VSAT networks is a superior platform for bringing affordable telecommunications services to rural populations. Gilat's technology is meeting our requirements and will enable us to serve our users." DialAw@y IP is one of the only VSAT products capable of providing high-speed Internet connectivity and toll-quality telephony service at the same time. Each unit supports a PC/LAN connection and up to six telephone lines. According to the company, it is a low-cost solution for the fulfillment of universal service/access obligations, Public call office requirements and small office/home office requirements for bundled telephony and Internet access. This network will enable Tata Teleservices to meet its universal service obligations under its license agreement with the Department of Telecommunications for Andhra Pradesh. In the future, Tata Teleservices expects to use the network to provide high-speed Internet connectivity to many of those sites.

Source: The Hindu dated July 22, 2003 and Business Standard dated April 15, 2002.

8.2 Internet in Villages

Rural areas at least have some modicum of telephony (rural tele-density is close to 1.3 percent), thanks to pressure from the Government over many years and also due of the efforts of BSNL. However, Internet connectivity is in a much worse shape. It is almost non-existent but for some of the recent efforts (see chapter 7). These initiatives are also saddled with many problems. Technology is a major impediment. The land lines that exist in rural areas are capable of supporting 9.6 Kbps or 14.4 Kbps Internet connectivity on dial-up modem, severely limiting the number and type of applications that could be offered. CDMA (IS-95) is another option but, even this technology limits the data connectivity rates to 9.6 Kbps. However, some strides in the path of improvement have been made using technologies like corDECT Wireless-in-Local-Loop which has the potential of providing 35 Kbps or even 70 Kbps dedicated (sustained) Internet connections.

The next biggest problem limiting the Internet connectivity in rural India is the affordability and availability of personal computers for rural families. Finally, there are very few applications that are truly relevant to rural ares rendering even connections where available, of little use. Therefore, it is hardly surprising that the Internet has barely made any impact in the rural milieu.

8.3 Regulatory history

It is not that this state of affairs of rural connectivity was not foreseen. Almost 4 years ago, some experts had suggested the introduction of a special category of operators called Rural Service Providers. They had argued that for years to come, the focus of the larger private operators would be on getting a bigger share of the pie in the urban telecom market. It was therefore desirable to create special operators who would focus on rural areas and attempt to make rural telephony and Internet businesses viable (*See Box 8.2*).

In fact, the efforts of ITC and n-Logue Communications have shown that there were companies who were undaunted by the challenging task ahead. Even though they were not provided a license to provide telephony, they have done a commendable job of bringing the benefits of the Internet to the rural areas. Fortunately, they were enabled by the Internet policy of 1999 which allowed virtually anyone to become an Internet Service Provider (ISP) with a token sum of under US¢ 2 as license fee and a nominal amount for a bank guarantee. ITC and n-Logue have used this ISP license to run their Internet operations in rural India. A well-planned and crafted regulation on the lines of Rural Service Providers would have enabled them to move faster and reach a wider section of people.

Box 8.2: New Policies Can Unleash Entrepreneurship in Rural Telecoms

Michael L. Best, Ashok Jhunjhunwala, Colin M. Maclay,

India can ill afford to continue with its head in the 21st century while its tail remains in the 19th, but by improving access to information and communication technology – especially in rural areas – we can move all Indians into the modern realities of a global knowledge economy. By releasing the shackles on India's entrepreneurs imposed by current communication regulations, we can catalyze widespread improvements in rural access at Internet speeds. In doing so, the government and BSNL will be largely relieved of the awesome and unmet challenge of offering quality telecommunications access at affordable prices in rural areas. Truly progressive regulation is required, and it is required now, if the government is to take advantage of the unique state of the current voice and data services markets. We believe that a policy that creates and promotes community-based Rural Service Providers will fundamentally change the economies and realities of access for rural India.

Currently, more than half of India's villages lack telephone connectivity let alone Internet access; the arrival of the information revolution to India is in doubt. The 26 million phone lines (mostly business-owned) and 1 million Internet subscribers that do exist nationwide are highly concentrated in urban areas, leaving rural areas out of the loop and harming the interests of both groups. If over 55 million televisions were wired with cable in less than a decade, imagine how many homes and villages could be wired with the Internet, a system that offers a far wider range of services, generates more earnings, is more flexible in design, and is essential to social and economic development. Sadly, rural Internet and telephony is not taking off like cable television because the regulatory environment, rather than promote universal access, actually serves to discourage it.

Overall, the private sector is doing well, even in the presence of problems posed by the dominant providers, in building out the information and communication technology (ICT) infrastructure and services in the class I cities (top 300 cities). Since the opening of voice telephony, private Basic Service Operators (BSO) have moved into the 20 largest cities, and the liberalization of Internet licensing has led to a large number of private Internet Service Providers (ISPs) working in urban areas. A variety of private companies are rolling out optical fibre backbones (technically suitable for voice and data) between major cities across the country.

However, no private sector ICT company is deploying into rural areas and BSNL is losing money (or at best breaking even) everywhere in the country except class I cities. Indeed, the cost structure of BSNL (and BSOs in general) means that for the foreseeable future it will be impossible for them to earn a profit on investments in the rural market. While investing in rural service is a core part of BSNL and the BSO's mission, and a legal requirement under universal service obligations, it is a poor financial proposition today.

With the creation of a myriad of local, small, entrepreneurial, fast, and flexible Rural Service Providers (RSP) India can fundamentally alter the economics of rural access and in doing so network the entire country. Because their operating costs are less than half BSNL's, small private RSPs can provide quality telephone and Internet service at affordable prices – but only if the policy environment allows them. Entrepreneurs will roll out reliable service quickly, help meet universal service obligations, add to BSNL's (and other BSOs and backbone providers) revenues, and reduce costs. If we have learned anything from India's cable television experience, now is the time to apply it.

At a bare minimum, the policy environment should offer initiatives such as:

• RSP licenses for operation outside of class I cities. Current telephony licenses require operation across an entire state thus limiting providers to large corporations. An RSP should be permitted to provide telephone and/or Internet service to any sized area outside major cities, whether a few villages, a taluk, or block. The RSP must be allowed to connect to BSNL or some other existing BSO, as well as an Internet backbone.

• Barrier-free entry for RSPs. Entering today's national ISP market requires an Rs 100,00000 bank guarantee, and BSOs pay a one-time entry fee (plus revenue sharing) to offer phone service. For rural providers all such requirements should be waived or substantially reduced.

• Revenue sharing terms for RSPs that are as attractive as the ones BSOs enjoy. The current model allows for a BSO to retain roughly 80% of long distance call revenues when it connects to BSNL's network. RSPs should receive an equal share of income. This is a fair agreement given the added revenue BSNL stands to generate from the RSP and the fact that the RSP is responsible for building out and maintaining its own infrastructure.

• Fee-free spectrum licensing for RSPs using wireless technologies. The current spectrum charge structure discriminates against rural areas; for instance, the annual cost per mobile phone subscriber in Delhi is Rs 100-150 versus Rs 2000 in rural areas. Annual satellite spectrum charges can reach Rs 50000. Wireless technologies will play a key role in offering quality economical service to rural areas in the immediate future, and current spectrum fees are unreasonable. A spectrum license fee holiday for wireless technologies used in rural areas should be put in place for the next ten years.

• Rationalized and reduced taxes and duties on ICT goods. Current levees including excise, sales tax, custom and import duties, etc. can reach 35% for basic computer and telecom technologies and 50% for satellite technologies. RSPs should receive substantial relief from these taxes. Furthermore, in this era of convergence, the taxation framework should be technologically neutral – telecom and Internet technologies should all be taxed at an identical and predictable rate.

India cannot truly advantage itself of its growing strength in the field of information technologies without servicing its own domestic needs first, particularly those in rural areas. Whether it's to meet the rapid growth in rural consumer and durable goods consumption, create new educational opportunities, stem the flow of people to urban areas, improve market functioning, better rural health care, or slow birth rates, ICTs have a significant role in the solution. India's advantages lie in its population density, the potential size of its network, economies of scale, understanding of rural poor needs, and its cultural and geographic diversity. By addressing these challenges and connecting up rural communities, India can boost its efficiency and economic competitiveness. The world economy is moving with increasing speed, and the last things India can afford is to leave most of its population disconnected from the high-speed global knowledge network.

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Source: *Economic Times, 4 April, 2001*

With the introduction of the NTP 99, the tottering mobile services industry (crushed under the burden of huge license fees) was brought back on its rails. At the same time, the inexperienced policy makers, regulators and operators were constantly at tussle as several vexatious arose on the issue of "Limited and Full mobility." Factional disputes came to the fore between basic (or fixed line) and mobile operators. While the DoT and TRAI were completely focused on resolving these complex and highly contentious issues, there was little time available to examine in depth, the issues plaguing rural telephony. Intense lobbying efforts in the country's capital were also focused on issues in urban areas only. Thus, the path breaking suggestion of Rural Service Providers was largely ignored. The policy makers either hoped that the concern of rural connectivity would either be addressed on its own or would simply await its turn.

When the rural service obligations of the private operators were done away with, vehement protests were raised against ignoring rural interests *(see Box 8.3)*. But, these were silenced with arguments that either BSNL would take care of providing telephony or the USOF would. Even as counter arguments flew that urban telephony bloomed (with both reduced tariffs and improved quality of service) only with competition among multiple operators, it was left to BSNL's devices to take care of rural telephony. This only meant that somehow competition would not be required in the rural areas and any benefits arising thereof are not important either.

Box 8.3: Letter to the Minister of Information Technology and Communications protesting withdrawal of rural service obligations

INDIAN INSTITUTE OF TECHNOLOGY MADRAS
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Dr. ASHOK JHUNJHUNWALA
Professor

Telecom and Networks (TeNet) Group
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REF: EE/AJW/962/03

01.12.2003

Shri Arun Shourie
Honourable Minister for Disinvestment & Communications
Ministry of Information Technology & Communications
1st Floor, Electronics Niketan, Lodhi Road
New Delhi - 110 001.

Dear Sir,

It was a surprise to us that along with the introduction of universal license in telecom (merging BSO and CMTS services), the obligations that the BSO had to expand their network in rural areas have been done away with. What is being stated is that the rural obligation will largely be driven in future by BSNL and USF will help in this regard. It is also being stated that the private BSO were any way not proceeding forward very much on the matter.

1.It is true that the private BSOs had moved very slowly on rural obligations. But under pressure from DOT, many of them had made a good beginning and started taking interest in rural connectivity. I understand that Reliance had already installed their POP in over 1000 SDCAs. Tatas had taken a massive effort to connect over 1000 hitherto unconnected remote villages in Andhra Pradesh using VSAT, and along with N-logue Communications were in the process of connecting over couple of thousand villages in Maharastra, which were so far not connected. Even in Gujarat, it was tying up with N-logue to work out a business model to connect every village in certain districts. Even the Govt. of Gujarat was participating in this milestone as Internet kiosk was to be put in each of these villages.

2. While much of these attempts were to meet obligations, the learning from these efforts would have enabled these BSOs to come up with innovative business models for rural areas. Unfortunately the new policy is killing these efforts in the bud.

3. Sir, you would agree that even in urban areas the telecom boom is taking place only after competition has been introduced. It is the competition that has helped reduce prices and enhance services. In a similar way the competition in rural areas was essential to make rural telecom a business proposition and help enhance services. Now by making the rural connectivity effort largely fall back on BSNL, one is taking a big step backward. Without competition in connecting rural areas, rural services are unlikely to significantly improve.
Sir, I do not think the objective of the merger of the licenses was removal of this rural obligation. This has happened perhaps due to oversight. I therefore feel that it is important that the removal of rural obligation due to the merger of licenses, be done away with immediate effect.

Thanking you,

Sincerely yours,

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8.4 Regulatory changes required

It is only in the recent few months that it has been acknowledged that BSNL is incapable and unable of making significant inroads into rural telephony into rural connectivity and that the USOF would not be the magic panacea for the ailing rural telephony market. Attention is now again being given to the regulations and policy framework for rural connectivity. The RSP policy is getting a fresh look. The TRAI has also suggested the creation of a new category called *"Niche Operators"* who will offer fixed line telephone services in rural districts where the tele-density is less than one percent.[83] This is akin to the concept of Rural Service Providers mooted earlier.

8.4.1 Rural Service Provider Policy

It is being increasingly recognised that smaller operators focused entirely providing services in rural areas are extremely critical. Regulations must therefore enable and encourage them to fully take advantage of the well entrenched optical fibre connectivity existing in India. Interconnections to the national and international backbone network should be facilitated by carrying all rural traffic to the nearest fibre point (irrespective of who owns the fibre) and should have a single point of handover. The RSPs should be allowed to freely use any technology they deem fit to provide connectivity.

As an encouraging gesture, any levy of upfront license fee should be waived, however a percentage of total revenue earned (equal to that charged of other telecom service providers) could be charged. Of course, spectrum charged as paid by other service providers may be charged as well. RSPs should be entitled to a percentage of call charges to carry the calls and appropriate mechanisms put in place to share call charges as defined by the operators. Their operations should be restricted to providing any extent of telephone and internet connectivity, although in the rural areas alone.

Such a broad-based regulation would truly enable the smaller operators focused on rural areas to create a viable business operation.

8.4.2 Other Policies and Incentives

There are a number of policy initiatives, which could help in enabling Rural India getting Internet connectivity at the earliest.

8.4.2.1 Duties, Taxation and Service fees

The primary reason for the reluctance of the telecom service providers in offering services, apart from the low returns is the high cost of setting up the network and running it. Customs duties, sales and service taxes amount to a significant percentage of capital expenditure in telecommunications.

The government has reduced the taxes on computers to drive penetration of Internet. However, the taxes and duties on telecom equipments remain at a high level resulting in a high infrastructure cost. In certain cases, it even amounts to 30 percent of the cost of equipment. Such high rates severely hamper infrastructure investment and impact the expansion of rural telecom. In order to ensure the viability of rural telecommunication, considerable reduction of taxes for rural infrastructure may be considered.

The service tax on telecom and Internet service is high at 10 percent. While it is supportable in an urban scenario, this cannot be sustained in a rural economy and may be waived as a special circumstance.

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[83] "TRAI proposes across-the-board cut in annual license fee – Pegs Rs. 180 cr as entry fee for unified license," The Hindu Businessline, August 07, 2004.

During the initial phases of the IT revolution, the government had identified Software and IT services as a thrust area and provided tax holidays for up to 10 to 15 years for companies operating in this domain. Such concessions if offered to rural connectivity would help drive penetration effectively.

8.4.2.2 Investment

Offering telecom and Internet services in the rural areas need three levels of investment.

Kiosks

Aggregation of demand is the viable option for offering sustainable services in the rural hinterland. Internet kiosks are a necessity to enable such aggregation. The setup cost of a typical kiosk ranges between US$ 1,000 and US$ 2,000. To encourage rural entrepreneurs to invest in such kiosks, affordable loans should be made available through banks, which are flush with funds. Banking regulations do mandate the banks to invest up to 40 percent of their funds in the priority sectors like agriculture, Small Scale Industries (SSI), etc., to enable growth for the underdeveloped sections of the society. However, Information and Communication Technology for rural areas is not recognized as a priority sector and necessary actions need to be taken to enable the same. Also, concessional interest rates should be made available. The total investment needed for connecting all the villages (638365 of them) at say US$ 1,500 or roughly US$ 1 billion may seem high. However, a substantial part of this amount requested as individual loans and providing these loans could be easier for banks.

Telecom infrastructure

Developing the infrastructure to provide connectivity to rural India will cost approximately US$ 100,000 for each rural area of approximately 2,000 sq km (with a radius of 25 km). In order to optimally cover rural India, 1500 such areas need to be connected and thus the total capital investment needed would be US$ 150 million. Such funds should be made readily available to the RSPs.

Raising this money is not too difficult. The Government has several schemes under Rural Infrastructure Credit and Investment. Cheap credit, tax holidays and most importantly, hassle-free access to these investment devices would facilitate the capital inflow necessary for the RSPs.

Consumer loans

The next level of investment would be in the form of consumer loans for individuals to acquire personal telephones, computers, Internet connections etc. The upper income bracket among the rural population would easily earn enough to acquire these and also pass any credit worthiness checks by banks. Therefore, it is an easy task for banks to finance the purchase of equipment necessary at the level of ordinary consumers.

8.5 Problems and bottlenecks

Even though the potential of connecting rural India appears bright, there are a few possible bottle necks which could retard growth. Some of them are discussed in detail in the following sections.

8.5.1 Liberalization of Rural Markets

Liberalisation of the Indian economy began in 1991 and allowed Indian industry to be governed and led by market forces. Yet, there are many restrictions that throttle rural development. The rural market still remains regulated and controlled by the government to a great extent. There are government diktats that allow the sale of some varieties of farm produce only through government-owned *mandis*. For example, sugarcane can be sold only to the nearest cooperative sugar factories and cannot be processed or sold by farmers directly. There are

crops that cannot leave the borders of the states they are grown in. And, there are some more that cannot be exported to the lucrative markets of other countries. These measures may have come into place to safeguard the interests of farmers. However, they are now passé and are not in synch with current realities. Some of these have since been done away with but others merrily continue.

There is a ceiling on the size of land an individual can hold and this hampers the use of large scale and intensive farming techniques. Farmers who subsist on the smaller plots are the ones who are hit the most as a result. Another quirk is that while farmers are now allowed to sell produce to buyers other than the *mandis,* no transparent price reference mechanism exists. This leads to dependence on unofficial sources including middlemen often leading to problems of a different kind. And, the farmers are unable to fully reap the economic returns that they deserve.

Thus, such archaic regulations and half-hearted, hastily planned measures stifle the growth of the rural economy and need to be done away with. The issues affecting rural economy needs to be seriously looked into and addressed effectively to create a robust and vibrant rural economy.

8.5.2 Social Factors

Rural society is highly fragmented with caste and religion differences existing even now. These differences raise important questions – who own the kiosks? Where are they located? How do various sections of people use the kiosks? How do women, easily the most oppressed in a rural setting gain access to the services in kiosks? These issues are complex and do not present easy solutions.

But, as some of the n-Logue kiosks have demonstrated, such differences are set aside when business is the prime driver for the kiosk operations. Kiosk operators who are keen on maximising their revenues are capable of finding the common ground to enable all sections of society to utilise the services at their kiosks. This also necessitates the introduction of services tailored for various segments of people. While email and browsing may be popular with the upper class and literate sections, applications such veterinary care are more relevant to the low-income segments dependent on the farm animals for daily livelihood. E-governance services which benefit the poorer section of the village community is another area to be vigorously pursued.

Competition is another great leveller; areas with multiple kiosks see the operators striving harder to reach out to all prospective customers enabling greater penetration of these services. The most critical factor driving success is the networking skills of kiosk operators with the local community.

8.5.3 Power Supply

The Internet kiosks require power to operate. There are parts of India, where rural areas have grid power for even 12 to 16 hours a day. Cost-effective options are available to offer power backup for 4 to 8 hours to enable uninterrupted operation of kiosks.

But, in several other part of India, power is available for barely 4 to 8 hours or often, even less. The power back-up would then not be adequate for the kiosks to be in operation for a significant portion of time. Solar power or diesel generators are other available options. Even though the kiosks may not require more than 300 W of power, the cost of solar panels with back-up is in itself significant and could almost double the cost of the kiosks, rendering them economically unviable at least in the initial stages. The use of diesel generators could serve as a viable alternative as the initial investment is less but the continuous operating cost is a worrisome factor. With extensive researches underway on bio-diesel, there is hope for availability of cheaper alternatives in the near future.

Solar panels, diesel generators and bio-fuel alternatives may address the vexing problem of power for Internet kiosks. But, driving the rural economy through a large number of micro-enterprises would require 20 KW to 100 KW of reliable power. With grid-based power supply remaining inadequate, the only viable option would be to set up decentralized, low capacity power plants in villages. The challenge lies in developing the technology to make them economically viable.

9 Conclusion

To conclude, there are compelling reasons to reach out to the rural market. The development of the rural market and improvement of the lives of rural people are themselves compelling reasons. For companies though, the fast saturation of urban markets presents the need to explore newer markets. Still, due to the high cost of telecom infrastructure, the diverse terrain that it needs to be deployed in, and particularly, the low affordability levels of the rural masses, these markets remain unexplored to a great extent. The answers lie in technologies that are cost-effective and easy to deploy, applications and services that are appropriate, business models that are scalable and a regulatory environment that embraces and applies itself to serve rural India.

Scalability:

India has over 740 million people living in more than 638,000 villages. The number of people whose lives would be impacted by effective ICT intervention is therefore extremely large, almost 12 percent of the world population. This also means that any work that is restricted to a few hundreds, few thousands or even a few tens of thousands of villages makes very little difference, given the sheer size of rural India in total. The key is to scale and to reach the most number of villages.

To provide all the applications and essential services discussed in various chapters before, careful co-ordination with all constituents of the drive to bridge rural divide is necessary. Isolated efforts do not attain a critical size simply for this reason. A united front to link together various elements like educational institutions, hospitals, banks, government bodies, private enterprises, welfare organisations and the like would help reach a critical mass in a shorter frame of time. Then, a target of reaching 100,000 villages could be easily possible with concerted and carefully planned efforts. Else, any non-scalable intervention is only easily rendered irrelevant.

Technology:

Fortunately, technologies to connect the villages of India do exist and can scale. A major asset is the fibre connectivity running deep in to each *taluka*. Current wireless technologies can be used to connect about 85 percent of villages. They are cost-effective and can easily bring down barriers for entering rural markets. Future wireless technologies are also rapidly evolving and seem capable of meeting rural India's future needs.

In addition to wireless technologies, a whole host of other technologies would be required to make the desirable impact in rural India.

- ***Multimedia technologies*** are today at the stage to make a difference.
- ***Caching technologies*** at servers are required so that even remote villages are not deprived of useful information.
- ***Internet-based transaction technologies*** are continuously evolving and have a major role to play as well.
- ***Technologies for banking and finance*** using ICT are available but need to be made cost-effective for widespread use in rural India. This is applicable for ***Computer and Internet-based education and healthcare*** as well.
- ***Language technologies*** are crucial to reach out the masses in India who speak a multitude of languages. While the last few years has witnessed some progress in this area, there is still a long way to go.
- ***Personal computers*** today are relatively inexpensive and rugged enough to be useful in rural India. But, the price points need to fall further, to facilitate movement from shared to individual usage.
- Probably, ***power supply*** is the one that requires most careful attention. ICT initiatives in rural areas cannot get far without solving the problems associated with power.

Services:

It must always be remembered that ICT is merely the means and not an end in itself. Therefore, ICT must enable fulfillment of the real needs of rural communities and remain relevant to them. Education, health and livelihood are the primary requirements of rural areas.

- Today, rural people appreciate the value of education for their children better than ever before. While schools do exist in most parts, the quality of teachers & of the education imparted and infrastructure is questionable. ICT can become an important tool in plugging these gaps.
- Despite the presence of Primary Health Centres in every three to four villages, healthcare is another major concern in rural India. Quality healthcare is still available only with doctors in the nearest towns who are often most sought after. Telemedicine through video-conferencing between urban doctors and rural patients provides this vital link. Using simple remote diagnostics, healthcare can be provided instantly and effectively.
- However, above all, ICT can definitely provide chances to rural people to enhance their livelihood. The demand for ICT and services can be sustained in the long run only by generating rural wealth. The primary wealth creators in this context are agriculture and agri-processing, animal husbandry, small scale handicrafts, food processing and often, even IT enabled services.

Regulations:

The key role of the Government and regulating bodies is to enable rural connectivity to happen at the fastest possible pace. At the same time, NGOs and other organisations focussed on rural areas must be enabled to provide the necessary services. While immense infrastructure (fibre and towers) have been built up to connect rural areas easily, these are sadly heavily underutilised. Existing telecom operators focussed on urban areas, treat these resources as property encashable at a future whenever they would be willing to consider operations in rural areas. However, the 741 million rural people cannot afford to wait. Regulations should be framed to ensure – that existing infrastructure is tapped to provide rural telephony; that open markets are allowed to flourish, that equitable compensation mechanisms are in place to protect the interests of all parties and that measures to develop rural livelihood and entrepreneurship are encouraged.

Is this a possibility?

Rural India is at a critical stage. It is large in size; problems are aplenty, the challenges are daunting and thus can present a scary picture to an outsider. But if enabled, it has the potential to transform itself quickly. Technologies exist today to provide telephony and Internet in every village. The development of the rural economy and improvement of the lives of its citizens is a prime force for governments, NGOs and other organizations working in the rural areas. There are also proven business models to sustain and drive efforts in this direction. The ability of the Internet to positively impact the lives of rural people has been amply demonstrated. Thus, Internet and other communication technologies can empower the rural populace such that they can chart their own bright futures, very different from what anyone could have ever imagined or written about.