1 World Connected

Data-driven Research to Bring Billions Online

Regional Brief: Africa

Africa – home to 1.04 billion people – remains the least connected to the Internet among all regions in the world today. Only 23.4 percent of households are Internet users, compared to 59 percent in Asia, and 85.4 percent in continental Europe[1]. Internet usage rates range from more than 60 per cent in the region's more developed countries, to less than 10 per cent in the region's least developed countries[2]. Bridging the digital divide in Africa is thus a key priority, especially during the COVID-19 pandemic – digital infrastructure can provide businesses, governments, and people a critical lifeline, and build the foundations of a resilient and robust economic recovery.

This regional brief provides a snapshot of projects seeking to improve broadband adoption in the Africa region. Based on our projects database containing 1090 projects in 152 countries and 119 in-depth case studies from 50 countries, the regional brief provides key insight into the regional distribution of the such initiatives, who deploys them, their funding sources, and their business models. Summary statistics of the overall database and case studies are provided in Table 1.

Table 1: Summary Statistics of Database and Profiled Case Studies – Africa vs. Global

	Overall Database				**Case Studies**			
	Africa		*Total*		*Africa*		*Total*	
	#	%	#	%	#	%	#	%
Overall Number	399	36.61%	**1090**	**100.00%**	50	42.02%	**119**	**100.00%**
Focus								
Demand	262	65.66%	629	57.71%	35	70.00%	69	57.98%
Supply	97	24.31%	383	35.14%	11	22.00%	42	35.29%
Both	40	10.03%	78	7.16%	4	8.00%	8	6.72%
Stakeholders								
Civil Society: NGO	177	44.36%	440	40.37%	22	44.00%	38	31.93%
Private Sector	134	33.58%	340	31.19%	20	40.00%	44	36.97%
Civil Society: Volunteer-led	36	9.02%	121	11.10%	5	10.00%	22	18.49%
Civil Society: Academia	27	6.77%	70	6.42%	1	2.00%	3	2.52%
Government	21	5.26%	109	10.00%	2	4.00%	12	10.08%
Civil Society: IGO	2	0.50%	6	0.55%	0	0.00%	0	0.00%
Multistakeholder Partnership	2	0.50%	4	0.37%	0	0.00%	0	0.00%
Domain								
Education	118	29.57%	314	28.81%	15	30.00%	36	30.25%
Health	91	22.81%	161	14.77%	7	14.00%	14	11.76%

[1] International Telecommunications Union, 2020
[2] Ibid

Community Network	47	11.78%	203	18.62%	6	12.00%	23	19.33%
Financial Inclusion	43	10.78%	68	6.24%	6	12.00%	7	5.88%
Agriculture	33	8.27%	66	6.06%	6	12.00%	10	8.40%
Commercial Deployment	29	7.27%	162	14.86%	6	12.00%	21	17.65%
Gender	20	5.01%	61	5.60%	0	0.00%	0	0.00%
E-Government	10	2.51%	41	3.76%	2	4.00%	5	4.20%
Accessibility	7	1.75%	11	1.01%	0	0.00%	0	0.00%
Local Content	1	0.25%	3	0.28%	2	4.00%	3	2.52%

Our data suggest an increased focus on innovative connectivity approaches in Africa compared to other regions. As noted above, Africa has the most initiatives in the overall database as well as among profiled case studies.

Initiatives addressing demand-side challenges – such as the lack of digital skills, local content – are predominant in both the overall database and in our case studies. The statistics for demand-side initiatives from Africa are slightly higher – both as a share of the overall database (66 percent) and of profiled case studies (70 percent) – compared to the total (58 percent of all initiatives; 58 percent of profiled case studies)

The greatest number of initiatives are run by non-governmental organizations, followed by the private sector, in both the overall database and among case studies, in Africa and globally. The share of African initiatives run by civil society organizations is slightly higher than the global distribution – 70 percent of all initiatives are run by civil society organizations, compared to 58 percent globally.

Initiatives focused on education – both in school and out-of-school – were the highest share of initiatives both in the overall database, and among profiled case studies. The statistics for Africa as a share of the overall total were similar in both the overall database and among profiled cases (30 percent in both). Interestingly, within the overall database, Africa had a larger share of community networks compared to commercial deployments (12 percent) compared to commercial deployments (7 percent), and the share of both domains for Africa was lower than the corresponding global share. This suggests the presence of more community-led networks than commercial deployments in our overall database, both globally and in Africa, focused on last-mile connectivity. The share of commercial deployments and community networks within the profiled cases are slightly higher than the share in the overall database. The African case studies profile an equal number of commercial deployments and community networks (12 percent each).

The remainder of the analysis primarily focuses on the profiled case studies (119 in number)

Regional distribution

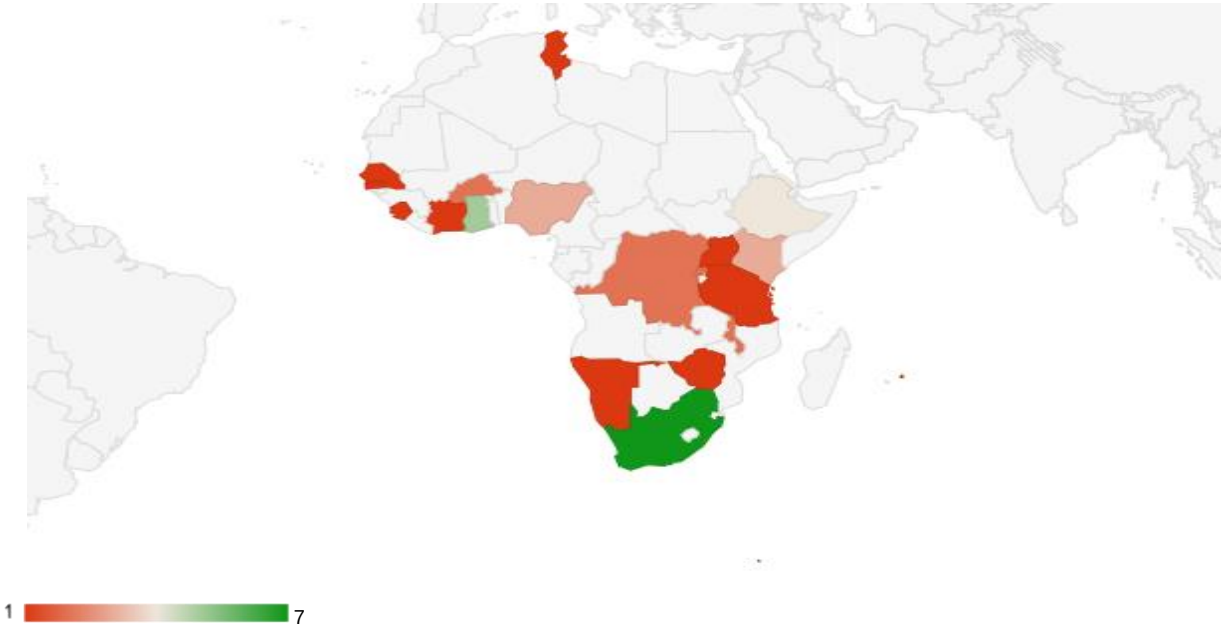
1 World Connected has analyzed 119 case studies (globally) and of these 50 were from Africa. Of the 50 African initiatives, 33% are in West Africa and 31% in East Africa. Southern Africa also

has a significant number (28%) of the profiled initiatives while Central Africa and North Africa only account for 4% each.

Among our profiled case studies, a few countries seem to have the highest concentration of initiatives. Our data show that countries with higher levels of penetration have more initiatives. The top five countries in Africa with concentration of initiatives are as follows: South Africa (11%), Kenya (11%), Nigeria (8%), Uganda (7%), and Tanzania (6%).

The country-based distribution is provided in Figure 1.

Figure 1: Regional Distribution of 1 World Connected Case Studies in Africa



Focus of Different Stakeholders

Our data show that different stakeholder groups focus on different types of initiatives, among our profiled case studies. Civil society groups were most involved in activities focused on addressing demand-side challenges, both in Africa and among all other regions. However, the private sector, traditionally strong on addressing supply-side challenges, has fewer case studies in Africa, compared to those in other regions. There are few government-led initiatives amongst our case studies, both in Africa and overall, focused on last-mile connectivity. Finally, our data show that there are several volunteer-led community-driven initiatives on the supply side that are taking root across our case studies, although the proportion of the same in Africa remains comparably low. Table 2 summarises our case studies by stakeholder group and the type of initiative they focus on primarily (demand-side challenges, supply-side challenges, or both.

Table 2: Initiatives by stakeholder group, categorized by focus

Stakeholder Group	Demand				Supply				Both			
	Africa		*Total*		*Africa*		*Total*		*Africa*		*Total*	
	#	%	#	%	#	%	#	%	#	%	#	%
Civil Society: NGO	17	14.29%	30	25.21%	2	1.68%	4	3.36%	3	2.52%	4	3.36%
Private Sector	14	11.76%	25	21.01%	5	4.20%	18	15.13%	1	0.84%	1	0.84%
Government	2	1.68%	9	7.56%	0	0.00%	1	0.84%	0	0.00%	2	1.68%
Civil Society: Volunteer-led	1	0.84%	4	3.36%	4	3.36%	17	14.29%	0	0.00%	1	0.84%
Civil Society: Academia	1	0.84%	1	0.84%	0	0.00%	2	1.68%	0	0.00%		0.00%
Grand Total	**35**	**29.41%**	**69**	**57.98%**	**11**	**9.24%**	**42**	**35.29%**	**4**	**3.36%**	**8**	**6.72%**

Location and Scale

Our data also suggest that most last-mile connectivity initiatives in our profiled case studies, both in Africa and globally, are at the national level. Africa has fewer regional supply-side initiatives than across all 119 cases, although region demand-side cases remain comparable. Africa also has the presence of several International NGOs implementing demand-side initiatives on digital skills; none on the supply-side though. The proportion of local initiatives focused on both supply-side and demand-side challenges profiled from Africa are comparable to their proportion in the overall database. Most supply-side initiatives in Africa only scale at local level, with very few regional level case studies.

Table 3: Scale of Projects by Focus

Scale	Demand				Supply				Both			
	Africa		Total		Africa		Total		Africa		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
National	15	30.00%	32	26.89%	1	2.00%	8	6.72%	1	2.00%	3	2.52%
Local	8	16.00%	11	9.24%	9	18.00%	24	20.17%	3	6.00%	4	3.36%
International	6	12.00%	11	9.24%	0	0.00%	1	0.84%	0	0.00%	0	0.00%
Regional	6	12.00%	15	12.61%	1	2.00%	9	7.56%	0	0.00%	1	0.84%
Grand Total	**35**	**70.00%**	**69**	**57.98%**	**11**	**22.00%**	**42**	**35.29%**	**4**	**8.00%**	**8**	**6.72%**

Economic Model

In terms of the whether initiatives have revenue models, 44 percent of the demand-side initiatives in Africa had no revenue generating model, compared to 38.66 percent in the overall database. On the supply side, 12 percent of initiatives in Africa had a revenue model, compared to 25 percent in the overall database. Overall, while 25 initiatives of the 42 supply side case studies have a revenue model, over half of the 11 case studies do.

Table 4: Projects by Revenue Model

Revenue Model	Demand				Supply				Both			
	Africa		Total		Africa		Total		Africa		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
No	22	44.00%	46	38.66%	5	10.00%	17	14.29%	3	6.00%	7	5.88%
Yes	13	26.00%	23	19.33%	6	12.00%	25	21.01%	1	2.00%	1	0.84%
Grand Total	**35**	**70.00%**	**69**	**57.98%**	**11**	**22.00%**	**42**	**35.29%**	**4**	**8.00%**	**8**	**6.72%**

Table 5 provides a summary of all African case studies in our database. The next section provides a summary of each of them. All the case studies can be accessed online at 1worldconnected.org

Table 5: Projects in Africa

Domain	***Project***	***Country***	***Stakeholder group***	***Scale***
Agriculture	African Women Power Network	Nigeria	Civil Society: NGO	Regional
	ESOKO	Various	Private Sector	International
	Farmerline	Ghana	Civil Society: NGO	International
	Farmradio	Ethiopia	Civil Society: NGO	International
	Jaguza	Uganda	Private Sector	Regional
	Muchoes Mangoes	Kenya	Civil Society: NGO	National
	Tambero	Various	Private Sector	International
Commercial Deployments	Li-Fi LED	Ivory Coast	Private Sector	Local
	Vanu Rwanda	Rwanda	Private Sector	Regional
	Vision Net	Democratic Republic of Congo	Private Sector	
Community Networks	Johannesburg WUG	South Africa	Civil Society: Volunteer-led	Local
	Pamoja Net	Democratic Republic of Congo	Civil Society: NGO	Local
	Project Isizwe	South Africa	Civil Society: NGO	Local
	Soweto Wireless	South Africa	Civil Society: Volunteer-led	Local
	TunapandaNet	Kenya	Civil Society: Volunteer-led	Local
	Zenzeleni Networks	South Africa	Civil Society: Volunteer-led	Local
	e-Daara Thieyetou	Senegal	Civil Society: NGO	Local
	Ghana Code Club	Ghana	Civil Society: NGO	Local

Education: In-School	Give1Project	Gambia	Civil Society: NGO	Local
	Informal Sector Business Institute	Kenya	Civil Society: Academia	Local
	Maendeleo Foundation	Uganda	Civil Society: NGO	National
	Nyirarukobwa Primary School	Rwanda	Civil Society: NGO	Local
	Project Tawasol	Tunisia	Civil Society: Volunteer-led	Local
Education: Out-of-School	Adaptive Tech Center for the Blind	Ethiopia	Civil Society: NGO	Local
	Africa ICT Right	Ghana	Civil Society: NGO	National
	Child Help	Sierra Leone	Civil Society: NGO	National
	Ikamva Youth	South Africa	Civil Society: NGO	Regional
	National Computer Board	Mauritius	Government	National
	She Will Connect Africa	Nigeria	Private Sector	International
	Siyafunda Community Technology Centre	South Africa	Civil Society: NGO	Local
	The Reach Trust	South Africa	Civil Society: NGO	National
	YISHDA	Nigeria	Civil Society: NGO	National
E-Government	WoredaNet	Ethiopia	Government	National
Health	DocmeUP	Ghana	Civil Society: Academia	Local
	Econet Wireless	Zimbabwe	Civil Society: NGO	Regional
	Karangue	Senegal	Private Sector	National
	MedTrucks	Morocco	Private Sector	National
	MomConnect	South Africa	Private Sector	National
	MOS@N	Burkina Faso	Private Sector	Local
	Peek Vision	Botswana	Civil Society: NGO	National
Local Content	FunDza	South Africa	Civil Society: NGO	National
	Sewasew Inc.	Ethiopia	Private Sector	National
Mobile Money	BanQu	Various	Private Sector	International
	NALA	Various	Private Sector	National
	Q Money	Gambia	Private Sector	National
	SmartMoney	Tanzania	Private Sector	National
	Tulaa	Kenya	Private Sector	National
TV White Spaces	Malawi TV White space project	Malawi	Private Sector	Local
	Mawingu	Kenya	Private Sector	National
	Namibia TV white space pilot	Namibia	Civil Society: NGO	Local

The case studies from Africa are now divided by sector and presented in brief below. They are clustered by a primary domain, acknowledging that case studies can belong to more than one domain.

1- AGRICULTURE

AFRICAN WOMEN POWER NETWORK: PROVIDING ICT-BASED TRAINING TO WOMEN FARMERS IN TARABA STATE, NIGERIA

The African Women Power (AWP) Network was founded in 2012 to train, empower, and publicize the stories of African women entrepreneurs. The organization provides a platform for publicity and funding for women and youth entrepreneurs in Nigeria. AWP currently runs three major training programs that combine technology and business education. The first program conducts webinars for African entrepreneurs featuring African experts. The second program provides education in developing business plans and pitch training opportunities to Nigerian students between the ages of 12 and 16. The third program trains women farmers in northern Nigeria, and connects them to improved agricultural methods and materials.

ESOKO: PROVIDING ACCESS TO AGRICULTURAL INFORMATION THROUGH ICTs ACROSS AFRICA

Esoko launched in 2005 and seeks to capitalize on increased mobile phone uptake across Africa to use information and communications technologies (ICTs) to help farmers improve their incomes. They started by sending voice and text messages to small farmers containing information on agribusiness, including weather and pricing, and linking farmers to buyers. They are now expanding the project to establish digital footprints within rural communities throughout Africa. They collect data from these communities (biometrics, GPS, and mobile money data) to form a database that can be used in a targeted way to connect users to specific services of interest (e.g., healthcare, business, e-governance, e-commerce, etc.). The project serves small farmers and rural communities in Ghana, Kenya, and Tanzania.

FARMERLINE: PROVIDING ACCESS TO INFORMATION OF FARMERS THROUGH VOICE MESSAGES IN GHANA

Farmerline is a private company that offers technology-driven solutions to small-scale farmers. With offices in Ghana, Switzerland, and the United States, Farmerline provides

affordable services to farmers seeking information on how to better access markets and prices, efficacious cultivation practices, sustainable growth, and increased productivity. In Ghana, where half the population depends on agricultural production for their livelihood and many struggle, Farmerline sells affordable mobile technology aimed at improving those livelihoods into profitable and sustainable practices.

FARM RADIO INTERNATIONAL: USING ICTs TO PROVIDE INFORMATION FOR FARMERS IN ETHIOPIA

Farm Radio International supports African broadcasters to provide radio services that share knowledge with and amplify the voices of small-scale farmers, their families, and their communities. It has been operational for 40 years. The organization helps African radio broadcasters meet the needs of local small-scale farmers and their families in rural communities through interactive radio programs. The organization currently works with more than 700 radio partners in 40 sub-Saharan African countries to fight poverty and food insecurity through providing high-quality resources for broadcasters, resources that help small-scale African farmers help themselves. The Canadian organization began operations in Ethiopia in 2012, and has offices in Malawi, Uganda, Ghana, Mali, Burkina Faso, and Mozambique. There are currently 36 impact projects running in seven countries, with over 40 national and international partners. Through its work with broadcasters and impact projects, FRI reaches tens of millions of small-scale farmers with agricultural information and opportunities to have a stronger voice in their own development.

JAGUZA FARM TECHNOLOGY: PROVIDING FARMERS WITH LIVESTOCK INFORMATION VIA MULTI-MEDIA SOURCES IN UGANDA

Founded in 2013, Jaguza uses information and communications technologies (ICTs) – such as its Livestock App – to facilitate the sharing of indigenous farming knowledge and enable poor farmers to obtain better prices for their products. In addition to printed how-to guides, Jaguza uses a variety of ICT tools, including websites, social media, blog posts, and Short Messaging Services (SMS), Unstructured Supplementary Service Data (USSD), and mobile, offline, and online web applications. Jaguza's model allows farmers to easily pick up new farming methods that can diversify and improve their yields and production. Jaguza also helps rural farmers sell their livestock directly to growing urban and foreign markets. There are more than 30 ethnic groups in Uganda, each with its own

indigenous farming methods, and Jaguza's model is designed to centralize and encourage farming knowledge transfer.

MUCHO MANGOES: PROVIDING AN SMS-BASED MOBILE PLATFORM AND DIGITAL SKILLS TRAINING TO MANGO FARMERS IN KENYA

Mucho Mangoes was founded in early 2015 to empower rural, smallholder farmers to improve crop production and reduce waste and losses in the mango farming industry in Kenya. Mucho Mangoes' methods include providing a short message service (SMS)-based mobile platform to share information and advice to farmers on what to do to prevent pests and diseases as well as provide training on how to use their system. Mucho Mangoes' business model depends on generating profits from sales of the products that they empower farmers to produce. Their target is to reach 200,000 farmers by the end of 2020.

TAMEBERO: PROVIDING ACCESS TO INFORMATION FOR SMALL FARMERS AROUND THE WORLD

Tambero is a web application launched in Colombia in 2012 that provides tailored information to farmers about how best to manage their livestock and crops. Farmers enter information about the type of food they are cultivating and the animals they raise; Tambero utilizes the entered data as well as information about the local environment to provide farmers with evidence-based recommendations about best farming practices in a language they can understand. For example, Tambero can advise farmers on what date they should stop milking cows in order to maximize yield during calving season. This knowledge is important to share, as many of the world's 570 million farms (of which 72% are less than 1 hectare in size) are not producing to their full potential, limiting the livelihoods of farmers and risking famine. Tambero now has over 200,000 registered users located in Benin, Colombia, Iraq, Mexico and Peru and other countries across the globe. The web application has a free version, which most of its users employ, but also 'premium' and 'pro' options. Tambero is currently exploring means of monetizing the web app via third-party advertisements and sales of much-needed agricultural goods.

2- COMMERCIAL DEPLOYMENTS & COMMUNITY NETWORKS

JAWUG PROJECT: DEPLOYING A COMMUNITY WIRELESS NETWORK IN JOHANNESBURG, SOUTH AFRICA

Johannesburg Wireless User Group began as hobby-turned-university project by four individuals in 2001. It had hundreds of participants at the height of its popularity, although its numbers have dwindled. JAWUG uses widely available standards-based radio frequency technology on a license-free frequency. It aims to create a community-owned wireless network. Free-to-use by non-members, JAWUG has a voluntary membership fee used to defray some of its operational costs. By 2017, JAWUG saw its user base dwindle to about 15 people, with a core group of eight who work to maintain the network's functioning. JAWUG is an example of a membership-model community wireless network sustained long-term by dedicated enthusiasts, but has seen membership decline as Internet access became more ubiquitous and cheaper from commercial providers.

LI-FI (LIGHT FIDELITY) LED: USING LED LIGHT BULBS TO PRODUCE INTERNET IN RURAL AREAS IN IVORY COAST

Li-Fi LED is a government-affiliated technology startup in the Ivory Coast that specializes in the intersection between Li-Fi (Light Fidelity) Internet technology and sustainable energy. Li-Fi technology provides high-speed Internet connectivity using everyday light bulbs and specialized receivers. Unlike Wi-Fi, which uses radio frequencies, Li-Fi relies on the visible light spectrum. Li-Fi LED has accomplished its short-term goals of providing connectivity and sustainable solar energy infrastructure to several difficult-to-reach border villages in the country, and seeks to achieve broader region-wide rollout in the long term.

PAMOJA NET: PROVIDING INTERNET ACCESS THROUGH MESH WI-FI IN THE DEMOCRATIC REPUBLIC OF CONGO

Pamoja Net is a mesh-Wi-Fi network on the island of Idjwi in Kivu, Democratic Republic of Congo. Ensemble Pour La Difference, a not-for-profit organization has deployed the network in collaboration with Fjord, an innovation consultancy based in the United Kingdom. The network has provided Internet access to 10,000 Congolese people through a public display system and Wi-Fi access points since May 2016.

PROJECT ISIZWE: PROVIDING PUBLIC WI-FI ACCESS IN SOUTH AFRICA

Project Isizwe is a non-profit organization in South Africa. Founded in 2013, it aims to connect low-income communities across South Africa to free, high-quality Wi-Fi networks at the lowest possible cost in public spaces. Project Isizwe seeks to promote education within these communities by providing Internet connectivity. Since its

inception, Project Isizwe has connected around 3 million South Africans to free, public Wi-Fi, and provided access to information and opportunities. Through the project's efforts, individuals have obtained more than 200 jobs and benefited from 11,000 online digital literacy programs.

SOWETO WIRELESS USER GROUP: CONNECTING LOW-INCOME COMMUNITIES THROUGH WIRELESS INTERNET IN SOUTH AFRICA

Soweto Wireless User Group (SOWUG), is a nonprofit organization based in Johannesburg, South Africa. The organization seeks to erode the digital divide in Africa. They provide include digital literacy training and deploy wireless hotspots. As of 2017, more than 1,000 people, including 50 youth and 10 businesses, have received digital literacy training. The SOWUG has also deployed upwards of 20 free, public hotspots. SOWUG is an example of a solution for accessibility and ICT familiarity in underserviced communities that is constrained by funding.

TUNAPANDA INSTITUTE: PROVIDING DIGITAL SKILLS FOR THE YOUTH IN KENYA

The Tunapanda Institute is a nonprofit organization founded in 2014. Located in the Kibera quarter of Nairobi, the institute offers free training programs for students between the ages of 18 to 25 in information and communications technologies (ICTs), design, and business. By providing residents of the city's largest slum with the skills and equipment to qualify for entry-level jobs in tech, Tunapanda aims to empower communities by shrinking the digital divide. It is currently developing a project to target even younger residents with ICT education and digital resources by building a community network to connect Kibera's 300 schools.

VANU RWANDA: PROVIDING AFFORDABLE CONNECTIVITY IN RURAL RWANDA

Vanu Rwanda deploys Compact Radio Access Network (CRAN) technology to provide GSM and Wi-Fi connectivity to hyper-rural communities in Rwanda. Vanu uses a unique wholesale network provider model, where Vanu's infrastructure can be used by existing Mobile Network Operators (MNOs) to extend their service. As of 2017, they have built 31 solar- powered sites in various communities in Rwanda. Three of these sites provide free Wi-Fi using the supaBRCK technology, which works in areas without connectivity. Each supaBRCK has

an advertisement-based service platform that provides zero-rated content after a short advertisement.

VISION NET: PROVIDING HIGH SPEED INTERNET IN THE DEMOCRATIC REPUBLIC OF THE CONGO

VisionNet is an Africa-based organization that offers a large range of high-speed wireless Internet services to customers in Bunia and Goma in the Democratic Republic of the Congo (DRC). They also offer satellite Internet access across the DRC. Launched in 2015, Pocket Cyber Café is a service that aims to provide low-cost Internet connectivity via Wi-Fi hotspots at rural universities in the DRC. The target audience is the student population on campus in rural areas, but the service also extends to private access points for small business owners, nongovernmental organizations (NGOs), and others in need of service. Each university has customer-provided equipment (CPE) that receives broadcasts from a central signal from the main transmitter, and transmitted to numerous hotspots across campuses. Five universities are currently using the service that is supported by Microsoft's Affordable Access Initiative.

ZENZELENI NETWORKS: PROVIDING AFFORDABLE WI-FI CONNECTIVITY TO MANKOSI IN SOUTH AFRICA

Zenzeleni Networks is a community network in Mankosi in the Eastern Cape province of South Africa, set up in 2012. It started through a collaboration between researchers at the University of Western Cape and the Tribal Authority in Mankosi. It provides affordable communications access to its 3500 residents, at half the price charged by the then-incumbent operator.

3- EDUCATION: IN-SCHOOL

CONNECTING E-DAARA SCHOOL IN SENEGAL: PROVIDING THE FIRST INTERNET CONNECTIVITY TO A SCHOOL IN SENEGAL

The Senegalese Chapter of the Internet Society (ISOC) has provided connectivity and information and communications technology (ICT) equipment to the primary school in Thieyetou, a forest-encircled village of 1,800 inhabitants in the Diourbel region of Senegal. An ISOC Community Grant in 2017 facilitated the purchase of desktop computers, tablets, a printer, and long-range router, as well subsidized the significant travel costs necessary to reach the remote area. The project's goals for its implementation of connectivity include increased school retention rates, improved socio-cultural cohesion, and enhanced

academic materials and methods for its pupils.

GHANA CODE CLUB: PROVIDING DIGITAL LITERACY SKILLS TO GIRLS IN GHANA

Ghana Code Club is an initiative started in 2015 by the not-for-profit organization Healthy Career Initiative to expose young people, especially girls, to computing and coding. In addition to basic information and communications technology (ICT) training, students learn skills such as games, animation, web design, and programming. The project was launched in underprivileged schools, but its long-term aim is for every school in Ghana to have a coding club.

GIVE1 PROJECT GAMBIA: PROVIDING DIGITAL LITERACY TO YOUNG GIRLS IN GAMBIA

Give1 Project Gambia is a not-for-profit organization that organizes All Girls Tech camps across Gambia. The project trains young girls aged 13-20 in web design, computer graphics, coding, and database design. Leading women in technology in Gambia give career talks and advice to youth, as part of the tech camp. The initiative brings girls from across the country to participate in training programs, develop information and communications technology (ICT) skills, and be paired with an entrepreneurial mentor. Currently, the initiative serves five schools and provides free training, food, and transportation costs to participants.

CONNECTING NYIRARUKOBWA PRIMARY SCHOOL: PROVIDING WIRELESS INTERNET ACCESS TO A SCHOOL IN BUGASERA DISTRICT, RWANDA

A 2013 grant- and donor-based initiative brought connectivity, training, and information and communications technology (ICT) equipment to the Nyirarukobwa Primary School in the Bugasera district of Rwanda, an underprivileged area on the outskirts of Kigali. The school responded well to connectivity, radically increasing its ranking, test scores, and enrollment. Nyirarukobwa was meant to serve as a pilot program for a more expansive connectivity project, but it hit roadblocks in terms of support and long-term maintenance. Despite the success of the program's initial stages, it is struggling with issues of sustainable financing.

INFORMAL SECTOR BUSINESS INSTITUTE: PROVIDING ICT TRAINING PROGRAM FOR INFORMAL BUSINESS OWNERS IN KENYA

The Eastland College of Technology (ECT) in Nairobi, Kenya, is host to the Informal Sector Business Institute (ISBI), that offers a training course in micro-entrepreneurship with emphasis on information and communications technology (ICT) education. ECT was established in 2004 to develop educational programs for the formal sector, training technicians to aid Kenyan industrialization. The micro-entrepreneurship course aims to improve economic development and business practices and alleviate poverty among small, informal business owners in Nairobi since 2004.

MAENDELEO FOUNDATION: PROVIDING MOBILE COMPUTER CLASSROOMS TO LOW-INCOME COMMUNITIES IN UGANDA

Established in 2008, the Maendeleo Foundation works to provide Internet access to rural Ugandan schools and villages. Originally conceived as a way to oversee donated stationary computer labs, the limitations of the area's Internet backbone made their plans unfeasible. Consequently, Maendeleo introduced what they refer to as mobile solar computing classrooms (MSCCs). Through the MSCCs, the foundation has reached 110 schools, partnering with each for a commitment of 2-5 years. Through these endeavors, the foundation works to increase Internet, computer, and mobile literacy programs as a way to empower rural East African communities. The Maendeleo Foundation is an example of finding creative solutions to circumvent impediments that arise due to the unavailability of necessary technologies. In crafting the MSCCs as a solution, the organization offers a model for reaching geographically separate and sparsely populated areas with little or no technology to build upon.

PROJECT TAWASOL: CONNECTING PRIMARY SCHOOLS TO CREATE AN INTERNET-EMPOWERED NEXT GENERATION IN TUNISIA

Project Tawasol is a project in Tunisia that's led by IEEE Sight, Tunisia chapter and People Centered Internet. The project connects primary schools across the country to the Internet, and train students to use the Internet through ICT skills workshops conducted by IEEE SIGHT members. The project aims to create an Internet-aware next generation by sensitizing youth to critical skills. The project launched in 2016, and connected a primary school in Tunis – Sadiki school – in 2017.

4- EDUCATION: OUT-OF-SCHOOL

ADAPTIVE TECHNOLOGY CENTER FOR THE BLIND: PROVIDING VISUALLY IMPAIRED ETHIOPIANS WITH INTERNET ACCESS AND ICT TRAINING

The International Telecommunication Union (ITU) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) launched the Adaptive Technology Center for the Blind (ATCB) in 2003 in Addis Ababa, Ethiopia to provide access to information and communication technologies for the blind and visually impaired people. The ITU and ATCB provided the training equipment and software that produces Braille by computerized embossers to its users for the first two years. The center is now a non-profit resource and information technology center open to all visually impaired Ethiopians.

AFRICA ICT RIGHT: PROVIDING ICT ACCESS AND TRAINING WITH A FOCUS ON EDUCATION, GENDER, AND HEALTH IN GHANA

Africa ICT Right (AIR) is a volunteer-run information and communications technology (ICT)- oriented nongovernmental organization (NGO) established in 2007. The organization seeks to use ICT tools to address education, gender, youth empowerment, and health in Ghana. They partner with donors, governmental and private institutions, NGOs, and local communities to address the digital divide. They run integrated programs that provide technological solutions and support to educational and health facilities in underserved areas. Under the education vertical, the organization runs three programs equips teachers with skills to integrate ICTs in their lessons, Computer4Change is a laptop-donation program, and Connecting the Unconnected consists of building replicable ICT-equipped community centers. Mobile4Life is a health services application, under their health program, and Girls In Tech educates girls about basic coding skills or ICTs.

CHILDHELP: SUPPORTING THE EDUCATION OF YOUNG WOMEN TO STEM CHILD MARRIAGE IN SIERRA LEONE

ChildHelp Sierra Leone is a recognized nongovernmental organization (NGO) founded in 1994. It is a social humanitarian organization with the national mandate to help child and youth through development, advocacy, and relief. After the Ebola crisis, ChildHelp aims to keep female students in school and encourage those who have never been enrolled to attend. ChildHelp focuses on the most marginalized and underserviced young women in particular communities of Sierra Leone and other parts of Africa. They

provide technology to schools as well as offer school scholarships, mentoring for young women and distance learning facilities to older women. ChildHelp is an example of a multi-pronged intervention that needs a permanent funding pipeline.

IKAMVA YOUTH: IMPROVING THE CAPACITY OF THE YOUTH IN SOUTH AFRICA

Ikamva Youth, a nonprofit founded in 2004, equips learners from disadvantaged communities in South Africa with the knowledge, skills, networks, and resources to access tertiary education and/or employment opportunities once they matriculate. Ikamva Youth aims to increase the collective skill level of the population, grow the national knowledge base, and replicate its success in more communities. Ikamva Youth currently operates with branches in five provinces of South Africa: Western Cape, Gauteng, KwaZulu-Natal, Northwest, and Eastern Cape. While learners enroll at Ikamva Youth when they are in grades 9, 10, and 11, the program's success is ultimately determined by the number of grade 12 learners who access tertiary institutions and/or employment-based learning opportunities when they matriculate. The Ikamva Youth model draws from a large and growing pool of volunteers made up of students from nearby universities and local professionals. Notably, ex-learners who gain entrance to tertiary institutions and return to tutor drive the organization's sustainability.

NATIONAL COMPUTER BOARD: PROVIDING INTERNET ACCESS AND DIGITAL LITERACY PROGRAMS IN MAURITIUS

The National Computer Board of Mauritius was established in 1988 by the National Computer Board Act to promote the development of information and communication technologies (ICT) in Mauritius. It is a para-state body administered by a board of directors and operates under the aegis of the Ministry of Technology, Communication, and Innovation. Its goal is to be a key enabler in transforming Mauritius into a Cyber island and regional ICT hub. The project is working to reduce the digital divide and promote connected communities by implementing 600 Wi-Fi hotspots with 10 megabit per second (Mbps) Internet connection through fiber-optics, set up in public places across Mauritius, as well as with the introduction of 270 computer clubs across the country. The projects are oriented toward providing universal access to ICTs to all segments of the population.

SHE WILL CONNECT: CLOSING GENDER GAPS USING DIGITAL LITERACY TRAINING IN AFRICA

Launched in 2014 by the Intel Corporation in partnership with UN Women and local NGOs, the She Will Connect initiative aims to erode the gender gap in technological literacy in Africa. Intel offers women in Nigeria, South Africa, and Kenya digital literacy training, skills for creating user-generated content, and mentoring for entrepreneurship and job-readiness. As of 2017, the program has trained over 200,000 women in face-to-face trainings and reached over 2.5 million women through their online content. She Will Connect uses local partnerships to efficiently implement a project for a targeted population and remains flexible in deployment to meet the target population's real-world needs.

SIYAFUNDA CTC: BRINGING CONNECTIVITY AND DIGITAL LITERACY TO UNDERSERVED COMMUNITIES IN SOUTH AFRICA

Siyafunda CTC brings connectivity, technology, and digital literacy to underserviced, generally rural, communities in South Africa. By engaging the government, corporations, and local nongovernmental organizations (NGOs), Siyafunda CTC successfully constructed approximately 180 community knowledge centers (CKCs) in rural villages and schools across the country. These CKCs provide access to the Internet as well as offer low-cost basic and advanced digital literacy training. Siyafunda CTC is an example of a multi-stakeholder implementation model to produce sustainable connected community centers for traditionally underserviced areas.

THE REACH TRUST: IMPROVING LIVES THROUGH THE DEVELOPMENT OF INNOVATIVE AND COST-EFFECTIVE MOBILE SOLUTIONS IN SOUTH AFRICA

The Reach Trust was established in 2012 to inspire and improve lives of low-income communities in South Africa through the development of innovative and cost-effective mobile solutions. Their mobile-first solutions are designed to cost-effectively enable the transition from a resource-based to a knowledge-based economy, while focusing on three priority areas to improve lives through education: parenting, student education, and youth employment. They have developed targeted programs to address each of these areas: CareUp, LevelUp, and MoveUp. To date, they have helped more than 10 million people transform their lives through access to free education, health, and counseling services on their mobile phones. They work in partnership with governments, the private

sector, nongovernmental organizations (NGOs), communities, and leaders around the world who support programs for cost-effective social change.

YOUTH INITIATIVE FOR SUSTAINABLE HUMAN DEVELOPMENT IN AFRICA: CAPACITY BUILDING PROGRAMS FOR YOUTH AND WOMEN IN NIGERIA

Youth Initiative for Sustainable Human Development in Africa (YISHDA) is a nonprofit organization that provides leadership training for youth in Nigeria. They provide training in the areas of education, information and communications technology (ICT) development, civic engagement, and business development, including employment training in building a résumé and cultivating soft skills. These programs bring youth and women to area libraries, with mutually beneficial impacts for libraries and users. YISDHA is developing a network of libraries in Nigeria equipped with ICTs and resources. The project is partnered with Beyond Access, the Universal Services Provision Fund (USPF), and the National IT Development Agency (NITDA).

5- E-GOVERNMENT

WOREDANET: PROVIDING SATELLITE-BASED E-GOVERNMENT SERVICES IN ETHIOPIA

WoredaNet is a terrestrial and satellite-based communications network that provides Internet connectivity and allied services such as video conferencing and messaging to federal, regional, and woreda-level government entities in Ethiopia. A woreda is an administrative division in Ethiopia managed by a local government, equivalent to a district with an average population of 100,000. WoredaNet seeks to establish a multi-service Internet Protocol (IP)-based system using broadband and very-small-aperture terminal (VSAT) infrastructure for government communications and e-government service delivery to citizens. WoredaNet aspires to optimize federal and regional government administrative efficiency, effectiveness, and productivity, and provide information on e-government services to the public.

6- HEALTH

DOCMEUP: USING MOBILE TECHNOLOGY TO PROVIDE PRENATAL CARE TO PREGNANT WOMEN IN GHANA

Since 2013, the DocmeUP project has implemented pilot programs to offer better prenatal healthcare to pregnant women in rural Ghana. Their first project involved providing mobile ultrasound scans that reached nearly 400 Ghanian women. Their

current project, launched in June 2017, also focuses on prenatal care. This time, however, instead of ultrasounds, DocmeUP is providing glucometers to test for diabetes in pregnant women. DocmeUP is an example of a public health intervention impeded by lack of funds and an overzealous bureaucracy.

ENERGIZE THE CHAIN: PROVIDING LAST-MILE VACCINE REFRIGERATORS USING TOWER POWER IN RURAL ZIMBABWE

Econet Wireless is a company that provides reliable green power for mobile towers and homes in off-grid rural areas of Zimbabwe. This electricity also powers vaccine refrigerators in partnership with the Energize the Chain project to provide vaccines for preventable diseases to children in these regions. Presently, there are 312 off-grid mobile towers with vaccine refrigerators and remote health clinics in operation, with implementation plans in other countries in the region, such as Ghana, as well as globally.

KARANGUE: IMPROVING MATERNAL AND INFANT HEALTH USING ICTS IN SENEGAL

Karangue ("Protection in health" in Wolof, the majority language in Senegal) is a phone application that sends SMS and voice messages to women reminding them of their prenatal, postnatal, and children's immunization appointments in 5 different local languages. The application automatically sends a message recorded by popular Senegalese music artists to subscribers 48 and 24 hours before their scheduled appointments. Data collected directly from patients via the application will also be used to improve measurements of antenatal care and vaccination rates at a local level in Senegal. A pilot study from September 2017 demonstrated a 20% increase in prenatal care visits, 17% increase in childhood immunization visits, and a 5% increase in postnatal care visits. Karangue has established two contracts, with CLM and UNFPA to deploy their application elsewhere in Senegal, and is in the process of training a further 200 medical professionals in its use.

MEDTRUCKS: BRINGING HEALTH VIA A MOBILE MEDICAL UNIT TO THE ISOLATED PATIENTS IN MOROCCO

MedTrucks is a social enterprise that has worked since 2015 to operate medical vehicles equipped to provide dialysis, dental care, ophthalmology, preventive medicine and medical imaging services in Northern Morocco. In order to deploy their resources most effectively to recipient communities,

MedTrucks collects patient data from facilities across their service area, to map disease burden and generate the most efficient routes for their vehicles to take. MedTrucks services are free to patients - MedTrucks contracts with local governments, hospitals, and NGOs to operate their trucks for a flat, per-day rate in chosen communities. Volunteer medical personnel from local hospitals staff the vehicles. MedTrucks operates 2 vehicles in Morocco serving over 10,000 patients in 200 communities. They have plans to expand to 60 vehicles in Morocco next year, start operations in underserved populations in France, and establish a franchise model in other countries in Africa.

MOS@N: USING A MOBILE HEALTH APPLICATION TO IMPROVE HEALTH IN RURAL BURKINA FASO

MOS@N is a nonprofit initiative that seeks to reduce mother and infant mortality through improved access to treatment, as well as reduce the number of people living with HIV (PLHIV) who drop out of receiving treatment by providing accessible treatment and targeted health information using mobile phones. The pilot project was launched in the district of Nouna in rural Burkina Faso on 9 January 2013 and completed on 28 February 2017. It piloted the use of mobile devices to improve the use of health care services by pregnant women, sending voice medical appointment reminders and health advice to "godmothers," who act as community relays to follow up with pregnant women in their respective villages. In 26 villages, served by five different primary healthcare centers, MOS@N brings together various stakeholders, including pregnant women, godmothers, rural primary healthcare centers (PHCs), health workers, technicians, and public health researchers.

PEEKVISION: PROVIDING SMARTPHONE-BASED TECHNOLOGY TO BRING ACCESS TO EYE CARE IN BOTSWANA

Peek Vision aims to enhance eye care in low- and middle-income settings across the globe. In 2016, in conjunction with the Botswana Ministry of Health & Wellness, Ministry of Basic Education, and other local partners, Peek rolled out a pilot study of a vision screening program in public schools using a smartphone application, providing glasses to all students who needed them. The program is designed to assist the government of Botswana in building capacity to address eye health issues of its citizens, the burden of which has increased by more than 30% over the past decade. The pilot, carried out in fall of 2016 in the Goodhope sub-district of Botswana, trained 243 teachers and healthcare workers on Peek

technology, screened over 12,000 public school students over the course of 2 weeks, and provided glasses to over 800 children who screened positive for refractive error. Peek is now working with the Government of Botswana on a program to provide vision screening to all of Botswana's school-age children within five years.

MOMCONNECT: MHEALTH TECHNOLOGY TO DELIVER INFORMATION TO IMPROVE MATERNAL HEALTH IN SOUTH AFRICA

MomConnect is a project of the Praekelt Foundation dedicated to building mobile technology to serve the world's poor. They first projects included 'text alert' interventions designed to remind patients with HIV to make follow-up appointments and take their medications as scheduled. Currently, they have expanded this model into interventions like MomConnect, a mobile application that contains a library on maternal health topics, a messenger helpdesk, and the ability for mothers to rate the quality of their health clinic visits. MomConnect has 2 million registered users and has been officially integrated into South Africa's healthcare system via the country's Department of Health.

7- LOCAL CONTENT

FUNDZA: PROVIDING ACCESS TO LOCAL CONTENT FOR THE YOUTH IN SOUTH AFRICA

FunDza is a non-profit organization operating in South Africa since 2011, which provides print copies of reading material to partnering schools. FunDza also operates a mobile application (fundza.mobi) that provides original fiction and non-fictional content, writing and publishing opportunities, reading comprehension education and career skills to South African youth. Their mission is to improve the ability, confidence and frequency of reading among youth in order to improve their sense of self-agency, their employability, and their ability to make change in their communities and the world. Since launching their application, FunDza has acquired almost 600,000 readers who have viewed over 5 million pages of content; they have also hosted 28 writers workshops and published the works of nearly 1000 young authors.

SEWASEW: COLLABORATIVE ONLINE LOCAL CONTENT PLATFORM IN ETHIOPIA

Sewasew enables users to curate and contribute content in their native language. It is named after the Amharic word for "ladder" and intends to provide an online content platform as a ladder to prosperity. The

platform aims to deepen knowledge about various topics relevant to Africa, to connect users to one another, and to increase awareness about Africa. The platform hosts crowdsourced content in four languages: English, Amharic, Afaan oroomo and Tigrigna. As of 2017, the site has 30,000 articles that vary from tips on how to use government services, travelers' guides for tourists, as well as information on local customs and culture. Sewasew aims to increase the locally relevant content on its platform through collaborations with local educational and cultural institutions, including the Addis Ababa University, the National Archives and Libraries Agency, and the Oromo Cultural Center

8- MOBILE MONEY

BANQU: ENABLING ECONOMIC EMPOWERMENT THROUGH ECONOMIC IDENTITY IN RURAL AFRICA, ASIA AND LATIN AMERICA

Established in 2016, BanQu offers a blockchain technology platform that connects low-level suppliers (particularly farm workers) to the global supply chains they participate in and the brands and organizations that power them. By making workers' identities and work products visible to the brands they serve, brands are able to ensure that they engage in socially responsible sourcing. By leveraging simple technology to enable workers to keep track of their transactional outputs and sales and to maintain mobile money accounts, BanQu facilitates the money management and financial empowerment that are key to poverty alleviation.

NALA: PIONEERING OFFLINE MOBILE PAYMENTS IN TANZANIA AND UGANDA

Launched in Tanzania in 2018, NALA is a pioneer offline mobile payment platform, free for users, that makes money transfers and payments possible using USSD as an API. It is an alternative to an earlier system of payment-making that was lengthier and more inconvenient, requiring users to enter a 46-digit code for each transaction. NALA allows users to transact without having a second account and across multiple accounts, and to view record of balances and charges all on one application. It also protects these data on par with top banks. The company stands out in particular for its human-centered design, which depends on weekly interaction with users to improve upon the application. Due to this regular user engagement, the majority of the growth of this service (approx. 75%) has been by word-of-mouth.

QMONEY: INCREASING MOBILE ACCESS TO FINANCIAL SERVICES ACROSS GAMBIA

Qmoney, formerly known as Qodoo Mobile Money, is a mobile money company that makes financial transactions more efficient, safe, and convenient for users throughout Gambia. Through Qmoney, customers can process cash in (deposits), cash out (withdraws), send and receive money, make payments (bills, goods, and services), and more. Because signing up for this service does not require a formal bank account, it promotes inclusion for those without access to financial services through traditional banks or financial institutions, and helps customers to reduce various costs associated with purchasing necessities with cash. Agents located throughout Gambia are intermediaries between the physical cash and electronic money, educating customers about services, processing transactions, and cashing out, among other key roles for helping users to make the most of Qmoney's offerings.

SMARTMONEY INTERNATIONAL: PROVIDING MOBILE SAVINGS AND PAYMENT SERVICES AND FINANCIAL LITERACY TRAINING TO RURAL COMMUNITIES IN TANZANIA & UGANDA

SmartMoney is a digital savings and payments company that has provided affordable and accessible financial services to rural communities in Africa since 2010. The company does so by charging zero fees to its retail customers and passing those charges on to local institutional partners/customers who also benefit from the reduced costs of engaging in digital transactions versus riskier cash transactions. SmartMoney runs a strategic marketing campaign and pioneers a scalable financial literacy training program, staffed by locals, to attract customers and partners and to teach them to use the company's mobile technologies.

TULAA: PROVIDING MARKET ACCESS FOR SMALLHOLDER FARMERS IN RURAL KENYA

Tulaa is a marketplace for smallholder farmers, providing them inputs, credit, agronomic advice and market linkages. The company aims to help these workers make more advantageous purchases, sales and agricultural decision-making by offering them skilled brokering, advisory services, and access to information and input financing. Their target demographic is farmers who work with horticulture crops and have about 2-2.5 acres of land. Currently, their focus is on workers in Kenya's Rift Valley and Eastern Kenya, for which horticulture is a significant part of the economy. Results of an independent analysis showed that approximately 71% of the farmers have never accessed input financing before, and

so were financially excluded prior to connecting with Tulaa. Despite women doing most of the labor, men represent the bulk of customers due to gender inequality in agriculture. However, 30% of Tulaa's clientele are women. Surveyed farmers also self-report increases in incomes over the prior season, including 84% of farmers in the latest season.

9- TV WHITE SPACES

MALAWI TV WHITE SPACES PROJECT: LEVERAGING TV WHITE SPACES TO PROVIDE AFFORDABLE INTERNET ACCESS IN MALAWI

The University of Malawi, in partnership with the Malawi Communications Regulatory Authority (MACRA) and the International Centre for Theoretical Physics launched a TV white spaces pilot in the university town of Zomba in southern Malawi in 2013. The project has connected different institutions until now, including a school, a hospital, an airport and a research facility. In 2015, the project expanded to connect a secondary school at Mulanje where students can now connect to the Internet via their computer lab.

MAWINGU: PROVIDING CONNECTIVITY THROUGH AFFORDABLE INTERNET ACCESS USING UNLICENSED SPECTRUM IN RURAL KENYA

The Mawingu project is a joint undertaking by Mawingu Networks, Microsoft, and Jamii Telecommunications that provides affordable access to wireless broadband Internet as well as device recharge facilities in the rural Kenyan counties of Laikipia, Nyeri, Embu, and Meru. Launched in 2013, more than 10,000 customers access its services through 300 Wi-Fi hotspots at less than $3 per month, with others in these districts – a total population of about 300,000 people – receiving free access through libraries, schools, and health centers. The project relies on a combination unlicensed spectrum and TV white space (TVWS) spectrum to provide last mile connectivity as well as backhaul.

NAMIBIA TV WHITE SPACE PILOT PROJECT: BRINGING BROADBAND ACCESS TO RURAL COMMUNITIES

My Digital Bridge Foundation launched a pilot project to test TV white space spectrum use viability in Namibia in 2014. Known as Citizen Connect, the project aimed to provide broadband to rural settlements via unused frequencies in the ultra-high frequency (UHF) terrestrial television broadcasting bands. The pilot was launched in the northern region of Namibia. The project has faced funding and regulatory challenges in initiating a countrywide rollout but succeeded

in connecting 27 schools and seven Ministry of Education offices.

About 1 World Connected

1 World Connected is a research project of the Center for Technology, Innovation and Competition at the University of Pennsylvania. Internet connectivity is one of the top global priorities. Governments, civil society organizations, and businesses around the world are initiating a wide range of efforts to improve Internet adoption around the world. This includes supply-side initiatives such as community networks and rural connectivity initiatives, and demand-side initiatives focused on improving adoption, through digital skills training and financial inclusion, among other methods.

1 World Connected is a unique effort that seeks to consolidate, extend, and share information about these efforts. Our aim is to highlight initiatives that have proven to be effective in improving broadband adoption and generate lessons from those which have failed. Our hope is to provide valuable insights to aid decision-making on what initiatives to implement in different contexts.