



# 1 World Connected

Data-driven Research to Bring Billions Online

## POLICY OPTIONS FOR CONNECTING AND ENABLING THE NEXT BILLION – PHASE III

### CONTRIBUTION BY 1 WORLD CONNECTED

*1 World Connected is a data-driven research project based out of the University of Pennsylvania's Center for Technology, Innovation and Competition. The project catalogs and compile case studies of innovative approaches to connect the unconnected, focusing both on interventions that address supply-side as well as demand-side challenges.*

*In this submission to Policy Options to Connecting and Enabling the Next Billions (Phase III), we submit some of our initial case studies that contribute to each of the three SDGs that form the focus of this year's intersessional work.*

#### **Goal 4: Ensure inclusive and quality education for all and promote lifelong learning**

##### **Case 1: Internet@MySchool, Yemen**

Internet@MySchool is an initiative by ISOC Yemen that seeks to set up Internet access hotspots and provide training in ICT skills through workshops and lectures to secondary school students, as well as by commissioning training materials in the local language (Arabic) in four schools in Sanaa and Aden in Yemen.

Internet@MySchool proposes a two-pronged approach to improve adoption and educational outcomes: first, to connect four schools to the internet through wireless hotspots, and second, to train secondary school students through workshops, lectures, and material in the local language. ISOC-Yemen has received a grant under the Beyond the Net grants program for the deployment of Internet@MySchool in 2016-17. The project identified schools in areas relatively shielded from the conflict to deploy wireless hotspots.

The chapter seeks to introduce an Arabic-language illustrative primer for secondary school students who have never been exposed to the Internet before. Multiple workshops, and guest lectures to train students in information and communications technologies, along with contests to engage the students and measure their progress in adopting to the Internet are used to improve adoption. The project culminated with the first ever Internet@MySchool conference, conducted in July 2017.

### **Case 2: Project Tawasol, Tunisia**

Project Tawasol is a project in Tunisia led by IEEE Sight, Tunisia chapter and People Centered Internet. The aim of the project is to connect primary schools across the country to the Internet, and train students to use the Internet through ICT skills workshops conducted by IEEE.

The project seeks to provide students small Raspberry Pi operated devices with hard disks that can be updated periodically with relevant content such as Wikipedia pages, TED Talks and other educational content from the Internet. The devices have been developed by IEEE Sight in Tunisia with aid from the San Francisco chapter. They are capable of automatically updating content when connected to Wi-Fi or 3G networks.

In December 2016, the Sadiki school in Tunis was identified as the first “Connected School” for the dissemination of these devices coupled with digital literacy training workshops by members of IEEE Sight. With support from the government, the project aims to connect, by the end of 2017, 24 such schools – one school in each region within Tunisia. The project focuses on primary schools, with an aim to make the next generation aware of new technologies and information that can be accessed through the Internet.

As part of the project, technical talks and digital literacy as well as ICT training workshops are organized by IEEE Sight, Tunisia. These talks cover interactive sessions that teach students how to build their own websites using drag and drop interfaces. The first workshop conducted in 2016 had a 50% participation by women, a key step in enabling gender parity in Internet access and skills.

In digital literacy training workshops that have been conducted by IEEE Sight, students have built their own prototype websites such as a school blog using HTML, CSS and modular

website building interfaces. The reactions in post-workshop surveys conducted thus far have been tremendously positive. “Most students asked us when we will return to provide them with their own devices for development,” says Skander Mansouri, one of the IEEE Sight members that conducted these training workshops.

### **Case 3: Escuela+, Latin America**

Escuela+ is a program that uses satellite technology and solar-powered infrastructure on the ground combined with innovative educational programming to connect rural schools in Latin America that do not have any Internet access to high quality educational content. The program, active since 2007, has reached over 1 million students, 65,000 teachers, and 6,800 schools in eight countries in Latin America including Colombia, Chile, Brazil and Argentina. It is supported by a broad coalition of organizations, including AT&T, DirecTV, National Geographic, Discovery and Fundacion Torneos.

ESCUELA+ uses last mile satellite connectivity to provide educational content from high quality sources such as the Discovery channel and National Geographic, as well as the National Television Council’s educational content, to students in rural schools. The satellite connectivity provides access to this programming in any school with TV and electrical power. Where such electrical power was not easily accessible, solar-powered alternatives are being deployed to make streamed educational content easily available to school-going children in rural areas, as part of ESCUELA+ Solar initiative. DirecTV’s DVR recording facility allows teachers to manage content and record over 100 hours of programming, and use this content as part of a pedagogy that integrates interactive and integrated learning supplemented by online information.

Teachers are trained in the use of ESCUELA+ audio/visual technology, as well as the *Discovery en la ESCUELA* pedagogy. Using media, technology and digital satellite television, learning processes are tailored to incorporate an innovative teaching methodology in these schools.

Over 80% of ESCUELA+ schools are in underserved areas. Independent evaluation studies conducted by the University of Chile Department of Education and by the Faculty of Social

Sciences in two waves concluded that students receiving education supplemented by ESCUELA+ methodology performed consistently better than a control group. ESCUELA+ students registered higher performance scores analyzed by year-on-year performance, grade level and subject matter.

#### **Case 4: Digital Village Squares, India**

Digital Village Squares is an Indian corporate social responsibility initiative implemented by American Tower Corporation in collaboration with the NIIT Foundation and Hole in the Wall Education Limited (HiWEL). HiWEL learning stations and digital literacy training classes by the NIIT Foundation are now available at 51 Squares in rural India. Students can engage in self-paced interactive learning through the learning stations, and adults are trained in basic computer skills using the National Digital Literacy Mission's curriculum at these locations.

Digital Village Squares are locations in rural India that are either adjoining tower sites or at local schools, where digital literacy training occurs. The initiative is part of American Tower Corporation's corporate social responsibility efforts in India, and seeks to advance the Digital India vision. American Tower partners with Hole-in-the-Wall Education Limited and the NIIT Foundation in India to implement this initiative.

The sites for Digital Village Squares are carefully chosen in locations that are central to villages. After a pilot was run in a few villages, community buy-in proved to be a strong determinant of the success of the program. A comprehensive mobilization plan is therefore used to create awareness about the training and services offered at the center. Pamphlets, skits, and sessions at the *Gram Sabhas* are held to reach as many people as possible. Children enrolled in schools have also proven to be helpful in spreading awareness about the project within their communities. The trainers recruited for imparting digital literacy training are all local to the areas where these Squares are located.

A sense of ownership also plays a role in whether there is increased use of these learning stations and classes. When learning stations were installed adjacent to tower sites, initially, there was more engagement at those locations than in schools. Continued engagement with school administrations to emphasize the utility of these learning stations has led to better uptake and use. At the training classes, the National Digital Literacy Mission's curriculum is

taught over the course of 20-25 days, at the end of which an assessment of ICT skills is administered by the trainer.

The program hopes to evolve to cover a wide range of e-governance services and engage local entrepreneurs in key ways to maintain these sites, as a means to enhance long-term sustainability.

Digital Village Squares are presently available in 51 sites all in rural areas, with 28 that are standalone HiWEL stations, and 23 that offer digital literacy training using the National Digital Literacy Mission's curriculum. The demand for training has seen a rise in these locations, evidenced by long queues for classes at the Squares.

#### **Case 5: Zaya Learning Lab, India**

Zaya Learning Lab is a non-profit organization established in 2013 to provide Wi-Fi access to low-income English-language schools in India. Their unique learning-focused connectivity devices provide Internet access and educational content at a much lower cost than a regular, open-Internet Wi-Fi connection. This case shows the value of tailoring connectivity to the needs of a specific site (region, culture, class, institution) and the importance of technical and person-to-person communication in making Internet access an effective tool for education.

Zaya Learning Labs provides affordable Wi-Fi to low-income Indian schools via a curated secured dynamic device called ClassCloud. This device is both a wireless router and a high-process server. It functions like any cloud service on the Internet, provides a wide-range WiFi signal, and runs software all at once. For a yearly fee (roughly the cost of one dollar per year per child, in their estimation), Zaya provides interactive and region-appropriate digital content through this device.

This content is based on an educational methodology known as "blended learning," which harnesses the capabilities of an online classroom in order target students' individual requirements, educational levels, and learning speeds. Not only is the software able to dynamically respond to each student's progress through a digitized workbook or textbook,

but this software is also programmed to communicate student struggles and successes to Zaya and their content providers, who use these analytics to refine and improve their tools.

Zaya currently has 400 schools spread throughout India subscribing yearly to their service, which reaches about 200,000 children between the ages of five and thirteen. They are currently working on expanding the age range of their software content to fifteen and continuing to subscribe additional schools—in and outside of India—to their service.

### **Case 6: Cisco Connected North**

Beginning in the 2013-2014 academic year, Cisco Canada's "Connected North" initiative aimed to augment educational and healthcare services available to youth in remote indigenous communities in Northern Canada. Deploying Cisco's Telepresence technology (MX 300 G2) to offer real-time, live interactive experiences with experts and students in other classrooms around Canada, the project has grown from a single pilot location to implementation in 30 schools. Within five years, Connected North expects to have Telepresence units in 100 schools. Connected North is indicative of the utility of immersive, interactive internet learning for students in remote regions to combat endemic local social issues (e.g. a graduation rate of approximately 20%; highest global per capita suicide rate among youth) whose expansion, while desperately needed, is curtailed by cost/funding concerns.

Connected North is an immersive, digital education and mental health and wellness network that provides customized services and real time experiences to students in remote Indigenous communities. Begun as a pilot in a single school in the Territory of Nunavut, the project has greatly expanded since 2013. Using Cisco TelePresence technology, Connected North leverages real-time, high definition two-way video to make powerful connections for students, bringing experts into JK - Grade 12 classrooms on a wide range of topics. There are five overarching content areas that Connected North focuses on – virtual fieldtrips, mentoring, experts on demand in a vast array of subject areas, classroom cultural exchanges (both between indigenous and non-indigenous student populations and indigenous to indigenous classrooms), and programming called "Future Pathways" which aims to help students attend post-secondary institutions as well as make them aware of career paths that are available to them.

In terms of content, 90% is indigenous-themed. Connected North staffers work hand-in-hand with teachers for content-offerings and work to reinforce indigenous cultural educational styles, such as emphasis in Inuit schools on collaborative learning.

In smaller schools, Telepresence setups are put in common areas so all classes may use them as needed. In larger schools, each intermediate classroom (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grades) has a unit. Cisco sells these units for \$30,000 Canadian, however, they offer a seventy percent discount to Canadian school districts, bringing the cost down to approximately \$9,000 Canadian. Due to the program's success, Cisco spun-off Connected North into a non-profit organization, which partnered with Taking IT Global. This latter organization has constructed an ecosystem of over 50 funding partners including Federal, Provincial, and Territorial governments, private sector lenders, private foundations, and individual donors.

The impetus and continued support for Connected North comes from two tragic statistics of Canadian indigenous youth; the dropout rate is approximately 80% and these communities have the highest rates of youth suicide per capita in the world. Combatting these systemic problems required more than just educational resources. The second facet of Connected North was to provide students with access to remote mental health and wellness professionals that would traditionally require great travel expense for the students' families and were thus generally unavailable.

#### **Goal 5: Achieve gender equality and empower all women and girls**

##### **Case 1: SheWillConnect, Kenya, Nigeria, and South Africa**

The Intel She Will Connect Africa program is an initiative that uses a combination of digital literacy training, development of gender-relevant content, and the creation of an online peer network to help bridge the gender gap in Internet access. The program has trained upwards of 150,000 women in Nigeria, South Africa, and Kenya in face-to-face trainings conducted by the program's partner organizations since its launch in 2013.

Launched in 2013, Intel adopted a three-pronged approach to fast track the uptake of information and communication technologies by citizens. It used Intel Learn Easy Steps™

modules to teach women who had no skills in using technology to use the Internet for the first time. The modules were tailored to be interactive and based on completion of tasks, so that women could gradually progress to completing complex tasks online. They started with basic lessons on what computers do and with the help of activity cards, progressed to teaching women how to create a resume online and how to use email and search functionalities.

Intel partnered with multiple organizations at the local level in order to provide this training to women in community centers – prominent organizations include CARE, ChangeCorp, Telecentre.org, World Pulse, and World Vision. The modules were provided for free to organizations willing to engage in training women. Training for trainers was organized by Intel.

Intel created an application that supports an online peer network to allow women to share common interests and find mentors. This aspect of the initiative, rolled out in collaboration with World Pulse, allowed users to search for and find relevant user-generated content in safe online spaces. It enabled users to create communities online and reap the benefits of connectivity many fold. The application is also available for free through a collaboration with Free Basics in Africa, enabling greater impact.

Recently, Intel launched My Digital Journey, an application that adopts an interactive approach to digital literacy training. Learners on My Digital Journey receive a digital completion certificate after successfully completing three quests, each of which involves completing three to six missions.

In addition, SheWillConnect also offers a mobile skills application that women and girls can use to receive training on their own personal devices.

### **Case 2: ICT for Girls, Pakistan**

The Universal Service Fund in Pakistan has several specifically focused special projects. ICT for Girls is a program that seeks to empower women from marginalized communities through training in digital literacy and Internet and communication technologies. So far, they have set up 50 centers that serve 4,000 women. There are also sites set up in Punjab, Khyber Pakhtunkhwa, and Sindh aimed to help users with disabilities.



**Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation**

**Case 1: Conectedos Hogares, Costa Rica**

The Connected Homes Program is a public-private partnership in Costa Rica that seeks to subsidize Internet access and computer equipment for 14,000 vulnerable households by 2018. Initiated by the Presidential Social Council of Costa Rica in 2015, the program aims to reduce poverty and inequality for 15% of Costa Rica's overall population and promote economic growth through creation of new jobs over the course of the next six years.

The Connected Homes program is an initiative that brings together different state institutions, including the Vice Presidency, the Rector and Regulator for Telecommunication. It is implemented by telecommunication companies and supported by NGOs, and is part of the "Bridge to Development Strategy" of the country. The Universal Service Fund provides the financial support for the subsidy. The telecommunications service providers provide both the Internet service as well as the computer resources and software licenses, engage in program promotion, as well as provide the requisite e-government applications and digital literacy training.

The government determines eligible households using criteria such as whether the household is at or below poverty level, as well as whether they belong to groups in the fourth and fifth deciles of income but have specific social needs to include the indigenous, differently abled, female-headed households and self-employed. It provides three levels of subsidy at 80%, 60% and 40% depending on their income and special needs, using the ratio of household income to the cost of internet service and a basic to determine subsidy amounts.

The program, which officially started disbursing subsidies in June 2016, will invest US\$ 128 million over the course of five years. The subsidy lasts three years, and covers the cost of a basic computer and an Internet service at 2 Mbps. FONATEL, the universal service fund, covers both the cost of the subsidy as well as the service.

The main goal of the Connected Homes program is to combat poverty and inequity, and promote job creation and economic growth through increasing access to information technology in vulnerable groups. The objective is to provide up to 80% of subsidy for

computer and broadband to almost 150,000 low income families, around 15% of Costa Rica homes.

### **Case 2: Nepal Wireless Networking Project, Nepal**

Nepal Wireless Networking Project is a social enterprise that provides connectivity to villages in Nepal through community Wi-Fi projects. Since 2001, it has connected over 200 rural hamlets in Nepal to the Internet. In late 2015, the team helped connect 12 villages in earthquake-affected areas and is presently pioneering an effort known as ‘Smart Village’ to provide the various benefits of connectivity such as easy access to online education, government services, health services and smart trekking routes to these communities. Nepal Wireless is implementing pilot project for the deployment of a community based hybrid wireless network using TV White Space and Wi-Fi spectrum in remote valleys around Manaslu Himalaya and Dhaulagiri Himalaya region in 2016.

The project started as an effort to bring a telephone line and an Internet connection to the Himachal Higher Secondary School in the Mygadi district of Nepal in 1996. After overcoming an environment of political strife, stringent government regulations, as well as technical challenges and financial constraints, the first project was completed in 2002. The project’s locations – mostly rural and isolated areas – are often inhabited by indigenous people who are subsistence farmers. There are many marginalized or socially disadvantaged groups living in these isolated villages of the Himalayan regions of Nepal.

By 2008, Internet connections had been provided to community centers, schools and clinics in 42 villages, with plans to expand to at least 19 more. In 2016, over 200 such villages have been connected to the Internet and had access to a whole host of services including telemedicine, online education, and online banking services.

The Nepal Wireless Project uses 2.4 GHz and 5.8 GHz frequencies to connect the villages, relay stations and base stations. Most of the network backbone is connected using Motorola Canopy radios at 5.8 GHz due to high reliability and to avoid signal interference. Last-mile connectivity uses wireless Ethernet (802.11b/g standard) radios at 2.4 GHz, which is cheaper and compatible across various manufacturers. In Mygadi, for instance, the system has two relay stations to forward the wireless signal to a base station and Linux server facility in

Pokhara, the nearest city with Internet access, with a connection to a hospital in the city. Users at the school use Internet on desktop computers and laptops.

The Internet connectivity is used to provide teaching and telemedicine services to the villagers. While dependent on the distance of a village from the relay and base stations, most connections provide a minimum bandwidth of 1 MBp/s in the local network, which allows for video conferencing facilities. At the telemedicine clinics, doctors use a network camera that can be controlled remotely.

The project charges a service fee to rural communication centers to ensure sustainability and cover the operating and maintenance costs of the network. The management structure allows community organizations to make their own decisions to run their communication centers and the system is deployed with active participation from local governments and youth from the communities.

The Nepal Wireless Networking project has connected 200 hamlets in remote, rural and mountainous areas in Nepal – the populations in each of these villages vary from a few hundreds to a few thousands. This connectivity provides villagers with vital information for trading their produce in local markets. Many villages now provide online bookings in trekking areas for tourists. Nepal Wireless has established a mechanism for online money transfers through different local agencies in rural areas, which benefits tourists and mountaineers.

There are also educational and health benefits that stem from providing connectivity to these rural hamlets. Telemedicine services at eight rural clinics now connect patients in remote villages with Kathmandu Model Hospital, Skin Hospital, and Pokhara Om Hospital for expert care. Teleteaching provides children in rural schools with multimedia educational content on the Internet.

Nepal Wireless has also partnered with several international organizations and has established weather stations for real time weather monitoring to assess the impacts of climate change over a long period.

### **Case 3: Sarantaporo.gr, Greece**

Sarantaporo.gr is a non-profit organization that aims to revitalize communities by providing Internet connectivity and technology education in rural Greece. Officially established in 2013, the organization has grown from connecting the mountain village of Sarantaporo to providing high-speed Wi-Fi to residents, organizations, and visitors in fifteen different villages in the region. With volunteer labor, grants, and a longstanding partnership with TEI University, Sarantaporo works to help villagers incorporate connectivity into their daily lives. Conceiving of the Internet as a commons, the organization endeavors to foster community-oriented mindsets in order to ensure the sustainability of the networks. This case highlights the importance of active community participation and investment in implementing and maintaining Internet connectivity and infrastructure in small towns.

In 2010, a small group of young people who had grown up in the village of Sarantaporo decided to help their village connect to the Internet. With no experience in IT or telecommunications, they reached out to open-source connectivity communities and applied to a local Greek foundation offering grants for hardware. They were successful and installed the first mesh routers in their local village, providing free local connectivity for the first time. Word spread and the project expanded to fourteen other villages in the surrounding region. Several volunteers with no connection to the villages joined the project out of a sense of social reasonability and outreach. Through this expanded demand for Internet connectivity in previously underserved areas, the group could secure a 90,000 Euro grant to solidify the network in 2014, interconnecting all the villages, and partnering with TEI University (60 km away) for free bandwidth.

Today, the project maintains its operations with low overhead from an all-volunteer staff, financial donations from private citizens and the communities themselves, and grants from organizations such as CONFINE (a European FP7 project), The People's Trust, and the Greek Free Open-Source Software Society. They aim to provide improved quality of life and social cohesion to inhabitants of rural areas that have suffered from increased isolation due to economic crises and ongoing digitization in metropolitan areas.

#### **Case 4: Tucan 3G, Peru**

TUCAN3G is a largely European-funded research organization that has worked since 2009 to provide 3G mobile voice and data access and infrastructure to isolated areas of Latin America. The organization's focus is on providing sustainable low-cost ITT solutions to improve quality of life and life expectancy in rural communities. With a focus on healthcare, TUCAN3G aims to connect underserved populations in developing countries with the medical resources of urban hospitals and treatment centers via telemedicine.

In its early instantiation, TUCAN3G deployed its 3G femtocell and WiLD (WiFi for Long Distances) technologies in order to provide single-access points for rural Latin American villages to connect to urban medical centers. These access points were by and large centered in regional government outposts and meant for widespread community use.

In recent years, a TUCAN3G project in the Napo River basin in the Peruvian Amazon has begun partnering with telecom companies to enhance the sustainability of its networks. The Napo network is additionally significant in that it is experimenting with shifting TUCAN3G's emphasis from providing telecom access to regional government outposts to connecting entire communities.

The link between sustainability and community is key: by facilitating relationships between large mobile service providers and smaller regional ones, the project is hoping to incentivize the continued participation of telecom corporations that have ignored these sparsely populated, low-income areas. By growing the user base, TUCAN3G aims to make the rural network a worthwhile interest for urban-centric corporate profitability and thus maintain connectivity in these underserved communities.

#### **Case 5: Open Wireless Network of Slovenia, Slovenia**

Since 2006, WLAN Slovenija has been working on a community wireless network to provide open and free access to the Internet across Slovenia. As of 2017, over 400 wireless nodes are active with over 2 million non-unique usages. Originally started in the Ljubljana region of Slovenia, WLAN Slovenija now extends beyond the country's borders and into Croatia and Austria. Costs are low because the system relies on common technologies already in use, though there has been private support. Users join on a voluntary basis and each individually

adds value to the overall network by increasing its reach. WLAN Slovenija is an example of building a community wireless network that is a symbiosis of accessibility needs and a shared interest in propagating the network that has the potential to be hindered by uneven retention, unfriendly or indifferent governmental/legal restrictions, and a too localized model.

WLAN Slovenija is an open-source and free community wireless network that has been active since 2009. WLAN Slovenija, like many other community wireless networks, repurposes widely used technologies (e.g. commercially available routers) and capitalizes on fiber-optic internet capabilities of urban centers to make the network function. By finding redundant capabilities within the existent networks (e.g. bandwidth users are paying for but not using), WLAN Slovenija provides individuals with reciprocal use ability. Users consent to allow for their bandwidth to be shared and then link to a larger antenna which broadcasts their “unused” internet. In this way, users are able use their own internet at home, have connectivity for guests, and “borrow” from another participant in the network when they are mobile. Beginning with the cities, WLAN Slovenija has moved into rural areas as well to meet demand. Awareness of the project generally travels by word of mouth.

While the initial genesis of the network demanded expertise, WLAN Slovenija has made the end-user process as frictionless as possible. Originally there were DIY instructions for interested participants to repurpose their in-home modems, however, users asked for already-made versions and WLAN Slovenija provided these by mail. From the outset, WLAN Slovenija has fostered a community that is linked by its desire to see the whole country have access to network.

WLAN Slovenija has minimal overall costs, though they have received some private and grant funding, and relies on voluntary participation and expertise.