

Policy Report

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Rural India on the National Optic Fibre Network: What Happens Next?

Preeti Mudliar



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Rural India on the National Optic Fibre Network: What Happens Next?

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ABSTRACT

As one of the world's largest rural connectivity endeavours, the National Optical Fibre Network (NOFN) project has been the subject of immense policy interest for the potential it holds to deliver high speed broadband internet to rural India. The building of infrastructure on a scale of this kind was acknowledged as an audacious move owing to the nature of transformation that this could herald in the way rural India could ride the digital information highway. The project, however, has been subject to numerous delays and deadline extensions for its completion are now a matter of routine. The pilot projects for NOFN were rolled out in the year 2012 in three States—Tripura, Rajasthan, and Andhra Pradesh—and they received functional internet connectivity from 2013 onwards.

This study visits the three pilot project sites to find out how the NOFN infrastructure is faring three years after it was first rolled out to 58 gram panchayats (village local bodies) in India. Adopting a qualitative lens, the study locates the infrastructure in the geographical, social, and work practice context of the sites where it

is supposed to be delivering seamless, reliable, and high speed internet connectivity through fibre optic cables.

This Policy Report details the ways in which the NOFN infrastructure draws attention to itself and becomes highly visible not due to its functioning, but due to its frequent breakdowns and the many disruptions that follow.

The Report recommends that attention to regular maintenance and repair, in terms of budgetary provisions that include salary for dedicated personnel, be incorporated as an integral part of the way the NOFN infrastructure is rolled out and built. Without this, the infrastructure loses its functionality and its 'completed' status is rendered meaningless.

TABLE OF CONTENTS

I	Introduction – The National Optic Fibre Network Story	1
II	Sites, Work, People, and Communities: The NOFN in Practice	17
III	Breakdowns: NOFN as a Visibly Collapsing Infrastructure	54
IV	Conclusions: Infrastructure as a Constant Work in Progress	63

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I. Introduction – The National Optic Fibre Network Story

India's bid to bring broadband internet to the vast spread of its rural population is an endeavour that is the largest of its kind in the world. Through this project, India aims to bring each of its 2.5 lakh gram panchayats on the internet grid and, in the process, reach out to nearly 600 million citizens of rural India. Various referred to as the National Optic Fibre Network (NOFN) and more recently as BharatNet, the project is an ambitious move to bridge the country's digital divide at an estimated cost of Rs.30,000 crore. The driving motivation for digital inclusion policy initiatives in all countries rests on the premise that access and use of Information and Communication Technology (ICT) is positively correlated to a country's overall development and socio-economic metrics (Ono & Zavodny, 2007). Rural areas are especially susceptible to lagging in development owing to poor infrastructural resources that negatively impact their access to economic, health, educational, entertainment, and cultural resources even while fencing rural communities into geographically isolated islands with poor connectivity (Whitacre, Gallardo, & Strover, 2014).

India's agenda in connecting its rural citizens is to ensure prompt delivery of utilities and governance services and the present National Democratic Alliance (NDA) government's flagship 'Digital India' programme is seen as yet another step in this direction following from successive central government projects to move towards a digital savvy India. Policy notes and briefs available on the Ministry of Electronics and Information Technology's (MEiTY) web portal, list a gamut of objectives that the government hopes to realise through broadband connectivity. These include improving compliance with panchayat management systems, targeted delivery of citizen services and state-sponsored schemes, and improving community participation and decision making structures (MEiTY, 2016). Additionally, the existence of broadband infrastructure is expected to invigorate other service providers in domains such as entertainment, e-commerce, and outsourcing agencies to launch their own offerings (Business Wire India, 2015).

The NOFN is by no means India's first experiment with providing internet access to rural areas. There have been various initiatives spearheaded by individual State governments, corporates, and non-governmental organisations (NGOs). These include initiatives such as ITC *e-choupal* that operates in Madhya Pradesh and Andhra

Pradesh mostly for e-procurement of certain agricultural produce; Aksh Broadband in the rural districts of Jaipur, Rajasthan, that supports village kiosks for e-agriculture initiatives; n-Logue internet kiosks in Tamil Nadu that aimed to provide voice and video telephony, and a range of financial, agricultural, and e-governance services; Akshaya (Tulip) computer training centres in Kerala that have been the outcome of a connectivity drive by the State government; the Community Information Centre (CIC) project in north-east India that is run by State government employees to provide internet access for email and web browsing facilities, and e-government initiatives such as Madhya Pradesh's intranet portal— Gyandoot which was a government to citizen (G2C) service portal (Bhatnagar & Vyas, 2001; Confederation of Indian Industries, 2010).

The National e-Governance Plan (NeGP), proposed in 2006 by the Union government led by United Progressive alliance (UPA) was accompanied by the creation of various forms of internet infrastructure in all States to enable efficient delivery of G2C services. This took the form of the State Wide Access Network (SWAN) that was conceived as a backbone network to support data, voice, and video communication throughout a State. Accordingly,

SWAN was rolled out in March 2005 to connect all government offices at the Block headquarters with the State headquarters at a minimum bandwidth capacity of two megabits per second (Mbps) per link. In addition to this, State Data Centres (SDC) were built to streamline and manage operations related to data and IT management for services such as data storage, disaster recovery, online delivery of services, and Citizen Information and Services Portal. Lastly, Common Service Centres (CSC) were positioned as a strategic cornerstone of the NeGP that would provide last mile utilities to citizens in villages and facilitate the delivery of a range of services encompassing governance, health, education, and telemedicine (MEiTY, 2016).

Even as internet connectivity under SWAN was being used to connect government offices at the Block level to the headquarters in the State capital, the need for a broadband policy as an enabler of social and economic growth was gaining recognition. This led to the government laying down a Broadband Policy in 2004 to improve the broadband, internet, and computer penetration rates that in 2003 were at 0.02 per cent, 0.4 per cent, and 0.8 per cent, respectively. The policy sought to improve these figures and achieve a target of 20 million broadband subscribers by 2010. It aimed to

boost internet access through various infrastructure such as optical fibre technologies, digital subscriber lines, cable TV networks, and satellite media (Department of Telecommunications, 2004). The efforts of the government were in keeping with a global push towards increasing internet penetration. As Srinivasan and Ilavarasan (2015) note, by 2010, the International Telecommunication Union (ITU) along with UNESCO set up the Broadband Commission for Digital Development and sought commitment from all member countries to accelerate broadband penetration and meet the United Nation's Millennium Development Goals (MDG) by 2015. The Broadband Commission mapped how internet connectivity could help achieve each of the eight MDGs such as the use of broadband in reducing poverty in the information age, empowering women, maternal health, combating HIV/AIDS, malaria, and other diseases, and pursuing environmental sustainability.

Taking the Internet to Panchayats

The genesis of the NOFN in its present form can be traced to a White Paper issued in August 2010 by the office of the Adviser to the Prime Minister on Public Information Infrastructure and Innovation headed by Sam Pitroda. The Paper sought to squarely

focus on the gram panchayats, which are the most elementary units of governance in India. It envisioned the building of infrastructural and administrative capacities of the panchayats through the provision of broadband connections that could be leveraged to create a public information infrastructure in the grassroots of rural India. The plan was to create infrastructure capabilities and enabling access and delivery of government services, health, education, and other services.

Quoting a World Bank report that projected a 1.38 per cent increase in per capita Gross Domestic Product (GDP) of developing economies for every 10 per cent increase in broadband penetration, the Paper was clear that access to broadband would lead to a wave of growth in India much like the spread of voice telephony in the 1980s that was, incidentally, also spearheaded by Pitroda (PII, 2010).

The technology of choice that was identified in the Paper was the optic fibre cable. Comparing the advantages and disadvantages of Digital Subscriber Lines (DSL), cable modems, and wireless technologies, it concluded that optic fibres were the best mode to bring internet to rural India given their long-term sustainability, reliability, and security aspects. The Paper also cited the adoption of

optic fibre by countries such as the U.S., U.K., Australia, South Korea, Taiwan, Singapore, and Malaysia, as evidence of a global move towards optic fibres being the preferred infrastructure of choice for rural connectivity. Following the publication of the White Paper, the Telecom Regulatory Authority of India (TRAI) also called for a national broadband policy that would bring all rural areas with a population count of at least 500 people on the internet connectivity grid. On October 25, 2011, the government approved a Cabinet Note for the creation of a National Optical Fibre Network (NOFN) to provide broadband connectivity to panchayats. The project would be funded through the Universal Service Obligation Fund (USOF) and executed by a special purpose vehicle (SPV) called the Bharat Broadband Network Limited (BBNL), incorporated under the Companies Act, 1956, and would include personnel from BSNL, RailTel, the telecom concern of the Indian Railways, and the Power Grid Corporation of India Limited (PGCIL).

The project execution was divided between BSNL, Railtel, and PowerGrid in a 70:15:15 ratio. While BSNL has undertaken responsibility of sixteen States and one Union Territory (UT), RailTel is executing the project in seven States and one UT, and

PowerGrid in five States and one UT (National Innovation Council, 2011). To facilitate the laying of fibre, MoUs were proposed to be signed between the Union and State governments and the executing agencies to resolve and waive right of way charges. BBNL (2013) describes NOFN project as a process that involves laying down incremental fibre from the block headquarters (up to which fibre had already been provided owing to the SWAN network), to the gram panchayat headquarters. The NOFN infrastructure thus created would also be made available without discrimination to all service providers such as cable TV operators, telecom service providers, internet service providers, and content providers to launch their own services for retail purchase by the end consumer. It is a process that BBNL represents diagrammatically as below.

When the NOFN was unveiled as official policy under the aegis of the BBNL in 2011, the proposed timeline for completion was two years during which incremental optical fibre covering 5,00,000 route km would be laid. Since then, the timeline has undergone multiple revisions with the latest deadline pushed to December 2018. Its original budget totalling Rs.20,000 crore, today stands at a recommended Rs.72,000 crore. The project itself has been

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

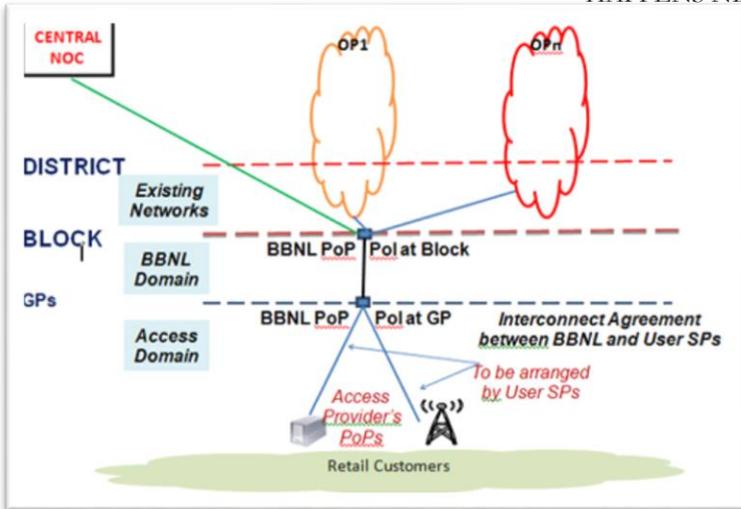


Figure 1: NOFN concept diagram on BBNL portal
 Source: Bharat Broadband Network Ltd.

renamed, BharatNet, after the NDA took over from the UPA government. In response to a query under the Right to Information Act, by *The Economic Times*, the USOF revealed that even with the original budget of Rs.20,000 crore, less than 29 per cent - that is only Rs.5,741.80 crore had been disbursed towards the NOFN programme until August 31, 2016 (Abbas, 2016). According to the weekly status update by BBNL, as of November 30, 2016, the laying of 1,47,398 km of optic fibre connecting 64,239 gram panchayats had been completed at a rate of 1,706 km of optic fibre per week at the time of the writing of this Policy Report.

The delays in the progress of the NOFN have been attributed to several reasons. An expert committee constituted by the government to examine the project, submitted its report in March 2015 (NOFN Committee Report, 2015). The Committee evaluated the execution and functioning of the NOFN infrastructure in three pilot sites in Tripura, Rajasthan, and Andhra Pradesh and the subsequent progress made on the NOFN project. The Committee said that it, "... felt strongly that it is essential to review the implementation of NOFN to raise the aspirational level to match that of Digital India."

Its evaluation found numerous issues in the design and choice of technology for NOFN, and pointed out the poor implementation and maintenance of the project, that resulted in underutilisation and disuse of the infrastructure. Investigation found that the project was marred by a lack of accountability in the way it was being managed both financially and in other aspects owing to inadequate resources by BBNL to track and monitor the progress. It observed that there was a total lack of ownership in executing the project by the three central public sector units (CPSUs) i.e. BSNL, RailTel, and PGCIL who found themselves disempowered in taking decisions because of excessive emphasis on cost controls.

Testifying to the inability of BBNL in ensuring rigorous planning and implementation of the project, the committee found that BBNL too was unable to claim autonomy in decision-making that led to very slow response times, which in turn impacted the project deadlines. Even in places where infrastructure was available, the committee observed that in the absence of a system such as a Government User Network (GUN) that could act as a service layer and leverage NOFN to provide government to citizen (G2C) services, there was little incentive to use the system effectively. States were found to be aloof and not involved in active collaboration leading to delays and slow progress in the implementation. At sites where NOFN had been completed, repair and maintenance issues were exacerbated with a lack of skilled staff compounded by unreliable electricity supply, and inadequate space to house and secure equipment and assets.

Commenting on the committee's report in the Economic and Political Weekly, Srinivasan and Ilavarsan (2015) offered additional suggestions such as the need to develop the absorptive capacity of government, citizen, and businesses to understand, learn, and utilise the advantages of broadband without which the benefits of rolling out a massive internet connectivity project would not be realised.

Additionally, they stressed on strong political will that could support and pursue a more inclusive business agenda in terms of removing barriers to access and improve affordability of internet for use by common citizens. This would also involve putting in place equitable service level agreements that would allow for greater participation from the private players and invigorate investment and innovation in services and utilities delivered using the Internet.

The Digital Empowerment Foundation (DEF), an NGO, was another organisation that undertook an assessment of the pilot projects. Its report, based on randomised surveys, released in 2015 notes several discrepancies between the claims made by BBNL about the number of connections provided to institutions in the pilot project and the number of working connections that actually function and provide internet connectivity (DEF, 2015).

Scope of the Report

The research leading to this Policy Report was conducted over a period of four months from May to August, 2016. Adopting a qualitative enquiry lens, I visited each of the three pilot study sites in Tripura, Rajasthan, and Andhra Pradesh to understand what

happened after the NOFN infrastructure was rolled out to the gram panchayats. I began the project with three research questions:

RQ1: What narratives of internet use and non-use emerge from rural communities that have recently received broadband connectivity?

RQ2: What challenges do rural communities face in accessing the internet as a resource for daily needs? What role does the government machinery play in assisting with these challenges?

RQ3: What kind of activities and device use do rural communities tend to gravitate to when harnessing the connectivity provided by broadband internet?

However, as I began my field work, it was soon clear that the reach of the NOFN infrastructure was limited to the offices of the gram panchayat and horizontal connectivity from there, extending to other institutions of importance in the villages such as schools, primary health care centres, veterinary sub centres, and land records office. The citizen communities themselves were largely unaware of the presence of broadband internet or the notion of the NOFN infrastructure and what it meant for them in terms of internet access and use. Enquiries revealed that the mandate with the existing agencies was to solely provide for connectivity up to the gram panchayat level and its allied institutions and not make the connections available for use or retail purchase by private citizens. In the absence of any strategy or system to extend the infrastructure

for citizen access and use, I then redirected my attention from the village community to sites where the NOFN infrastructure was present to understand narratives and the nature of use, non-use, access challenges, and activities for which the connectivity was being harnessed.

Fieldwork

As part of the fieldwork, I visited all the three blocks whose villages formed a part of the pilot sites in Panisagar, Tripura; Arain, Rajasthan, and Parawada, Andhra Pradesh. Though official documents state that the pilot projects were completed in October 2012 (NOFN Committee Report, 2015), all three sites reported using a functional internet connection from 2013 onwards. My visit was thus taking place three years after the NOFN infrastructure had been put into place in the pilot sites. The choice of gram panchayats I visited in each of the blocks mainly depended on factors such as accessibility since not all places were readily accessible by available means of transportation. For instance, while some of Panisagar's and Parawada's gram panchayats were well connected with local transportation, Arain's gram panchayats had none. Hence, depending on the site, the bulk of my time was either spent in the

offices and institutions surrounding the block headquarters or in the gram panchayats that had NOFN connectivity.

I spent close to 10 days in Panisagar, Tripura, 17 days in Arain, Rajasthan, and five days in Parawada, Andhra Pradesh, tracing the presence and utility of NOFN infrastructure at these sites. My research was ethnographic in nature and focused on building “thick description” (Geertz, 1994). It took the form of daily visits and “hanging out” at the block headquarters at each site along with spending time making observations of internet usage by citizens during visits to gram panchayats, schools, health care centres, and other institutions. I also conducted several interviews with the staff and visitors at the offices included in the field study, and interviews with government officials and staff from BSNL, RailTel, PowerGrid who were overseeing the execution and maintenance of the projects.

Drawing from Star and Ruhleder’s (1996) framework of infrastructures and its properties, the Policy Report begins with a description of the geographies of places that hosted the pilot roll out of NOFN. It lists the sites, contexts, and the personnel who interact with the NOFN infrastructure to draw contours of space and place of rural India within which the NOFN seeks to be

embedded. Next, given that malfunctioning equipment were the dominant state of the NOFN infrastructure that were evident from the field visits, the Report characterises the nature of disuse, disrepair, and disruption afflicting the infrastructure to clarify the conditions under which breakdowns take place. Finally, it provides an overview of the efforts by bodies outside the NOFN to bring internet connectivity to rural India to place the government's efforts in context with other initiatives by private players.

II. Sites, Work, People, and Communities: The NOFN in Practice

The NOFN project first manifested itself in 2012. It took the form of three pilot sites chosen by the UPA government to receive broadband internet connectivity before the nationwide optic fibre cable rollout to 2,50,000 village councils could begin. According to BBNL, the objectives that it hoped to achieve through the pilot project were to learn more about the technology choice and architecture, gain experience with the ground realities in rural India, test the Network Operation Centre being developed by C-DOT, understand how telecom service providers and internet service providers would utilise the NOFN infrastructure, integrate the gram panchayats with the existing network, allow operators at the panchayat to interface with the NOFN network, plan a template for G2C services, and assess the synergy and collaboration between different agencies involved in the project.

Implementation of the pilot

The three sites chosen for the pilot were Panisagar block in Tripura in north-east India with 18 gram panchayats, Arain block in Rajasthan in north-west India with 25 gram panchayats, and Parawada block in Andhra Pradesh on the eastern coast of India with 15 gram panchayats. Accordingly, the pilot covered 58 gram panchayats across the three chosen blocks. The sites were chosen owing to the diverse geographical and topographical conditions that each of them represented, which allowed the organisations tasked with executing the project to acquaint themselves with the conditions and challenges of different geographies that they would encounter while implementing the NOFN roll out. The executing agencies for Panisagar, Arain, and Parawada were RailTel, BSNL, and PGCIL respectively, which meant that the laying of cables and taking incremental fibre to the gram panchayats was their responsibility. The National Informatics Centre (NIC) through the National Informatics Centre Services Incorporated (NICSI) provided support in terms of supplying software and hardware, equipment such as computer systems, LCD screens, and all in one printers, and hiring contractual staff for NOFN. However, the role that NIC and NICSI played in NOFN was specific only to the pilot sites. Thus, barring the pilots, the NOFN roll out in the rest of the

country is limited to ensuring the laying and functionality of the optic fibre that will bring broadband connectivity to the panchayat and does not include any other infrastructural and personnel support.

Equipment and Infrastructure

Under the pilot project, offices in the block headquarters as well as the offices of the gram panchayat are connected with optic fibre cables that carry high speed internet with a minimum speed of 10 mbps. Though the pilot sites were supposed to receive connectivity speed up to 100 mbps, the speed tests conducted at the sites by the author mostly reported speed in the range of two mbps – 25 mbps across all three sites. The staff at every office complained that the speeds had decreased over time and the early days of the NOFN rollout reported speeds closer to 100 mbps. Officials at RailTel, and BSNL attributed the slowing down of speeds due to power loss owing to frequent fibre cuts. In addition to the fibre connectivity, institutions of importance in every gram panchayat such as government schools, post offices, veterinary centres, and land records offices were provided horizontal connectivity with the help of broadband wireless terminals (BBWT) devices manufactured by C-DOT. Hardware equipment for use of the NOFN internet was

supplied by various agencies such as NIC and RailTel's CSR scheme and included computer systems, LCD display screens, webcams, all-in-one printers, UPS battery for power backup, and furniture such as tables and chairs to ensure proper space for the equipment. Additionally, the NIC recruited data management associates (DMA) on contract for every panchayat to assist in operating and overseeing the infrastructure that was created under NOFN. Each institution connected to NOFN internet received at least some or all of these materials under the pilot project. The common refrain of people in every site that the author visited was that while both the internet as well as the equipment worked very well when the project first began, they gradually began breaking down with many sites reporting infrequent or no use of internet and the computers six months to one year later. This situation was particularly common in almost every office with horizontal connectivity through BBWT devices.

The following sections place the NOFN infrastructure that were studied by the author in the context of their location and status of use.

Panisagar, Tripura.

Panisagar is located in the North Tripura district of Tripura approximately 150 kilometres from the State capital Agartala and around 16 kilometres from the district headquarters, Dharmanagar. The block has 11 gram panchayats and three autonomous development councils (ADCs) that perform the same functions as the gram panchayat, but are granted special recognition in view of the largely indigenous tribal population that inhabits that area. Other than Panisagar, the fieldwork in the block comprised visits to the gram panchayats of Jalabassa and Bilthai as well as the ADCs of Chandrahampara and Indurail.

Panisagar is serviced by a railway station and is connected to Agartala by the Silchar-Agartala broad gauge passenger train that commenced operations on a trial basis only in May 2016. Panisagar is also connected to Agartala by road with private buses regularly plying between the Dharmanagar and the State capital. Access to Dharmanagar is readily available in the form of six-seater autorickshaws that transport passengers. The autorickshaws also service some of the nearby gram panchayats from Panisagar and other villages that are on the route to Dharmanagar provided enough passengers line up to make the journey economically

feasible for the driver. Panisagar covers an area of around 296.3 sq. km. and its total population is 81,196 of which 39,859 are women. It reports male literacy at 90 per cent while female literacy is 87 per cent.



Photo: Preeti Mudliar

Picture 1: The administrative map of Panisagar displayed at the block headquarters.

The block has three police stations that are located in Panisagar, and the panchayats of Dhamcherra and Khedacherra. Panisagar has a sizable commercial presence with a large market for groceries, vegetables, meat, and fish as well as other items of everyday use. The bazaar also has at least four shops dealing in mobile phones and accessories. These shops are frequented by residents of Panisagar

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

and surrounding villages owing to the prepaid mobile recharge facilities that they offer. The block also has smaller kiosks, which offer games and songs downloading facilities that are popular with the youth from Panisagar and surrounding villages in the block.



Photo: Preeti Mudliar

Picture 2: Kiosks offering digital services in Panisagar

In addition to the office of the Block Development Officer (BDO), the premises of the block headquarters of Panisagar hosts a range of other offices such as that of the sub-divisional magistrate, land records and an ‘e-subidha’ centre that offers a single-window application centre for G2C services. The e-subidha centre is a busy place with citizens queuing up for a variety of certificates ranging from income certificate, birth and death certificate, permanent

resident certificate, and caste certificates. Internet connectivity is crucial for a successful trip to the centre, but citizens from the panchayats affiliated to the Panisagar block and the staff at the centre, find themselves waiting for hours or undertake multiple trips owing to various disruptions in services caused either due to electricity failure or internet downtime.



Photo: Preeti Mudliar

Picture 3: E-subidha centre at Panisagar block headquarters.

The NOFN at work in Panisagar

The block and its offices in Panisagar are connected by both NOFN as well as SWAN infrastructure. As the SWAN network was in place before NOFN internet, staff at the offices have access to both the

internet networks. Though the NOFN provides better internet speed than that of the 2 mbps SWAN, the staff often switches to the SWAN since connectivity to the NOFN infrastructure is frequently disrupted owing to fibre cuts that take up to three hours to be identified and spliced back.

The block staffers complain that their work flow is prone to interruptions and delays owing to the disruptions to NOFN and the very slow speeds offered by SWAN. One of the staffers at the e-subidha centre told the author:

“Given that everything is now digitised, I cannot accept applications, validate documents or issue any certificates without the internet. The interruptions are frequent and we lose valuable time waiting for connectivity to be restored. If we switch to the SWAN network, it is equally frustrating since the speed is very slow. We often stay back beyond our working hours since we can’t always ask people to come back the next day so we try our best to ensure that we are able to complete the work they are visiting for on the same day. This is why you see so many people waiting around the office. Almost half of our work hours are only spent in waiting for internet connectivity to be restored.”

Other than the block offices in Panisagar, NOFN connectivity was provided to other local institutions such as the veterinary centre, two

government schools, the Primary Health Centre (PHC) from where telemedicine sessions were held in the early days with doctors from Agartala, and a Krishi Vigyan Centre which acts as a resource centre for agricultural activities. The NOFN infrastructure was dysfunctional at all these places except the block office owing to a variety of reasons such as malfunctioning of computer systems whose annual maintenance contracts (AMC) had long expired without budgetary provisions to renew them or BBWT devices that had stopped functioning and were awaiting repair and replacement ever since. In the past, functional WiFi connectivity was also present at almost all the panchayat offices as well as the block office. The RailTel officials though reported disabling the WiFi since they found that the password was being freely shared by the villagers for entertainment purposes such as downloading of songs, games, and films on their devices, leading to a slowdown of the NOFN network.

At the gram panchayat, the villages visited for the study were Bilthai, Jalabassa, Chandrahalampara, and Indurail. As in Panisagar block, only the gram panchayat offices in all these villages had functional internet access. In Jalabassa, the common service centre (CSC) was the only other site where NOFN internet was being used by the

village level entrepreneur (VLE) who was running the CSC. Schools, PHCs, veterinary sub centres, and post offices at Bilthai and Jalabassa had no internet connection, and the computers provided to these institutions were lying in a state of disrepair. At the PHC in Jalabassa, the office administrators were making use of mobile internet data cards and USB dongles from private service providers such as Airtel to complete digitisation of their work that they were required to submit daily to the district hospital in Dharmanagar.



Photo: Preeti Mudliar

Picture 4: Internet downtime caused by a fibre cut at Bilthai panchayat

An office assistant at the health centre said,

“Almost all our duties such as health insurance enrolment and claims, filing vaccination reports, and all government health schemes such as the mother child tracking system, and our supply chain management system is wholly online. In many instances, we use our own mobile internet plans to check and send emails and to ensure our updates are logged in since the

data cards are also extremely slow and do not provide reliable internet connectivity. Since we don't always have internet here, we have to go to the block hospital to submit our records. Often the block office also does not have internet so we have to check if any of the surrounding gram panchayats have connectivity. It leads to a lot of wasted time because we have to run around with our registers hoping to find a place with internet to submit our records.”

Gram Rozgar Sevaks (GRS) who are required to update the National Rural Employment Guarantee Scheme (NREGS) muster rolls everyday had a similar refrain. The GRS at Bilthai said,

“I don't really get internet connectivity at the panchayat. I actually spend from my own pocket to update the muster as I don't have the time to go to the block office or to look for internet elsewhere. Most times, I click pictures of the workers on my smartphone and then send it on WhatsApp to the supervisor. For the muster records, I sometimes make use of my own data card to upload the data.”

The schools in both Jalabassa and Bilthai have locked up the computers in a room ever since the BBWT devices that provided horizontal connectivity malfunctioned with no recourse to repair or replacement. The principal at the government school in Bilthai said,

“In the early days when we were provided all the equipment along with internet connectivity, there was a lot of enthusiasm both among students as well as teachers. We even had regular classes via video conferencing with teachers in Agartala, but

after six months the internet stopped working. We didn't know what to do with computers alone without a working internet connection so we locked them in a room.”

While internet use is crucial to the kind of work staffers in government offices are expected to perform, for others, the intent and interest to use the internet remains unrealised owing to dysfunctional equipment leading to very little utilisation of the NOFN infrastructure. This, in spite of there being a real need for reliable and uninterrupted internet connectivity for work purposes.

Personnel

The maintenance of the NOFN infrastructure at the block and at the panchayats operates on the principle of reciprocity that is dependent on the goodwill and familiarity of the SWAN system engineer or the DMA at the panchayat with the office staff. While the SWAN network at the block has a dedicated engineer staffer who looks after the operations and maintenance of the network and draws a regular monthly salary for his responsibilities, he is also expected to handle operations of the NOFN infrastructure since the budget for the NOFN DMAs was not renewed. According to the SWAN staffer at Panisagar, looking after the NOFN infrastructure

is a responsibility that he is expected to attend to even though it is not a part of his job description. He said,

“Since I am a local and well known to everyone here, it is not possible to refuse when I am asked to help out so though it is not a part of my job, I do it because there is nobody else to take care of the maintenance and our relations extend beyond work. Everybody knows everybody here and I often need assistance both personally and professionally too so it is difficult to cite official job descriptions as an acceptable reason for not helping out though it does become very hectic for me at times. I am even helping with the digitisation of voter ID cards though that has nothing to do with my job as a system engineer here simply because I was requested to.”

Most of the DMAs (or IT managers as they refer to themselves), who were appointed on contract, remain unemployed after the end of their original contract period. They continue on the job with the hope that their contract would be renewed in the future as there is an acute shortage of employment opportunities in Tripura. Former DMAs still visit the block office every day in search of odd jobs such as contributing to the digitisation of voter ID cards for which they expect to be paid on completion of the project.

Additionally, almost none of the elected members of the panchayats that the author visited were computer literate and depended on the DMAs to operate the computer and the internet. Every panchayat

attested to the need for skilled personnel to manage the internet and computer tasks. A common sentiment that the panchayats echoed was that even the panchayat secretaries were not always computer or internet literate, and were therefore completely dependent on the DMAs to maintain and update panchayat accounts using software such as PRIASOFT. This meant that official work was often delayed if they could not persuade the DMA to assist them in completing the process. Recalling the early days of NOFN, the sarpanch of the Bilthai panchayat said,

“The LCD screens that we were given were very useful to us because we would video conference with the BDO at the block and even join in for meetings taking place in Dharmanagar and Agartala. But we have not used the LCD screen in two years now since irregular internet means we don’t video conference anymore.”

While the DMAs at Chandrahalampara and Jalabassa have stopped reporting for work owing to non-renewal of contracts, the managers in Bilthai and Indurail continue visiting the panchayat office regularly because they remain unemployed and believe that if they don’t visit the office, the post might be occupied by someone else whenever the contract comes up for renewal. Hence to maintain their claim over the post, the DMAs, who usually belong to the same village that they work in and are thus securely embedded in the social

fabric of the village, continue to visit the office and perform occasional tasks for the panchayat.

Owing to the ongoing work of laying cables in the neighbouring district of Unakoti, the RailTel engineers are a regular presence in Panisagar and are often in close touch with the DMAs and other staff at the panchayats. The DMAs attest to the fact that RailTel engineers are very responsive when they are notified of any downtime on the internet. The SWAN engineer at the block says,

“RailTel officials do their job. If we inform them that the internet is not working, they get on to the task immediately, but that is only if the problem is something that they are in a position to solve. If entire devices are malfunctioning, then they too are not in a position to help since that does not come under their purview.”

The DMA at Indurail concurs: “I am in constant touch with the RailTel officials. In fact, I think I make their job easier because they depend on me to inform them of service interruptions, which I diligently do since I need the internet for the panchayat work.”

While both the need and the availability of skilled personnel to manage the internet infrastructure is present, work often gets delayed as contracts have not been renewed and no salary is paid to

the DMAs. Whatever work is accomplished at the panchayat offices continues with informal arrangements that the panchayat manages to strike with former DMAs. However, even with this, the work is not complex enough to merit the resources invested in implementing a capital-intensive resource such as the NOFN since it is limited to data entry jobs on PRIASOFT or updating NREGS muster rolls. The absence of a service layer such as the GUN proposed by the committee report on the NOFN, too points to this lacuna in ensuring that the network even when functional is not utilised to capacity.

NOFN awareness in the village community

The former DMAs in Jalabassa, Bilthai, and Indurail reported that villagers who were aware of the NOFN infrastructure would sometimes come in to use the internet for their personal work. Says the DMA of Bilthai:

“I live right here and these are people I have known my entire life. They often ask me to come over to help not just with official work, but even if they just want to log on to Facebook. Once we ended up buying twenty pairs of shoes online because all my friends wanted a pair each so I placed the order on their behalf. These are generally young males or older men who are my friends and we never have women visiting the

office to use the Internet. Sometimes, my friends just want to check Facebook, but often there are more urgent requirements such as checking exam results. Once, my neighbour's son fell very ill. They took him to Chennai to the Apollo hospital for treatment, but they could not afford follow up visits, so he came to me and I helped them access Skype in the panchayat office, which they used for a video call with the doctor in Chennai. They used Skype for two follow up calls with the doctor after that and it was really useful to have internet connectivity in the village. There are also a few families whose members are working abroad in the Middle East. They sometimes ask if they can Skype with their relatives so I help them out too.”

Indurail, too, reported limited awareness about internet connectivity and the DMA said that it was the male youth who would usually approach him for help. In Jalabassa, however, the panchayat secretary was not in favour of spreading awareness about the availability of the Internet. Pointing to limited infrastructure that would justifiably interfere with the day to day working of the panchayat, he said:

“Where is the space if people start coming in and ask to use the Internet? We only have two computers in the panchayat and just one table and chair. We need at least one computer for panchayat work. Even if the other one is free, look at the space constraints that are there. There will be chaos and noise if we open this to the villagers. How will we accomplish any work?”

Arain, Rajasthan

In line with the Indian rural administration system, Arain, in Rajasthan, serves as the Block headquarters for around 25 gram panchayats in Ajmer district. Covering an area of around 36.22 sq. km., it is around 70 km from its district headquarters in Ajmer and around 132 km from the State capital, Jaipur. The nearest city Kishangarh, which boasts of one of India's largest commercial marble trading market is around 26 kilometres from Arain. Owing to its status as the block headquarters, Arain houses the offices of the administrative units that discharge various governance functions for the villages affiliated to it.

It is also the location for the PHC, a police station, and a tehsil office along with a BSNL rural telephone exchange building. Branches of two national public sector banks serve the financial needs of the population. Its government schools provide education up to X standard. For high school and undergraduate education, students generally travel to colleges in Kishangarh or Ajmer in the pursuit of higher education.

Arain is served by the Rajasthan State Road Transport Corporation (RSRTC) with State-operated buses connecting Ajmer to Arain

every hour. These buses form an important linkage between Arain, Ajmer, Kishangarh, and surrounding towns from where people staffing the administrative offices in Arain usually commute. The bus journey takes two hours from Ajmer and an hour from Kishangarh. While RSRTC provides bus service to Arain, its affiliated villages have no form of public transport and people have to rely on their own vehicles or on private jeep owners who operate transportation services between destinations depending on demand. For the fieldwork in Arain, the author sought help from volunteers of a NGO and hired a jeep to the gram panchayats that were accessible. These included Sironj, Borada, Jheerotiya, Dhadiya, Chotta Lamba, Deopuri, Gothiyana, and Katsura.

The NOFN at work in Arain

Through the NOFN infrastructure, the block office and the gram panchayat in Arain village receive internet through both broadband wireline and WiFi. The WiFi connection, the password of which is known to most villagers with smartphones, is available at three locations—the BSNL telephone exchange, where the GPON (Gigabit Passive Optical Fibre Networks) and OLT (Optical Fibre Network) ports are installed, the block headquarters that houses various administrative departments serving Arain and its affiliated

villages, and Arain's own panchayat building, located around 100 metres from the block headquarters. From here other institutions such as the police station, the primary health care centre, and the land records office are provided horizontal connectivity through BBWT devices.

At the time of fieldwork, none of the organisations were benefiting from horizontal connectivity owing to malfunctioning BBWT devices that were lying unrepaired though they reported using high speed broadband internet during the early days of the pilot project. Instead, these organisations were now dependent on the Rajasthan State's SWAN network also known as RSOne for their daily internet needs for work. Even offices with direct access to the NOFN infrastructure through the ONT devices often reported switching between NOFN and SWAN networks depending on whichever network was providing better speed at a given time.

Horizontal connectivity offices though were solely dependent on the SWAN network given that the BBWT devices had failed rendering the NOFN internet non-existent. The constable in-charge of digitising reports at the Arain block police station said,

“I have been working here since December 2014 and we are required to ensure that all our reports on the website are up to date. I usually work on the RS One network. If that fails, then I make do with the BSNL internet connection. But, I have not used NOFN since a long time. It stopped working and we did not know whom to contact to lodge a complaint so I am really not even aware about the reason why it stopped working.”

Both the block headquarters and the panchayat office in Arain house two Atal Seva Kendras or CSC centres where various e-governance services such as birth and death certificates and Public Distribution System (PDS) cards are issued for a fee. The two Atal Seva Kendras are run by a VLE as part of his e-mitra CSC service and he often acts as an intermediary for technology and internet connectivity related trouble shooting and maintenance. The village council building also houses the Digital Knowledge Centre (DKCs) that was tasked with the mandate of organising various digital literacy programs around social themes such as education, health, agriculture, and provide free internet and computer access to people.

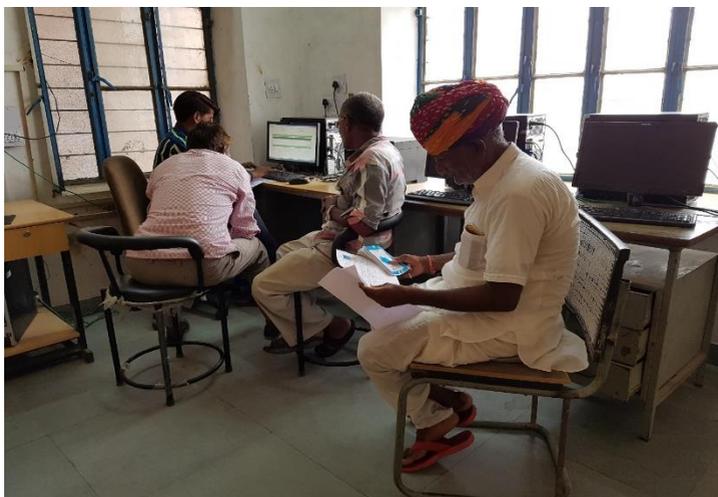


Photo: Preeti Mudliar

Picture 5: VLE resolving ration card duplication at Atal Seva Kendra, Arain

Other than high speed broadband, the panchayat and the block headquarter offices in all three pilot project sites also received hardware equipment such as desktop computers, laser printers and scanners, UPS power back-ups, LED TV screens, and web cameras to facilitate video conferencing. In Arain, video conferencing facilities were regularly used by the staff at the block headquarters for meetings with state and district officials, but not in the panchayats.

Barring the internet infrastructure at these locations, there were no public spaces such as cyber cafes that provided internet or computing access either free of cost or on payment. An exception to this were Pratham telecentres, a NGO working in the field of education that was conducting digital literacy classes for the children in the village. The Pratham telecentre in Arain was a paying client of the NOFN infrastructure for a monthly fee of Rs.7,000 to use WiFi in its telecentres for its classes. Students up to Standard X are allotted a time slot and attend hour long classes at the telecentre every alternate day to use the internet. They also participate in distance education classes that are conducted on Skype on a range of subjects with teachers from various Indian cities. While reliable high speed WiFi was available in the Pratham telecentre, its access was limited to children who were attending Pratham's free classes.



Photo: Preeti Mudliar

Picture 6: A Pratham telecentre in Sironj panchayat, Arain.

Pratham's presence in Arain is an instance of how the NOFN infrastructure can be harnessed by private players for a fee to provide services to people. While Pratham was not charging children for its classes, it does pay BSNL to use the NOFN infrastructure. Similarly, the infrastructure can be opened up to other private players who can then use the backbone to provide commercial internet connections for retail purchase by residents. The presence of NOFN infrastructure in Arain sometimes occasions interest by private players interested in harnessing the internet network to conduct trials for provision of WiFi services. At least two different private, for profit, WiFi solution providers had conducted month-long trials by providing free coupons that allowed users to access WiFi internet within a range of 1 km from their base stations. Since these trials had now lapsed, people in the village were no longer able to access reliable WiFi internet even though many indicated a willingness to pay for usage, if it gave them quick and reliable connectivity.

While SWAN was an option for offices at the block, the panchayats had no recourse to alternative modes of reliable and speedy internet connectivity. Almost all main panchayat offices that the author visited appeared to have a working NOFN connection and

computers, though the UPS systems were lying in a state of disrepair. Computers and internet therefore could not be used during power outages. The internet's utility also depended on the digital literacy of the staff at the office. As in Panisagar, the IT contracts of the DMAs had not been renewed. However, unlike Panisagar, the DMAs were not residents of neighbouring villagers and hence could not be roped in by the panchayats on grounds of reciprocity and goodwill once their contract lapsed. Thus, depending on the panchayat staff and the levels of digital literacy at a panchayat, NOFN use varied.

Even while panchayats were able to access a regular internet connection, the horizontal connectivity given to allied institutions in the village was completely dysfunctional owing to BBWT device issues. At the Dadhiya panchayat, the author found staff from the village's health centre working using the panchayat's WiFi with their office laptop to update their records. They said:

“We have to leave the health centre and come to the panchayat office since there is no internet there. The connection just stopped working one fine day and we have contacted every person whom we thought could get it fixed, but it has been close to eight months now without an internet connection. We wouldn't complain if it were not for the fact that we have to comply with the digitization of data. We are

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

answerable to our supervisors if we don't update the data online and have no option but to leave the health centre and sit at the panchayat every time we need internet. Our work suffers a great deal because of this.”



Photo: Preeti Mudliar

Picture 7: Health centre staff at Dadhiya, Arain using the panchayat's WiFi to update their records in the absence of internet connectivity at the health centre owing to a faulty BBWT device

Personnel

At the Arain block, the staffers in the office would rely on the VLE to resolve issues related to NOFN or SWAN, by getting in touch with the appropriate people – mainly the BSNL staff. As the VLE had business interests that were dependent on the availability of internet (without which he would not be able to provide e-mitra services to citizens), he was usually proactive in resolving issues.

However, the VLE too pointed out that in the face of non-responsiveness from BSNL staff, there was nothing he could do. He said:

“Earlier the JTO (junior technical officer) at Kishangarh exchange was extremely responsive to any issue. The service interruptions would mainly involve fibre cuts and as soon as we would experience downtime here, I would get in touch with him and he would restore the service within a couple of hours. But, ever since his transfer the new JTO is not as responsive and the internet speeds have also become very slow.”

As mentioned earlier, unlike in Panisagar where the DMAs were sometimes a part of the village community and hence continued to help the panchayats to protect their claim on the seat, the responsibility of operating the internet and equipment rested solely with the staff at the panchayat. Also, unlike in Panisagar, where RailTel officials were known to the staff at the panchayat and would visit it regularly, staff at the panchayats were usually unaware about whom they needed to contact to get their connectivity issues resolved.

NOFN awareness in the village community

The three built structures with NOFN connectivity also had password-protected WiFi that was meant to be used by staff

members for official purposes. Given that the block headquarters was staffed by many residents of the village itself, the password to the WiFi network inevitably leaked with the result that almost everyone in Arain in possession of an internet-enabled device can access WiFi in the vicinity of the three buildings. The leakage of the WiFi password into the village often causes a great deal of consternation among the staff at the block headquarters, which is the most popular site among the youth to access internet as it has better speed than the other two WiFi sites. The annoyance of the VLE who finds the already unpredictable speed of the NOFN network speed slowing down considerably and delaying his work is particularly acute. The VLE and the staff members at the block also express helplessness in their inability to change the password due to limited technical knowledge of the working of the optical network device (ONT) that would need to be reset for a new username and password to be entered.

While it is not entirely clear if a single person is responsible for leaking the password, the staff at the block headquarters claim that a former employee who was in charge of overseeing the functioning, maintenance, and repair of the NOFN network in the village was actually responsible for this as his work contract was not renewed.

In a fit of vengefulness owing to the loss of employment, he leaked the password as the end of his term neared. As he is a resident of a place located at considerable distance from Arain, the staff members have no way of getting him to visit the block headquarters and reset the password.

Whatever the conditions in which the password was leaked, the vicinity surrounding the block headquarters at Arain now functions as a public WiFi spot for all practical purposes though with extremely low network speeds. Both the VLE and the youngsters that the author spoke to reported that the VLE who is a well-known resident of Arain often storms out and snatches away the phones of the boys who cluster outside the block headquarters on days when he feels particularly nettled by their visible WiFi access on their phones that causes the network to slow down. He reports that his annoyance peaks during school hours when students sometimes even miss class to access internet on their phones which they carry from home. The school has now begun conducting surprise checks to confiscate mobile phones which have reportedly acted as a deterrent for students carrying phones to school. This awareness and use is however restricted to men and the male youth of the village owing to gender taboos and restrictions for women in freely

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

accessing public spaces, but still points to the demand for internet among the general village community populace of Arain.

Parawada, Andhra Pradesh

Parawada is located around 20 kilometres from Vishakapatnam city in Andhra Pradesh. Spread out over 111.67 sq. km., the block administers 14 gram panchayats and reports population figures of 48,625 out of which 24,440 are males and 24,185 are females. In comparison to predominantly rural Panisagar and Arain, Parawada is more industrialised and its social and economic character can be more accurately described as peri-urban rather than rural, which is its official classification.

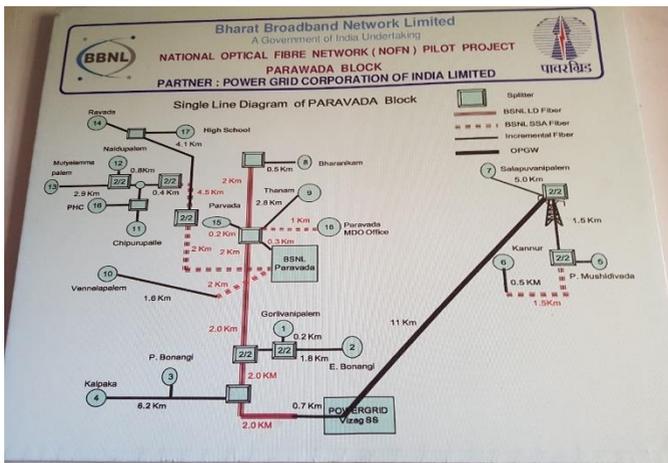


Photo: Preeti Mudliar

Figure 2: OFN connectivity map, Parawada panchayat, Andhra Pradesh.

Parawada is situated in close proximity to many industrial townships such as the PGCIL, the Simhadri National Thermal Power Plant, Vizag Steel, and other institutions of national importance such as the Indian navy's dockyard. Andhra Pradesh State Road Corporation (APSRTC) buses ply regularly to Parawada from Vishakhapatnam and surrounding areas such as Gajuwaka and the block boasts of excellent road connectivity with frequent buses to and from Parawada village. The panchayats affiliated to Parawada also exhibit a peri-urban character and lie on either sides of a busy bypass road that connects National Highway 16.

In July 2016, Andhra Pradesh embarked on a 'smart pulse' survey that involved surveying all households to capture socio-economic data directly in digital form through internet-enabled tabs given to enumerators for the specific purpose and all households were assigned a digital code upon completion of the survey. Most panchayats were busy with the survey and hence fieldwork in Parawada could be conducted for a limited duration of five days with visits to Kannur and Parawada gram panchayats.

NOFN at work in Parawada

Even though Parawada suffered damages during cyclone Hudhud in 2014 that disrupted the NOFN and ICT infrastructure, such as computers and UPS systems, the block has managed to make a recovery with a functional internet connectivity and computer systems at most panchayats. Owing to a robust G2C service layer already in place in Andhra Pradesh that has also been in the forefront of proactively adopting information technology for governance, panchayats in Parawada are familiar with the use of software for record keeping and discharging other official duties and



Photo: Preeti Mudliar

Picture 8: Staff at Parawada panchayat office in a video conference with the staff at Kannuru panchayat.

hence, follow up regularly with BSNL officials in case of disruption of service. Though PGCIL was responsible for executing the project, given that internet connectivity was drawn from BSNL cables, panchayats directly communicate with BSNL officials for any disruptions in internet connectivity and attested to quick response times from the BSNL staff.

At panchayat offices, internet connectivity was a crucial requirement for the daily discharge of work. Unlike Panisagar and Arain, the staff at Parawada were also using tablets supplied by the State government with provision for 3G data cards and WiFi connectivity to collect fingerprints and digital signatures for real time authentication of transfer of funds such as pension and loans. The staff also reported use of the webcam to communicate with staff at other panchayat offices for meetings and were at ease with using the internet. However, similar to other institutions with horizontal connectivity through BBWT devices, institutions in Parawada too were stranded without internet access. For instance, the branch manager of the Andhra Pradesh Grameena Vikas Bank (APGVB) in Parawada village said that they had to carry record books to an internet café in Gajuwaka every evening to update records as the

NOFN horizontal connectivity provided to them in the bank was not functioning.

Personnel

As in the case of their counterparts in Panisagar, the DMAs in Parawada were local residents of their own panchayats and thus continued to report for work hoping for an extension of their contracts, and a desire to maintain good relations with the panchayat members of their village. A striking feature of the NOFN set up in the Parawada that was completely absent in both Panisagar and Arain was the recent appointment of an official by the Andhra Pradesh state government to monitor the NOFN progress and maintenance in Vishakhapatnam district. As the official was appointed less than a month before the field visit, he was still in the process of gathering data on NOFN connectivity. Notwithstanding his newcomer status, he still shared a PowerPoint listing an inventory of devices that were malfunctioning and awaiting repair causing interruptions in internet use. This official cited a busy schedule and was not available for a meeting or an interview leading to limited data being collected from Parawada.

The inherited complexities of infrastructure

In their discussions on infrastructure, Star and Riehler (1996) draw attention to the fact that infrastructures are often embodiments of standards and conventions that reflect the way systems are designed and function. Thus, the challenges that surround the repair, maintenance, and replacement of the infrastructure are as much about the negotiated order surrounding the devices, artefacts, and personnel of the NOFN as it is about the functioning or disuse of the hardware themselves.

Infrastructures rarely sprout out of nowhere. They are overlaid on bases of existing infrastructures, practices, and people inhabiting an existing ecosystem of work practices and infrastructures inherit much of the strengths and limitations of what went on before they began to be built. As a system, the NOFN project joins efforts to create a national network connectivity backbone and work seamlessly and in tandem with the pre-existing infrastructure laid down by earlier initiatives such as SWAN. It thus inherits personnel, norms of practice, advantages, and disadvantages, having a bearing on the way the new system is operated and maintained. The layered complexity of infrastructures also mean that they are never completely fixed at once so even as the NOFN awaits repairs,

replacements, and personnel, in some places, it improvises and makes do with interim fixes such as drawing on local goodwill to persuade contractual staff from working even without a salary, using the SWAN network or data cards from private service providers in lieu of the NOFN internet, and curtailing the kinds of uses (for e.g. video conferencing) the network was put to before the infrastructure started failing

As Star (1999) points out that infrastructure often mean different things locally and are built and grow by increments. They become artefacts that are encountered and learned about, thus giving rise to a community of practice around it. In the case of the NOFN pilots, the community of practice centres around an infrastructure that is looked upon as a constant work of restoration by the community that it is supposed to serve rather than as an infrastructural system facilitating work for the community. Locating the contexts in which the NOFN infrastructure is situated in Panisagar, Arain, and Parawada allows us to see the ways in which the internet functions and is used for work, the disrupts that accompany its break downs, the consequences of delays in its repair, and how the larger village community within which it is located, reacts to its presence.

III. Breakdowns: NOFN as a Visibly Collapsing Infrastructure

This chapter discusses the ways in which the NOFN infrastructure is rife with breakdowns and disruptions that require frequent repair and maintenance in order for it to function. The community of practice that has formed around the NOFN infrastructure, therefore, looks at it as an artefact that is forever a work-in-progress, unreliable, and unstable in its behaviour with an unpredictable temperament. In this aspect, NOFN thus inherits prevailing notions of what governance, implementation, and maintenance of a state-led initiative have been in India. The pilot projects of the NOFN demonstrate that when rural India got on to the internet, little thought was given to what would happen next.

Writing ethnographically on infrastructure, Star (1999) notes that it is commonly accepted that infrastructures are, by definition, invisible. Their rightful place is in the background of things, from where they operate unobtrusively. The inconspicuousness of infrastructure is rendered visible and begins to be most noticeable

only when they break down. Repairs are thus a way of paying attention to infrastructure and nudging them back into invisibility from where they can continue to operate seamlessly.

Walking along the NOFN pilot project trail three years after its implementation is a journey signposted with several signs of the glaring visibility of the NOFN infrastructure. They stand testimony to the many ways in which the project fails to work. Sometimes, the reminders of the service they were once capable of are so glaring in their impotency that special efforts are taken to sweep them under the carpet and out of sight behind closed doors.

Fig. 11 shows the 'NOFN' room at the government school in Bilthai panchayat in Panisagar, which was provided with ICT infrastructure and horizontal NOFN internet connectivity from the panchayat office. Though it was used to conduct remote classes through video conferencing with teachers in Agartala in the early days of the project, the BBWT device soon malfunctioned and was never restored. After futile efforts to get it fixed, the school found no use for the computers without a working internet connection.

On the author's insistence to see the room, the school staff set out to find the key, with a warning that as the room had not be opened for a very long time, it would not be a pretty sight. The picture below was shot immediately after the door was unlocked. The carefully covered computer monitors and the printer, the wall-mounted LCD screen, the UPS power back up, and the NOFN box on the top right corner – all provided to the school as part of the NOFN pilot project – were in a state of disuse, surrounded with bird droppings in a room.



Photo: Preeti Mudliar

Picture 9: The NOFN room at the school in Bilthai panchayat, Panisagar.

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

Nor was Bilthai panchayat the only instance. The government school in Jalabassa, Panisagar too had locked its NOFN infrastructure in a similar room. Moreover, there had been instances of break-ins and theft of computer parts in Jalabassa, highlighting the lack of security that surrounds infrastructure and makes it vulnerable to destruction and theft.



Photo: Preeti Mudliar

Picture 10: Staff at the government school in Jalabassa panchayat, Panisagar, displaying the missing parts of the CPU after a break in.

The next section will categorise the failures of the system, based on evidence gathered during the field study, which has reduced the NOFN pilot to a dysfunctional infrastructure that lies visible, exposed, vulnerable, and in wait for repair. The working of NOFN

three years after the pilots were completed has been marred by the following:

Uncertainty of ownership

One of the foremost reasons for the lack of attention paid to the upkeep and maintenance of the NOFN infrastructure is the uncertainty surrounding the ownership of assets and infrastructure. While the NIC recruited DMAs and tasked them with the responsibility of operating and maintaining the assets, the budget soon ran out and the contracts for the personnel were not renewed. Officials in the Department of Electronics and Information Technology (DEiTY) and NIC who were overseeing the roll out of the pilot say that the Centre was in charge of the implementation and maintenance of the pilots only for a limited period of time and that the State governments should now be required to assume ownership of the project and budget for its functioning themselves.

Though officials of the IT department from every State claim that talks about the taking over the responsibility of the pilot sites from DEiTY and NIC are in an advanced stage, none of the pilot sites have still been handed over to any of the State governments. Given the absence of a clear nodal authority willing to assume

responsibility, the pilot projects find themselves in a situation akin to being orphaned. Hence, it is no surprise that the infrastructure continues to be utilised at a bare minimum.

Malfunctioning devices

Effective membership of the work practice community around the NOFN requires familiarity with devices such as ONT, Optical Line Terminal (OLT), BBWT, and Gigabyte Passive Optical Fibre Network (GPON). Manufactured by C-DOT, these devices repeatedly malfunction and interrupt work. While officials from the executing team from RailTel and BSNL claim that they attend to minor repairs to the ONT device, the BBWT devices are beyond the kind of repair they can perform and can only be replaced. Consistently, across sites, the BBWT devices demonstrate limited functionality with reports that they failed within a few months of installation. Thus, the failure of horizontal connectivity in all of the three pilot sites was a recurrent issue pointing to a manufacturing defect in the BBWT devices that were supplied to the NOFN pilot sites. Replacing these devices or sending them for repairs is again hampered due to uncertainty about ownership and lack of budget to undertake the repairs.

Transfer of personnel

Routine transfer of personnel who can be relied upon to fix issues of repair and maintenance often leads to uncertainty among the staff at the panchayats about whom to call when things go wrong pointing to a lack of awareness and continuity in the chain of command. Barring Panisagar, where the RailTel engineers were in constant touch and readily available for maintenance work and splicing caused by cuts in the optic fibre, staff at Arain and Panisagar reported confusion about whom to report service interruptions to after certain BSNL officials vacated the post in the course of routine departmental transfers. Sometimes, the new occupant of the post would not exhibit the same sense of urgency or response as his predecessor throwing the chain of command into disarray. In the absence of clear delegation of authorities and responsibilities, responsiveness of officials to complaints is often dependent on individual traits of conscientiousness of the official who receives the complaints. While some exhibit urgency and recognise their role in keeping the infrastructure functioning, some others are lackadaisical in the discharge of their duties. This points to a lack of responsibility and accountability among the executing agencies in being responsive to matters of repair and maintenance.

Location change

The NOFN infrastructure plan also does not pay sufficient attention to instances when offices move locations. While ONT devices are installed in a particular building, renovations, demolitions, or damage due to natural and manmade disasters inevitably require moving to new premises. Given the uncertainty surrounding the ownership and with no budget left for the pilot projects, it is unclear who should be responsible to ensure that the devices are moved to the new premises so that the internet connectivity is restored.

The land record office in Arain was one such instance where it moved to a new office building, but was still awaiting the transfer of devices from the old building where it previously had access to NOFN Internet.

Security of equipment

As is evident from the description of a theft in the government school in Jalabassa, earlier in this chapter, security of equipment is a concern. In the instance of the school, the authorities claimed that they did not have the budget to appoint a watchman and hence a simple lock was the only security that they could offer with the hope that it would suffice. While this is not a drawback of the NOFN

infrastructure *per se*, it demonstrates that security of equipment will remain a major concern and sites that house and use NOFN infrastructure may need budgetary assistance in ensuring the safety of the equipment.

The visibility of the NOFN infrastructure as a broken and disruptive order is thus caused by the absence of a clear lack of ownership leading to no funds being allocated for maintenance and for hiring personnel who could be tasked with the operation and supervision of the infrastructure to ensure its functioning.

IV. Conclusions: Infrastructure as a Constant Work in Progress

India's vigorous efforts to haul itself on the internet connectivity grid involves numerous stakeholders who are enthusiastically pitching in to get the 'next billion' users online in various ways. The government has undertaken an ambitious policy initiative of laying optical fibre cables to provide broadband internet connectivity to the country's 2,50,000 gram panchayats as a starting point of onboarding its rural population on to the Internet. In addition to this state initiative, global internet-based companies such as Facebook and Google are highly visible players in their attempts to 'digitally empower' India's unconnected in the rural and urban areas and integrate them into the knowledge economy (Barnuik, 2016; Google Asia Pacific, 2016; Google India Blog, 2016; NOFN Committee Report, 2015; Pichai, 2015).

Even as the government is focused on salvaging the building of an internet highway to its rural population, current internet connectivity initiatives by both Facebook and Google centre on public WiFi hotspots in rural and urban spaces alike. In January

2016, Google in partnership with the Indian Railways and Railtel rolled out the first of its free high-speed WiFi network at Mumbai city's Central railway station with plans to include close to 100 railway stations by the end of the year, making it one of the largest public WiFi projects in India. According to figures released by Google in June 2016, close to 1.5 million Indians were accessing WiFi across 19 railway stations where the project was functional (Google India Blog, 2016).

The usage statistics released by Google reveal that the average consumption per user on the network is almost 15 times the data per day that would have normally been consumed on their mobile cellular network through 3G data packs. Usage patterns also revealed that the per capita consumption of data in Tier 2 cities where reliable access to high speed internet is more challenging, exceeded the data consumption in Tier 1 cities. Users typically accessed infotainment content, but also used the network for job search, education related uses as well as downloading software and apps on their phones (Google India Blog, 2016).

Concurrent to Google's efforts at creating free public WiFi hotspots and supporting digital literacy initiative such as Google India and

Tata Trusts 'Internet Saathi' outreach programmes that focus on providing digital literacy to rural women to allow them to experience the online world, Facebook has partnered with telecom service providers in India to conduct trials for its project called 'Express WiFi' that is being tested at around 125 rural sites across the country though it is unclear exactly where these sites are located. Unlike Google's Railwire, Express WiFi is a paid service that will allow users to purchase WiFi from local service providers (Barnuik, 2016).

In addition to Express WiFi, Facebook is reported to have partnered with state-owned telecom operator BSNL to create 100 WiFi hotspots in rural India (Google Asia Pacific Blog, 2016). BSNL has also been independently rolling out public WiFi hotspots across the country and claims to have 2,489 hotspots across 1,209 locations as a paid service after an initial period of free connectivity. Other public WiFi initiatives in India include both free and paid internet access offered by various players though these are not scaled to or standardized across locations in any meaningful way that would guarantee high speed connectivity similar to Google's public WiFi project (Pahwa, 2016).

Conclusion

Rural India's need and use for the internet is real, both in terms of connectivity to discharge official duties as well as for personal consumption. While officially, various government departments are mandated to digitise their work flow processes as well as comply with online reporting of their records, personal consumption for entertainment, maintaining social connections, and e-commerce all fuel the need for reliable and fast internet connectivity.

Both the government and the private players driven by commercial interests recognise the demand for internet. However, while private players engage in experimenting with wireless means of providing internet that are open to the general public for consumption, the government seeks to invest in time and resource intensive means requiring digging and laying optical fibre cables that will provide functional broadband connectivity to the panchayat offices.

Even while the NOFN struggles to keep up with its deadline of laying the OFC cables and providing panchayats with functional internet connectivity, the policy governing the project would do well to recognise that the laying of cables can hardly be the only measure of the completeness of the project. Infrastructures by their very

nature can never be declared complete because their functionality and continuity needs to be maintained (Graham & Thrift, 2007). Rather than viewing the NOFN as a fixed entity that can be declared as a built initiative with the laying of a cable, it is essential to recognise that infrastructures are inherently dynamic systems requiring constant maintenance and supervision to deliver on their capabilities.

Centring around hardware, devices such as OFC, GPON, ONT, OLT, BBWT comprise the core of how the internet is being delivered to the panchayats under the aegis of the NOFN. Breakdowns and disruptions in these devices require remedial intervention with specialised technical skills that are not easily available in rural India. Thus, while the devices work together to ensure the functioning of the internet, they are not self-correcting artefacts that can recognize and repair the faults in their functioning. As detailed in Chapter 3, with no provisions to ensure continuity of devices and hence internet services, the NOFN infrastructure can never be completely functional without constant work on the parts that contribute to its status as an infrastructure.

In terms of a policy recommendation, this Report advocates that the NOFN project rethink the attributes on which it can be declared as a completed project. In the absence of insufficient or no attention paid to recognise the nature of infrastructure, the NOFN remains neglected in terms of resources of time, money, and personnel to ensure its completeness. The NOFN thus is no different from other infrastructural systems such as roadways, railways, electricity, and other systems of communication and transportation – all of which require constant maintenance and attention to faults and repairs to ensure that they keep running with minimal disruption.

Studying the NOFN pilot sites three years after they were commissioned was an opportunity to observe not just the implementation of the project, but its longevity and sustainability in terms of operation and management. In this, the NOFN pilot projects were found severely wanting and contain lessons that should be scaled for the rest of the project. This report thus primarily questions the ways in which an infrastructural undertaking of this scale can be declared complete when the optic cables laid do not deliver functional utility of any kind owing to frequent breakdowns. The government would do well to pay heed to the numerous studies and evaluations that are now attesting to the

RURAL INDIA ON THE NATIONAL OPTIC FIBRE NETWORK: WHAT HAPPENS NEXT?

shoddy management and implementation that plague the NOFN project especially with regard to repair, maintenance, and personnel to respond to the infrastructure's needs that are necessary to keep it functional

Though renamed to BharatNet, one can only hope that the cosmetic name changes would also carry with them the weight of concrete steps that will strategize and deliver on the infrastructural promises made by the government to its people as a pathway to a better life.

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