

National Optical Fibre Network of India : A position paper

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March, 2014



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3 List of Abbreviations

BBNL	Bharat Broadband Network Limited
BHQ	Block Head Quarters
BPO	Base Post Office
BSNL	Bharat Sanchar Nigam Limited
C&T	Cabling & Trenching
CAGR	Compounded Annual Growth Rate
CAL	Computer Aided Learning
CII	Confederation of Indian Industry
CO	Central Offices
CPSUs	Central Public Sector Undertakings
CSC	Common Services Center
DEITY	Department of Electronics and Information Technology
DHQ	District Head Quarters
DOT	Department of Telecommunications
DSL	Digital Subscriber Link
DTP	Desk Top Publishing
FDI	Foreign Direct Investment
FTTX	Fiber-to-the (X=Anything)
G2C	Government to Citizens
GAILTEL	Gas Authority of India Ltd Telecom
GDP	Gross Domestic Product
GPON	Gigabit Capable Passive Optical Network
HRD	Human Resources Department
ICT	Information & Communication Technology
IPTV	Internet Protocol Television
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunications Union
KBPS	Kilo Bits Per Second/Kilo Bytes per Second

LWE	Left Wing Extremism
MB	Mega bit/Mega Byte
Mbps	Mega Bits Per Second
MDG	Millennium Development Goals
MMP	Mission mode Projects
MOU	Memorandum of Understanding
NeGP	National e-governance Plan
NIC	National Informatics Center
NICNET	National Informatics Centre Network
NKN	Natural Knowledge Network
NLDO	National Long Distance Operating
NOFN	National Optic Fibre Network
NREGA	National Rural Employment Guarantee Act (India)
OFC	Optic Fibre Cable
OLT	Optical Line Terminals
ONT	Optical Network Terminal
POP	Point of Presence
PPP	Public Private Partnership
PSU	Public Sector Undertaking
RAILTEL	Railways Authority Of India Ltd Telecom
RF	Radio Frequency
rkms	Route Kilometers
RoW	Right of Way
SDC	State Data Center
SHQ	State Head Quarters/Sub-Divisional Head Quarters
SLA	Service Level Agreements
SP	Service Provider
SPV	Special Purpose Vehicle
SWAN	State Wide Area Networks
SWOT	Strengths, Weakness, Opportunities & Threats
TRAI	Telecom Regulatory Authority of India

UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollars
USOF	Universal Service Obligation Fund
UT	Union Territories
VAS	Value Added Services
VOD	Video on Demand
VSAT	Very Small Aperture Transmission

National Optical Fibre Network of India: A Position Paper

Abstract

The present paper discusses the national optical fibre network (NOFN) in India. As a continuation of policy evolution of telecom within the country and the international arena in the context of Millennium Development Goals, an NOFN is being implemented in India, largely by the public sector organizations using the universal service obligation fund. The NOFN will be connecting 250000 gram panchyats, a local administrative region for group of villages and aims to deliver ICT based goods and services to the rural households in partnership with private service providers by December 2012. The pilot implementation of the project was able to connect only the government offices, and private service players are yet to actively participate. Despite support from the top political leaders, the project is delayed by more than two years due to bureaucratic hurdles and lack of excitement on part of the private players. The paper suggests that the absorptive capacity needs to be developed and private players require aggressive goading, but without ignoring the idea of social inclusion. There should be sustained political support till the final implementation of the project, with the largest impetus coming from the government in the initial phases.

1. Telecommunications, Electronic Governance and Broadband in India

The Indian telecommunications industry is one of the fastest growing in the world and has been hailed as a success story like no other. In the last two decades since its liberalization in the early 90s, the Indian telecom sector in general, and mobile telephony in particular, have witnessed significant growth. India now is the world's second largest telecommunications market, with 915 million subscribers as of December 2013 (TRAI, 2014), with CAGR of 32 percent in 2000-2010, much higher than world average, 17.3 percent (TRAI, 2012). This growth can be easily attributed to the increasing network coverage and a competition induced tariff structure that is touted to be the lowest in the world. The sector's revenue grew by 13.4 per cent to reach US\$ 64.1 billion in FY12 and is expected to witness up to US \$

56.3 billion in investments and an expansion in size to US \$ 101 billion in the next five years (TRAI, 2012).

Since the early 2000s, the deployment of information and communication technologies (ICT) infrastructure by several public and private players saw its rapid absorption by several sectors through private or public investments. Observing the impact of telecommunications services on economic development elsewhere in the world, the Indian Government felt compelled to accelerate the growth of Broadband services in the country and achieve the necessary outreach. The government is at present implementing an ambitious broadband infrastructure plan through an optical fiber network connecting gram panchayats, a local administrative region for group of villages. The present paper attempts to analyze the ongoing process, its objectives, possible challenges it can face and offers some recommendations.

Like banking and other sectors, the Government of India too saw ICT as an effective and efficient means of delivering Government to Citizen (G2C) services. Consequently, electronic governance policies and initiatives saw endorsement in policy circles. The National e-Governance Plan (NeGP), comprising 27 Mission Mode Projects (MMPs) and 10 components was approved by the Union Government on May 18, 2006. E-Governance was set to evolve from mere computerization of departments into a service oriented, seamless and transparent offering at the citizen's doorstep. Implementation of the NeGP involved setting up of public IT platforms such as: State Wide Area Networks (SWANs), State Data Centres (SDCs), Common Services Centres (CSCs) and Electronic Service Delivery Gateways. Using a Public Private Partnership model to increase outreach, NeGP was designed to be a citizen centric centralized initiative with decentralized implementation at the state level while Department of Electronics and Information Technology (DEITY) would facilitate interoperability and catalyse the efforts of several ministries and state governments to build the e-governance ecosystem.

NeGP took a holistic view of e-Governance initiatives across the country, integrating them into a comprehensive vision. In March 2005, the Government approved the Scheme for establishing State Wide Area Networks (SWANs) across the country, at a total outlay of 666

million USD¹ to be expended by the DEITY under a Grant-in-Aid of 401 million USD, over a period of five years. Under this Scheme, technical and financial assistance was to be provided to the States/Union Territories (UT) for establishing SWANs to connect all State/UT Headquarters (SHQ) up to the Block Headquarters (BHQ) level via District/ sub-Divisional Headquarters (DHQ), in a vertical hierarchical structure with a minimum bandwidth capacity of 2 Mbps per link. Each of the State / UT could enhance the bandwidth up to 34 Mbps between SHQ and DHQ and up to 8 Mbps between DHQ and BHQ depending upon the utilization. Steps were initiated to integrate all SWANs using the National Knowledge Network (NKN). SWAN was envisaged as the converged backbone network for data, voice and video communications throughout a State/UT.

As part of the larger e-governance effort, SWAN was to be a component of the core network infrastructure that could later be deployed for education and health services too. While NICNET, a VSAT based network, was already being operated by the National Informatics Centre (NIC), the SWAN was to be set up to help ministries, government departments and state governments to conduct business and extend services to citizens. States were asked to provide bandwidth of at least 2Mbps up to block level through contracts with BSNL or any other operator. The Government's funding to establish a SWAN in a state was contingent upon it having undertaken implementation of at least three major state wide e-governance projects that require such connectivity.

Simultaneously, NICNET was to be augmented -through Optic Fibre Connectivity (OFC) where feasible and state-of-the-art VSAT technologies where needed -as a backbone for enhanced interstate and Centre-State connectivity. As part of the NEGP, the government had launched an e-governance programme through mission mode projects and wanted to utilise the "seamless connectivity" through SWAN and NICNET. Multiple technologies for last-mile connectivity were being looked at including wireless technologies. The setting up of strategic gateways was to enable inter-state connectivity. Government departments and organisations were urged to use dial-up, leased lines, radio frequency (RF) and wireless connectivity at the block headquarters and at all other higher administrative levels to provide last mile connectivity to various local offices.

¹ An exchange rate of 1 USD = INR 50 is used in the report.

The establishment of CSCs in rural areas was one among the many mission mode projects. The CSC program was a cornerstone of the National e-Governance Plan (NeGP) and was approved by the Government in May 2006, as part of its commitment in the National Common Minimum Programme to introduce e-governance on a massive scale. The CSCs were to provide high quality and cost-effective video, voice and data content and services, in the areas of e-governance, education, health, telemedicine, entertainment as well as other private services². In addition to G2C services, the CSC guidelines envisaged a wide variety of content and web enabled e-services that could be offered from each CSC which included agriculture services, education & training services, health services (telemedicine, health check-ups, medicines), rural banking & insurance services (micro-credit, loans, insurance), entertainment services (movies, television), utility services (bill payments, online bookings) and commercial services (DTP, printing, Internet browsing, village level BPO). As per the initial plan, 100000 CSCs were to be established in a public private partnership (PPP) mode. While several CSC were established with VSAT connectivity from private telecom players, the state owned Bharat Sanchar Nigam Limited (BSNL) was catering to the call of the Government to connect its administrative layers. By August 2013, 82% of the 1,53,098 CSCs had already been rolled out.

3.1.1.1

As part of its thinking on electronic governance, the government was also looking at broadband. The Broadband Policy was introduced in 2004. According to the preamble of the policy³, the government recognized the 'potential of ubiquitous Broadband service in growth of GDP and enhancement in the quality of life through societal applications including tele-education, tele-medicine, egovernance, entertainment as well as employment generation by way of high speed access to information and web-based communication'.

The international policy climate for broadband also served as an impetus for ushering broadband in India. In May 2010, the ITU and UNESCO set up the Broadband Commission for Digital Development as part of efforts to meet the Millennium Development Goals (MDGs). The Commission underlined that expanding broadband access in every country was vital to

² For more details, please see <http://csc.gov.in/>. The roll out status is here:

<http://csc.gov.in/cscstatus/cscstatus.html>

³ www.dot.gov.in/print/telecom-polices/broadband-policy-2004

accelerating progress towards these MDGs by the target date of 2015 and sought commitments from all member countries to effect such plans. As a continuation of this, the Office of Adviser to the Prime Minister, Public Information Infrastructure & Innovations under the leadership of Mr. Sam Pitroda released a 15 pages white paper entitled, 'Broadband to Panchyats' (PIII, 2010). This paper outlined the need to extend high speed Broadband services to 250000 Gram Panchayats in the country through an optic fibre network.

Gram Panchayats are the local self-government body at the village or small town level in India. A population of 500 is required to have a gram panchayat. Sometimes two or three villages are combined to form a panchayat, hence the size varies from state to state (for more details, see Buch, 2012). Gram Panchayats have been at the core of the governance structure in rural India. The panchayats are key interface points for administrative programs and are vital channel for pushing the inclusive growth agenda of the government in rural India through delivery of beneficial public services and entitlement programmes such as food security, financial inclusion, agriculture, health, education etc. To meet this inclusive agenda, services such as e-medicine, e-education, e-commerce and geospatial planning are to be reached to illiterate and semi literate people scattered across the vast geography of the country. Hence multimedia applications that are enabled by Internet technologies are needed. Since such multimedia applications have intensive bandwidth requirements, both in terms of capacity and speed, the need to build a high speed broadband network across the nation came to be recognized as a priority.

The white paper reinforced the need for a strong information infrastructure and the associated administrative machinery at the Panchayat level to discharge the duties. It also listed three objectives to meet this vision. To quote (PIII, 2010; p.5):

- i. *Establish Optical Fibre cable (OFC) based high capacity broadband connectivity at every Panchayat in the country to benefit from convergence of voice, data, and video for improving training, education, service delivery and governance*
- ii. *Develop relevant applications, processes, programs and standards for Panchayats to meet local, state, central government and public needs*

- iii. *Build Infrastructure and institutional mechanisms to include OFC connectivity, computer hardware, software, trained human resource, management, organization, etc, to assure utility, scalability and sustainability*

For such an all encompassing ICT platform to be operationalized at the Gram Panchayat level, both speed and capacity were required. In 2010, 86% of India’s broadband connections were being provided using Digital Subscriber Link (DSL) technology with 60% of the subscribers and 75% of such connections existing in the top 30 cities in the country (PIII, 2010). DSL connectivity was nonexistent in rural India due to low penetration of copper cable pairs. State owned players too had thus far not invested in high speed infrastructure beyond the district headquarters as part of the SWAN initiative.

In 2010, only 0.53% of India’s broadband connections were working on optical fibre. The country had close to 1 million routes Km (rKm) of optical fibre network available and of this nearly 650,000 belonged to the state owned BSNL. The deployment of optical fibre involves significant costs and challenges involved in acquiring the Right of Way (RoW) for laying the cable and installing the associated equipment. The white paper estimated a cost of 2.66 billion USD and 24-30 months for the complete deployment through creation of a special purpose vehicle (SPV) of a group of relevant public sector stakeholders and departments. On 25 October 2011 the Government of India approved the setting up of a National Optical Fiber Network (NOFN). The timeline of this evolution from telecom sector growth to the approval of NOFN is captured in Figure 1.

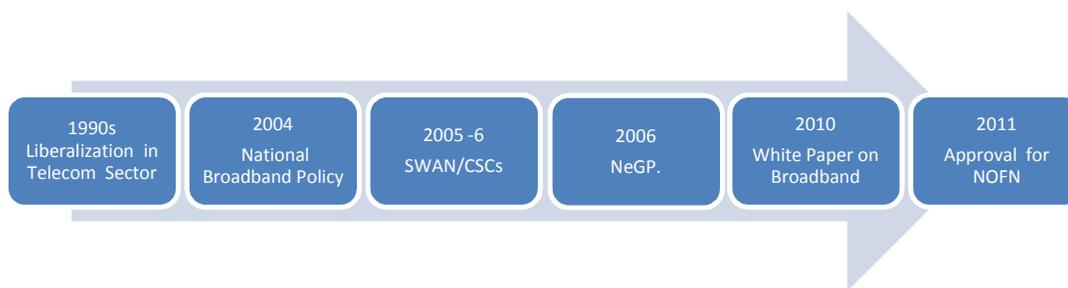


Figure 1: Policy evolution of broadband in India.

2. National Optical Fibre Network

2.1 Organization

In December, 2010, Telecom Regulatory Authority of India (TRAI) released a report containing recommendations on the growth of broadband in India (TRAI, 2010). This report articulated many guidelines for establishing the broad policy, with the associated regulatory framework and strategies for deciding the most optimal investment model for the deployment of a core, middle mile and access broadband infrastructure in the country. It also echoed many suggestions or options listed by a study (Analysys Mason, 2010) sponsored by the Confederation of Indian Industries (CII), a major trade association in India.

The report stated that in September 2010, the penetration of broadband⁴ in the country was 0.8% as against a tele-density⁵ of 60.99. The number of broadband connections was only 10.3 million as against a target of 20 million set for the year 2010. It recommended the establishment of a National Broadband Network connecting all habitations with population of 500 and above.

In Oct 2011⁶, a committee headed by Mr. Sam Pitroda, Advisor to the Prime Minister, suggested setting up of an SPV comprising Central public sector undertakings (CPSUs) which had already deployed optical fibre cable networks for their internal use. The proposal suggested Bharat Sanchar Nigam Ltd (BSNL), RAILTEL, the telecom arm of the Indian Railways, Gas Authority of India Ltd's telecom arm GAILTEL and Power Grid Corporation be made part of the SPV. Finally on Oct 25, 2011, the Union Cabinet approved the scheme to set up the NOFN, which would primarily be used to provide broadband connectivity to village-level bodies. In Jan 2012, the government formed an SPV for the same, called as Bharat Broadband Network Limited (BBNL) and incorporated as a Public Sector Undertaking (PSU) in 25 February 2012. BBNL was to be a wholesale bandwidth provider who would provide non-discriminatory access to the NOFN infrastructure to all Service Providers. BBNL

⁴ Broadband is defined as minimum download speed of 256 kilo bits per second (kbps) to an individual subscriber from the Point Of Presence (POP) (<http://www.dot.gov.in/hi/node/68>). The limit has been increased to 512 kbps in July 2013.

⁵ Teledensity is the number of phones (wireless + wireline) in use for every 100 individuals.

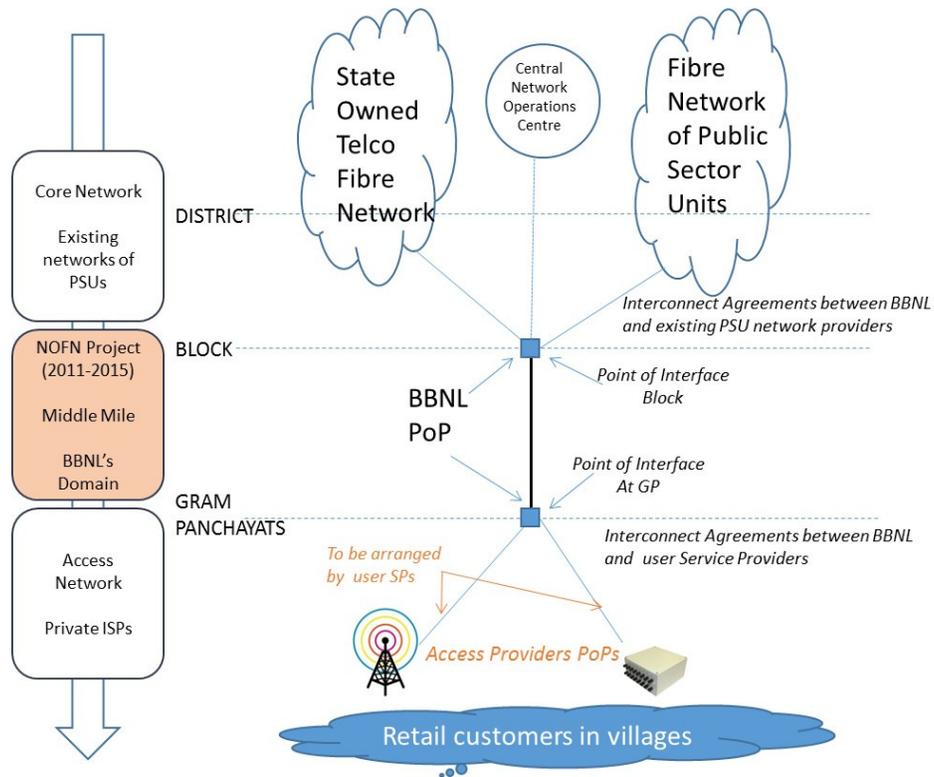
was granted a National Long Distance Operating (NLDO) license by DOT with effect from 1 April 2013. The funding for the project was to come from the Universal Service Obligation Fund (USOF).

In 2009, the existing fibre optic infrastructure deployed by various operators was approximately 1.1 million Rkms and covered the entire urban area but had only limited presence in rural India. BSNL accounted for most of the existing fibre infrastructure (~60% of the total) and had Points of Presence (PoP) in all the districts / cities and 28,000 villages. These PoPs were mainly installed at the existing 38,302 telecom exchanges of BSNL which were connected through fibre. Apart from BSNL, RAILTEL, POWERGRID and GAILTEL had also deployed fibre infrastructure for their internal use and for leasing out excess capacity to other companies, but this infrastructure was primarily deployed along the railway and main utility lines, and was thus not optimized to reach a large number of remote rural areas. The existing infrastructure of private operators such as Airtel, Reliance Communications and Tata Communications was restricted to the top 150 cities. It was estimated that additional OFC of 301,000 route kilometers, mainly from every Block headquarters to the Gram Panchayats in the Block, were required to be deployed as part of the backhaul network (Mason Analysys, 2010).

The final deployment plan was based on utilizing the existing optical fibre network of BSNL, POWERGRID and RAILTEL. Gram Panchayats to be reached were allocated to BSNL, POWERGRID, RAILTEL in the ratio of 70%, 15% and 15% respectively and this deployment was to be completed in 24 months.

POWERGRID was asked to deploy the network in the four states of Andhra Pradesh, Himachal Pradesh, Jharkhand and Orissa. RAILTEL was allocated the 11 regions of Arunachal Pradesh, Dadra and Nagar Haveli, Daman and Diu, Gujarat, Manipur, Meghalaya, Mizoram, Nagaland, Pondicherry, Tamil Nadu and Tripura. While BSNL was asked to handle deployments in the 18 territories of Andaman and Nicobar, Assam, Bihar, Chandigarh, Chattisgarh, Haryana, Jammu and Kashmir, Karnataka, Kerala, Lakshwadeep, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Sikkim, Uttar Pradesh, Uttarakhand and West Bengal.

The NOFN was to be rolled out in a phased manner at a cost of 4 billion USD and was slated for completion in December 2012. The Telecom Commission approved a 3-phase implementation of the NOFN. The first 100000 Gram Panchayats were to be covered in the first phase up to March 31, 2014 and an additional 100000 Gram Panchayats were to be reached by March 31, 2015. The rest were to be covered by September 30, 2015. Priority was to be accorded to villages in the north east region of the country and 88 districts in the heart of the country affected by Left Wing Extremism (LWE). Upon the completion of the NOFN roll out, Gram Panchayats were expected to get broad band connectivity with speeds of up to 100 megabits per second. The concept diagram of the NOFN is presented in Figure 2.



Source: <http://www.bbnl.nic.in/content/page/nofn-concept-diagram.php>

Figure 2: Concept diagram for NOFN.

As part of the project, the State Governments have been given the responsibility for providing free Right of Way (RoW) for laying Optical Fibre Cable (OFC). The project envisaged the signing of a tripartite MoU for free Right of Way (RoW) between the Union Government, State Governments and Bharat Broadband Network Limited (BBNL). 16 States/UTs signed the MoUs on 26 October 2012. These states and UTs were Andhra Pradesh, Arunachal Pradesh, Chhattisgarh, Jharkhand, Karnataka, Manipur, Mizoram, Rajasthan, Tripura, Uttar Pradesh, Uttarakhand and 3 Union Territories viz. Dadra & Nagar Haveli, Daman & Diu and Puducherry. Under the MoUs, 140727 gram panchayats will be connected via an Optical Fibre Network in these States and UTs. Tripartite MoU were signed in the presence of Union Minister of Communications & IT with 10 other states and UTs on 12 April 2013. These states and UTs were Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Nagaland, Odisha, Punjab and Andaman & Nicobar Islands. In these states and UTs, 85731 gram panchayats will get covered by the Optical Fibre Network. BBNL will commence work in these states and UTs to deploy OFC to the Gram Panchayats. For the pilot projects, the tariff for 100 mbps bandwidth is fixed as USD 1333 per 100 mbps per gram panchayat per annum (exclusive of taxes) for the purpose of providing government services.⁷

2.2 Technology

According to BBNL (2013), NOFN will use Gigabit Passive Optical Network Technology (GPON)⁸. This technology reduces the amount of fibres required from the Central Offices (CO) as compared to a point-to-point system. SA fibre pair from the CO in the network is split into several subscriber lines by the use of passive optical splitters. These splitters are inexpensive and do not use electronics and no maintenance and power supply is required. They can be kept at any convenient location in the network.

At the provider's end, there is an Optical Line Terminal (OLT) in the CO and at or near the customer premises there is an Optical Network Terminal (ONT). This Optical Fibre in the access network is capable of providing high bandwidth throughput for services (even upto 100 Mbps) such as high definition IP Television (IPTV), video on demand (VoD) etc.

⁷ For further details, please see <http://www.bbnl.nic.in/upload/uploadfiles/files/tarif.pdf>

⁸ For further details, <http://www.bbnl.nic.in/content/page/technology.php>

2.3 Goals

It is expected that various services or goods for the rural population could be delivered through broadband, especially through public service institutions. As the numbers indicate (TRAI, 2010) leisure activities music and video downloading, searching for information, especially education related, are gaining in popularity and showing considerable increase in Internet usage in rural India. As compared to urban areas music / video on Internet was more popular among the rural users with 67% of rural users accessing the Internet for this purpose as compared to 45% in urban areas. In addition to this, rural users were also increasingly using the internet for email, text chatting and general information search. This increasing absorption of ICT in rural areas, signals a significant role that broadband is likely to play in the future and the consequent impact of the same.

Another area where broadband is expected to play a notable role is e-education (TRAI, 2010). Various initiatives of the Government for increasing the use of ICT in education are already in progress (for instance, Sarve Shiksha Abhiyan, Education for All programme has a component of Computer Aided Learning (CAL), wherein a provision of 5 million USD per district had been made as an innovation fund. The Centrally Sponsored Scheme “Information and Communication Technology [ICT] in School” was launched in December 2004, to provide opportunities to secondary stage students to develop ICT skills and also for ICT aided learning processes to be adopted. Many states have already made provisions in their IT policies for encouraging the use of IT in schools/ colleges/ education institutes. Based on this it was clear that there would be a considerable demand for broadband from the education sector and at least 2 Mbps of connectivity would be required for each such educational institution.

The health sector too had been plagued by the near absence of infrastructure and a dearth of trained staff especially in hard to reach rural locations. As per the TRAI (2010), 75% of the health infrastructure, manpower (including the qualified consulting doctors practice) and other health resources were concentrated in urban areas, 23% in semi-urban (towns) and only 2% in rural areas; where as 70% of population lived in the rural areas. Hospital beds per

1000 people were 0.10 in rural as compared to 2.2 in urban areas. The TRAI felt that medical advice, monitoring, diagnosis and trainings delivered through broadband could help in bridging these gaps.

Deployment of ICTs by small and medium enterprises or ICT based enterprises, especially for the rural population or run by them would with the availability of Broadband help to expand the e-commerce market. E-commerce is tipped to be the next growth sector for business in India,

3. Present Status

The NOFN was to be rolled out in a phased manner and was slated for completion in December 2012. It was subsequently pushed back to December 2013 and recent news paper reports say that implementation has been further delayed at least by four years.⁹ The Chairman of TRAI in a public function summarized the implementation status more aptly, ' We have done a terrible job in broadband. We are nowhere near to meeting the target of NOFN and unless it is done, internet penetration cannot happen at the desired pace'¹⁰

The Cabling and trenching (C & T) work by BSNL, POWERGRID and RAILTEL have been delayed, as their initial funds to deploy manpower and pay salaries of executive staff are yet to be cleared by the cabinet as of Feb 2014¹¹. This has pushed the first phase itself back by two years. The above three players are supposed to subcontract the C&T work to multiple vendors as a part of implementation plan which has so far not been done. As in Jan 2014, even the tenders for C&T were not finalized.¹² On the other hand, BSNL has blamed BBNL for not giving the necessary clearances. Acquiring RoW too has been a major hurdle.

⁹ http://articles.economictimes.indiatimes.com/2014-01-22/news/46463062_1_nofn-bbnl-bharat-broadband-network-ltd

¹⁰ <http://www.indiantelevision.com/iworld/e-commerce/we-have-done-a-terrible-job-in-broadband-penetration-rahul-khullar-140211>

¹¹ http://articles.economictimes.indiatimes.com/2014-02-26/news/47705357_1_nofn-project-broadband-venture-bharat-broadband-network-ltd

¹² http://articles.economictimes.indiatimes.com/2014-01-22/news/46463062_1_nofn-bbnl-bharat-broadband-network-ltd

Delays and budget overruns notwithstanding, the Government has constituted a joint working committee with Indian industry and Mr. Kiran Karnik, a reputed administrator, has been appointed as its chairperson¹³. This committee has been entrusted with the task of trying to define and create an enabling ecosystem. Various confidence building measures are being looked at. The need to strike the right balance and to see that the infrastructure has the right response from the other stakeholders has become apparent to policy makers. BBNL has also formed an alliance with the Ministries of Rural Development, Panchayati Raj, HRD, Health and family welfare and women and child development so that the demand aggregation will optimize the utilization of the NOFN infrastructure from an e-Governance perspective.

3.1 Evaluation

BBNL embarked upon pilot projects in three blocks covering 58 Gram Panchayats in three different states. All participating PSUs (i.e. POWERGRID, RAILTEL, and BSNL) were asked to execute a pilot project in one Block each within 90 days. These Blocks were Arian in Ajmer district (Rajasthan), Parvada in Visakhapatnam (Andhra Pradesh) and Panisagar in North Tripura district (Tripura). The target date for completing the Pilot Projects was 15/10/2012, and the same has been achieved with fibre laid out to all the Gram Panchayats in the Pilot Blocks and Electronic Equipment (OLT and ONT) having been tested for offering services. The pilots brought home ground realities to the participating PSUs and helped the concerned government departments plan the template for pilot testing of G2C services. It also helped to address the interfacing of NOFN with access operators at Gram Panchayats and issues related to coordination between the three organizations for better execution.

In its annual report, BBNL (2013) offers a SWOT analysis of NOFN. Though not detailed, the analysis lists out all the possibilities (reproduced in Figure 3).

There are undoubtedly great strengths in the NOFN that is being implemented. Its cause was espoused and supported by the highest offices in the country i.e. the President and the

¹³ <http://www.governancenow.com/views/interview/250000-gram-panchayats-two-year-tall-order>

Prime Minister. When in place, it will be a powerful enabler for advancing economic and social development through the creation of new types of economic activity, employment opportunities and the enhancement of networking and participation while taking to fruition the inclusion agenda of the government. The government with the help of industry bodies like the CII has created a comprehensive plan to roll out this network. The three pilots envisaged have been completed and as many as 22 states and 4 Union territories have agreed to provide Right of Way for this NOFN. Several pilots of e-services by both government and private sector establishments have been carried out and studies have been conducted to ascertain their viability, scalability and replicability across the country.

Though the mission and intentions are indeed creditable, several weaknesses are apparent in this grand plan. As stated earlier the project is already behind schedule and is now to be completed only in September of 2015 or later. Many argue that the plan to lay fibre to every one of the 250000 Gram Parishads was only meant to utilize the USOF funds which as stipulated by law can be used only for telecom related purposes. These detractors further claim that while the government has delivered the supply push little has been done to create a demand pull. In the e-Governance space, many of the line departments that have to deliver the services are themselves not ready at the back end.

In essence a national capacity building plan has not been defined and neither has a single nodal agency been identified for creating and supporting a cohesive all encompassing broadband enabled ecosystem.

Strengths

- *Strong Commitment and funding from the Government*
- *Collaborative approach leveraging CPSUs strength*
- *Little competition in the rural area of operations*
- *Legacy baggage*

Weaknesses

- *Weak demand may affect the viability of the project*

- *Problems of rural areas like power, theft etc. may strain the performance of the network*
- *Health of existing fiber network may impact the SLAs*
- *Complexities of the project may delay the project*
- *Dependence on the three PSUs may affect the performance of the company*

Opportunities

- *Low broadband penetration means huge untapped demand*
- *Growing demand for data and video will spur demand for high bandwidth*
- *Connectivity provided by NOFN will be needed by G2C initiatives*
- *Business imperatives in rural areas will favour proliferation of B2C services*

Threats

- *Ecosystem is not mature which may result in low uptake threatening the viability of the project*
- *Operators not having connectivity at Block level will have to depend upon others, leading to inter-connect and competitive issues*
- *Low purchasing power in rural areas may put pressure on revenues*
- *Government funding for G2C connectivity may not be sufficient*

Reproduced: BBNL, 2013, p.14-15.

Figure 3: SWOT analysis of NOFN

Also absent are incentives to private players to provide last mile access and deliver services in rural areas. While several trials/models in the areas of e-Banking, e-Agricultural Support, e-Education, e-Health and e-Commerce are being studied, traction is yet to be achieved in creating viable economics and commercials to scale these across the countries. Demand is still to be generated and while the government's plan to subsidize access to the rural household holds promise, measures are still wanting when it comes to creating relevant content for the rural citizen and building awareness in him/her on the benefits of such e-

services. While availability and accessibility of infrastructure have been planned for, its affordability and acceptability vis-a-vis a rural household still remain unaddressed.

Despite these weaknesses, there remains a huge potential for different Value Added Services (VAS) once broadband access is made available. The real potential for ICT growth still remains untapped in rural India. The need is to attract quality content/application players who would drive the creation of the ecosystem while reaching the unreached in rural areas. While balancing the bottom line and a social agenda may keep private players away, as indeed it has, the onus is on policy makers in general and “facilitators” like BBNL in particular to create the demand pull that would make this an attractive business proposition for private stakeholders of the ecosystem.

The biggest threat to the NOFN project is its becoming another “white elephant” which finds no takers and lapses into disuse. This would require concerted measures on part of the government. While the Government hopes that NOFN will help bridge the current gaps in India’s progress report and create the foundation for inclusive growth and sustainable development across the nation, the response of other stake holders including the private sector has at best been tepid. Several other challenges, too, require immediate attention. Government run telecom providers have always had their set of challenges with inefficiencies, infrastructural inadequacies, lack of manpower, management shortages and consequent customer dissatisfaction and it is feared that several of these issues will plague the NOFN rollout as also its subsequent operations.

The other major worrying concern is low use of the core network in several areas with many pieces of equipment reaching “end of life” and requiring replacement, thereby causing further delays and waste of investment. Private players, thanks to their commercial compulsions, invest time, effort and money in the upkeep of their networks. It is feared that lack of commercial returns or continued patronage from the successive governments may reduce the motivation to keep the NOFN well maintained.

Affordability of high end bandwidth intensive services for village households still remains a grey area and unless adequately addressed by the government would leave the rural areas

financial unattractive for private players to invest in access infrastructure and service. While the plan is to pull fibre to every Gram Panchayat, Railtel and PowerGrid will carry the fibre only till their points of presence and thereafter the link to the Gram Panchayat will have to be a wireless or a wired connection depending on the infrastructure available. Such a connection consequently may not be of the same quality level as an FTTx link as touted in the National Broadband Plan. With the spread of 4G services on the anvil, better technologies would become available in the market for parties interested in high levels of bandwidth and this may render the NOFN dated.

There are no publicly available evaluation reports on the three pilot that were executed. A representative of NOFN¹⁴ observed that:

- while government offices are well connected through NOFN and seemed to be working well, the lack of electricity was posing a major problem at other locations. In one of the pilot locations, there was no electricity from 9 AM to 7 PM, owing to which the NOFN proved ineffective. Installing inverters providing 12 hours of back-up could serve as a temporary solution, but to succeed in the long run, the presence of complementary assets is essential.
- the response of service providers to exploit the NOFN infrastructure is insignificant, as they perceived the size of the rural market to be too small for investing in and hence unviable
- the interconnect agreements between the BBNL and the user SPs are yet to be completed.
- cable television in rural areas seems to be a viable option for service delivery. However, the monthly rate should not exceed 3 USD / day. The extent infrastructure coverage is, however, inadequate (lack of radio frequency interface electronics) and neither the NOFN team nor the SPs are willing to invest in the same.
- to increase the demand for and consequent usage by the rural consumers, an initial push is required from the government. This push can be in the form of improving the availability of services or enabling access to the hardware like smart phones or tablets.

¹⁴ Identity is protected.

Initial journalistic reviews of NOFN in Tripura,¹⁵ a hilly region of ethnic minorities, showed that government driven e-learning, direct cash transfers and communication have improved greatly. However, there are problems in the functioning of e-health and the electronic outpatient departments due to low digital literacy.. In another report¹⁶, the consumers were not aware of the project and of the potential benefits that could be availed from NOFN.

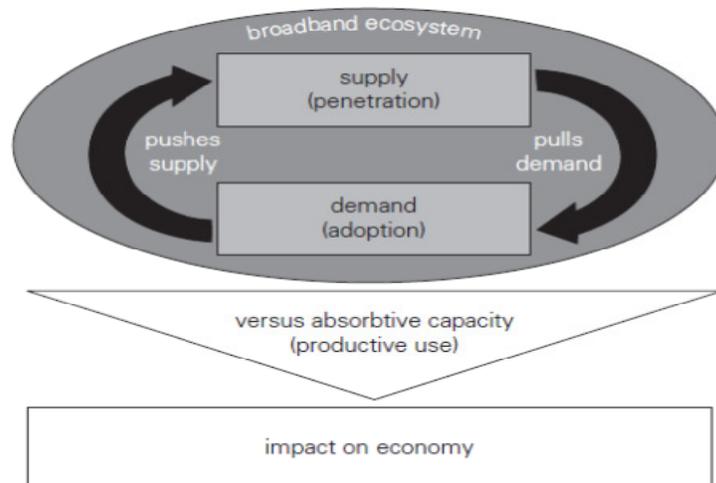
4. Discussion

4.1: Need for development of absorptive capacity

Kelly and Rossotto (2012) argue that impact of broadband on the national economy is possible only where when there is adequate absorptive capacity present in the system (see Figure 4). Under this model, the supply of broadband network platforms is the first necessary condition (that is, broadband infrastructure must be made available), a step clearly taken by the Government of India. However, the demand for broadband is just as important in order to make substantial network investments worthwhile. The multiplier effect of broadband can positively influence GDP, productivity, and employment growth; provided there is absorptive capacity, to learn and incorporate broadband capabilities into other sectors, to realize such benefits.

¹⁵ <http://www.thehindubusinessline.com/features/some-hits-many-misses-in-tripura-pilot-project/article5753263.ece>

¹⁶ <http://www.thehindubusinessline.com/features/so-far-yet-so-near/article5753246.ece>



Source: Reproduced from Kelly and Rossotto (2012)

Figure 4: Broadband ecosystem & its impact on national economy

Absorptive capacity is the presence of a mechanism by which the benefits obtained from broadband flow into the economy, allowing this technology to unleash its enabling potential. The need is for non-ICT sectors to use and create broadband enabled services and applications, as this boosts demand and encourages further network deployments while keeping these networks well maintained and the network technologies therein up to date. Also, broadband users (citizens, businesses, and government) must also have the capacity to understand, learn, and utilize capabilities of broadband across the economy and society. Thus to fully realize the benefits of broadband, the various sectors of the economy and society must have the capacity to acquire, assimilate, transform, and exploit the capabilities enabled by such a platform.

The existence of broadband alone has limited impact as a technological platform, but it holds the potential to have a significant impact on economic and social progress and to transform the economy. Policy makers should facilitate the capacity to understand and incorporate the many benefits of broadband by developing and implementing policies that are complementary to broadband build-out. They also need to encourage the private sector to adopt broadband as an input to drive productivity, growth, innovation, and welfare throughout the economy and society. Governments should seek to stimulate demand and

uptake of broadband through the creation of an enabling environment by addressing awareness, affordability, and attractiveness (perceived value) of broadband services.

4.2: Inclusion as part of business agenda

The government had realized that in order meet the demand pull created by the Millennium Developments Goals (MDG) targets to be achieved by 2015, technology would need to be harnessed. It appears that policy institutions, TRAI and BBNL, recognize the potential that broadband holds. It is envisioned, as highlighted in the background papers, that the benefits could be brought to the poorer communities and the capacity of the underprivileged within these communities to become potential users of ICT and participate in new economic ventures. However, this should be viewed not just as a business prospect but should be aimed at improving the standard of living of the poor population of the country.

While ICTs are hailed as powerful enablers for advancing economic and social development through the creation of new types of economic activity, employment opportunities and the enhancement of networking and participation, the advantages they are bestowing on the urban Indian are not reaching the rural citizens who are on the other side of the digital divide. This failing could be attributed to several factors. Using and benefiting from ICTs, require education, training, affordable access to the technology, information relevant to the user and the building of an enabling environment most of which the rural populace did not have. Rural geographies still remain unviable and unprofitable for many private players as they are characterized by low demand and consumption.

The demand-side components—including services, applications, and content—are essential to promoting a vibrant broadband ecosystem. In the absence of relevant, useful, and innovative advances in the development and delivery of services, applications, and content, there would be little or no demand for broadband leaving the NOFN unutilized. In India, like in other nations, the more-affluent and better-educated populations generally have had earlier and better access to ICTs than the less-affluent and less educated populations. The lack of broadband access, due to absence of connectivity or its affordability, could have a

negative impact on the social and economic development of those who lack broadband access or do not understand the relevance of broadband-enabled services.

4.3: Enabling the potential of private players

A study by KPMG & CII (2013) noted that the NOFN project would build a strong middle mile, but for a sustainable and scalable ecosystem with viable and profitable business models around the relevant e-services for the rural masses, the core and last miles would also need to be taken care of.

This would require collaboration between the government and private sector enterprises to work out access strategies that make the proposition viable for all stakeholders. This, however, may be easier said than done. With multiple stakeholders owning the core, middle mile and access networks enforcing service level requirements for applications like e-Education to function would be a challenge. Public sector telecom operators may have come a long way from being monopolistic entities to market driven operators with professional customer handling capabilities, yet the private operator owning and operating the access network would fight shy of giving service level guarantees to e-service providers knowing that it does not have end to end control over the broadband network. Without any equitable service level agreements (SLAs) in place, private e-service providers would be unwilling to venture into the rural geographies.

Kelly and Rossotto (2012) insist that investments or policies to foster or adopt broadband or policies are unlikely to produce significant GDP gains without complementary investments or policies in other sectors, such as education, innovation, e-governance, and health care. Developing appropriate policies and synergies will largely determine the extent to which broadband affects the economy and serves as an enabling platform. Politics based policies like favouring indigenous or public sector providers of equipment/services over international or private sector players with better technologies also have detrimental effects. This appears to be already visible in the implementation phase where participation of private players is almost non-existent.

From an economic standpoint, it is hoped that the recent FDI relaxations in this sector may spur more players to attempt to open up the vast potential in the rural markets. While the

decision to use locally manufactured equipment could be an advantage in the face of the rupee plummeting against the dollar, other factors like delays and budget overruns may negate these benefits. Even though the original policy papers spoke of NOFN not being an area for private players to participate in and later statements from the government deferred private equity in the NOFN for a future date, the inclusion of private stakeholders, with the inflow of private equity and technologies, is an imperative if scale and reach are to be achieved.

It appears that the government has been fairly categorical in its views regarding the role of the private sector in the NOFN. Very reminiscent of pre-liberalization days, these monopolistic attitudes and attempts of the government to keep the private players out of the game may do little for society at large.

Mutually beneficial public-private arrangements need to be evolved for the creation of pertinent applications and content that would form the basis of this broadband ecosystem. As of now, BBNL is more focused on laying the infrastructure and forcing the state governments to undertake diffusion work. Though provisions exist for private service providers to participate, BBNL appears to be reluctant to bring the private players on board. There is need for a favourable policy environment to be in place in order to encourage private enterprise to develop business models for the rural customer.

While the current thrust of the Government is almost entirely on giving the supply push vis-a-vis broadband, creating the demand pull with credible public or private sector partners and more importantly making broadband conveniently accessible, affordable, applicable, acceptable and advantageous for the rural citizen will fast become the imperatives for the success of NOFN.

4.4: Sustained political support

Politically the NOFN will be game changer bringing hitherto unreached population segments into the national fold increasing both awareness levels and the quality of governance, the latter serving both as a cause and a consequence. However, in order for this to happen, political will on part of the powers that be would be required to either motivate or coerce stakeholders to extend their reach. Like questioned by ITU in the case of the CSC programme (Shadrach and Sharma, 2013), is there the political will and the requisite coordination between the Central ministries and the state governments to establish this ecosystem? As we enter the election year is this political will going to drop even further? Who is the agency/department that is driving the creation of the broadband ecosystem? Is BBNL in a facilitating capacity good enough to ensure creation of the demand pull and build the absorptive capacities of the rural populace?

A newspaper article¹⁷ titled, 'Lack of harmony delays rural broadband connectivity' infers lack of coordination or a forced one between state and central government. The article reports that BSNL had wanted the Government to drive usage by undertaking e-governance projects in a big way, as there are few rural takers. Are the central ministries and state governments really ready with their G2C services? ITU in its assessment of the CSC program (Shadrach and Sharma, 2013), was critical of the lack of cohesiveness and ownership and little seems to have changed since. Whether it is banking services from public sector banks or e-Governance services from line department, outreach plans and efforts have not happened despite infrastructure, though of lower speeds and capacities, being available.

If NOFN roll out is completed as scheduled by September 2015, then all stake holders would have to commence laying out their plans if not already begun. The onus of creating the business climate for the private players and indeed the ecosystem for all stakeholders lies with the Government of India.

The telecom sector as a whole has seen considerable instability with unwarranted political interference and frequently changing regulatory regimes. In order for this ecosystem to be

¹⁷ <http://www.thehindubusinessline.com/industry-and-economy/info-tech/lack-of-harmony-delays-rural-broadband-connectivity/article4133710.ece>

established and expand, a stable environment would have to be established. It's unclear how a private player can be forced to offer products that benefit the society as desired by a central minister?¹⁸ In the absence of sound business propositions would private operators be ready to join the ecosystem and in their absence can the envisaged outreach really be achieved?

With economic environment in the country being uncertain/tentative thanks to the general election in 2014, there are apprehensions around whether the importance/priority accorded to a multi-year and a multi-crore project like this one would see dilution. As this project, unlike an NREGA or Food Security, promises no immediate results or gains for the establishment there is the likelihood that this project would be moved to the back burner thereby slowing down the progress even further.

4.5: Initial impetus from the government

For telecom players and content providers to see the necessary volumes to sustain this network, initiatives in mobilizing and awareness building at the grass root level would have to be urgently formulated and undertaken. While the mobile revolution has done much in bringing home the benefits of technology to rural citizens and rendering it as a people-friendly tool, accepting e-services in place of traditional "touch and feel" modes would require a socio-cultural change and this would be particularly challenging in sensitive areas such as banking and health.

It is not only critical that broadband access becomes available to the users but should be affordable and acceptable to them. Also, expecting constituencies like rural women to become users of broadband without any handholding or big demonstrations is unrealistic. Graduating from the simple cell phone to devices requiring smart handling by users requires a giant leap. Much needs to be done by way of awareness building and training to have rural households accept and use broadband enabled services. The inclusion of civil society

¹⁸ <http://www.thehindubusinessline.com/industry-and-economy/info-tech/rural-broadband-bsnl-pushes-for-common-wireless-network/article2409427.ece>

organizations in this effort along with the administration, duly guided by a central nodal agency of the government, would help to achieve the necessary outreach.

Being a late starter in the telecom scenario, India has had the advantage of using the latest technology and so is in a better position when compared to many other countries as far as introduction of next generation networks is concerned. Broadband technology will, as discussed, enable several independent platforms like banking, health and insurance to converge their services to a rural household. Education, banking and e-commerce will, it is expected, boost entrepreneurial endeavors in both agriculture and other value chains. Apart from facilitating the spread of eco-friendly practices, it is expected that energy efficiencies in both the backhaul and access networks would be addressed using newer more innovative technologies. On the other hand, prolonged delays in deployment could bring technology closer to obsolescence casting doubts over its maintenance and requiring replacement.

5. Concluding remarks

Given its pan India coverage, the anticipated impact of NOFN over lives of the populace, especially poor, seems to be huge. As of now, the project seems to be repeating the mistakes of other such large projects and programmes undertaken in the country over the last few decades. As the number of stakeholders is large, local, state and central governments, and public and private firms, the relationships are complex and require a great deal of flexibility from all parties in order to realize the full potential of the endeavour. The changing business and political contours in contemporary India would also determine the future of this project. Unlike other organizations, BBNL appears to be aware of the challenges of its undertaking and is ably supported, at least on paper, by many studies or reports by the local agencies both in the public and private space. The success of NOFN is dependent on timely implementation, active participation by the private players and the creation of complementary assets. The paper hopes that it is able to sensitize the policy makers of the same.

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