Emerging technology for connectivity

Accelerating digital transformation in LDCs, LLDCs and SIDS

An Overview of Emerging Technology for Connectivity

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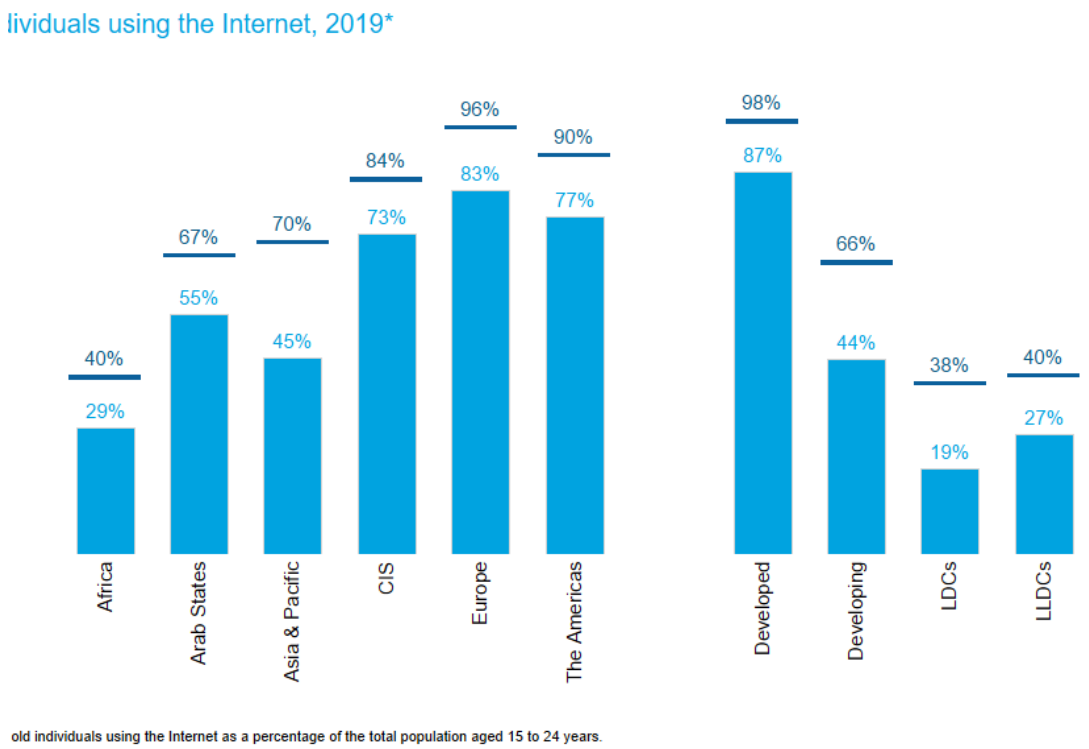
Introduction

- About half of world's population offline
- Concentrated in least developed countries
  - 19 % online in LDCs
  - 29% online Africa
  - 45% online Asia-Pacific



Connecting the Unconnected

Step 1:

Identify digitally unconnected (and underserved) geographies

Step 2:

Review options from existing solutions

Step 3:

Select sustainable solutions by matching viability subject to constraints

Step 4:

Implement interventions to extend sustainable connectivity service

Connectivity Mapping

Demand mapping	Infrastructure mapping	Investment mapping	Service mapping
• Demand for bandwidth • Quality of service • Willingness to pay • Required services	• Telecommunication structure • Other relevant infrastructure (utilities) • Construction works (roads, buildings)	• Segmenting infrastructure by investment sources • Private / funded • Planned / realized	• Bandwidth & Access Technology (level of service availability) • Provider • Data volume usage, take-up • Price

Wireless Technology for Connectivity

Technology	Potential throughput / QoS	Range	Capital expenditure to deploy new network	Operating expenses	Infrastructure required	Suitability for rural deployments	Spectrum licensing requirement	Access device type
Wi-Fi: 802.11	2 Mbit/s (a) to 10 Gbit/s (802.11ax)	100s of m	Low	Low	Wi-Fi routers	Yes, but backhaul required (satellite, microwave or fibre)	No specific licence but compliance with technical specifications via “blanket licence" under non-interference/non-protection regime	Wi-Fi enabled smartphones, tablets, computers
Mobile cellular (2G, 3G, 4G, 5G)	0.1 – 1000 Mbit/s	5 to 15 km	Medium to high	Medium to high	Towers and radio equipment	Yes, but backhaul required (satellite, microwave or fibre)	Yes	Cellular mobile phones, laptops, personal computers (via dongles)
Fixed wireless access (4G/ 5G)	20 – 1 000 Mbit/s	Up to 10 km	Low to medium	Low	Towers and radio equipment	Maybe, depending on financial viability and demand	Depends on country regulations	Consumer premises modems to Ethernet or Wi-Fi
Satellite (HTS GEO and MEO)	5 – 150 Mbit/s	1 000s of km	High (for new satellite deployment); low (for end-user terminals)	Low	Earth station, satellite, very-small-aperture terminal	Yes	Yes	Very-small-aperture terminal, consumer premises modems to Ethernet or Wi-Fi

Wireline Technology for Connectivity

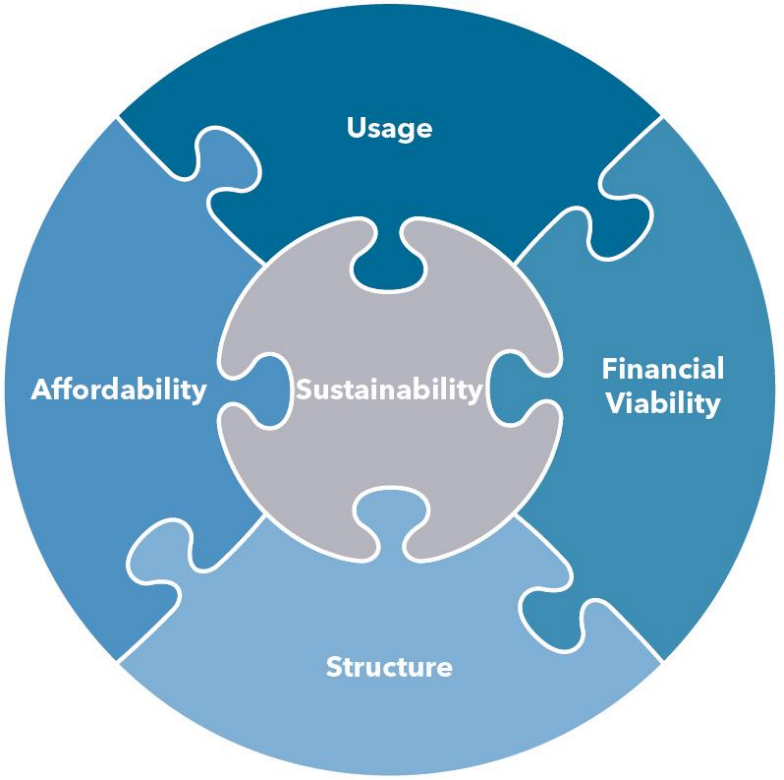
Technology	Potential throughput / QoS	Range	Capital expenditure to deploy new network	Operating expenses	Infrastructure required	Suitability for rural deployments	Additional regulatory issues	Access device type
Fibre	100 – 1 000 Mbit/s	100s of km	Overhead cabling: low to medium	Medium	Tower, poles, cabinets, active network equipment	In some cases, with sufficient purchasing power and population densities	Pole attachment	Fibre modem to Ethernet-enabled devices or to Wi-Fi
			Below ground: medium to high (new excavation)	Low to medium	Subterranean duct work, cabinets, active network equipment	No	Right of way	
Coax (cable)	Up to 200 Mbit/s	Up to 100 km	Low to medium	Low to medium	Tower, poles, cabinets, active network equipment	In some cases, with sufficient purchasing power and population densities	Pole attachment	Cable modem to Ethernet- enabled devices or to Wi-Fi
Copper	0 to 24 Mbit/s (for ADSL, ADSL 2, ADSL 2+); 100 Mbit/s (for VDSL, VDSL2, Vectoring); 1 Gbit/s (G.Fast)	0.1 to 5 km	Low to medium	Low to medium	Tower, poles, cabinets, active network equipment	In some cases, with sufficient purchasing power and population densities	Pole attachment	Modem to Ethernet-enabled devices or to Wi-Fi

Emerging Technology for Connectivity

Technology	Wired or wireless	Potential throughput / QoS	Range	Infrastructure required	Suitability for rural deployments	Spectrum licensing requirement	Backhaul suitability	Access device type
HAPS	Wireless	Up to 30 Mbit/s	1 000s of km	High altitude balloons, autonomous drones	Yes	Yes	Could work for both backhaul and access	Cellular devices in last-mile cases (such as Google Loon)
LEO satellite		Up to 100 Mbit/s	1 000s of km	LEO satellites (for new network deployments)	Yes	Yes	Could work for both backhaul and access	To be determined
Millimeter wave		Up to 20 Gbit/s	1 to 10 km	Towers and radio equipment, fibre backhaul	No	Yes for certain bands, some unlicensed / licence-exempt	Local backhaul	To be determined
Free-space optical communication		10s to 100s of Gbit/s	1 to 10 km	Specialized equipment using light to transmit high-speed data	Yes, but requires line-of-sight data transmission	No	Local backhaul	Used for backhaul
TV White Space		5 – 150 Mbit/s	10 to 25 km	Towers and radio equipment	Yes, especially for non-line of sight	Authorization of use required under the opportunistic use principle	Could work for both backhaul and access	Consumer premises modem to Ethernet or Wi-Fi
Long range		Up to 50 Kbit/s	10s of km	Towers and radio equipment	Yes (though very low throughput)	No (utilizes licence-free industrial, scientific and medical bands)		Long-range radios to IoT devices / applications
Power line communications: fibre via overhead medium-voltage distribution lines	Wired	100 – 1 000 Mbit/s	100s of km	Tower, poles, cabinets, active network equipment	Yes (eight times longer than high voltage lines)	No	Yes	Fibre modem to Ethernet-enabled devices or to Wi-Fi

Sustainable Connectivity

- **Affordability** – Ensuring that connectivity service user pricing falls within a given affordability threshold, such as the 2 per cent of monthly GNI per capita for 1GB of mobile broadband data discussed above
- **Usage** – Identifying the applications and services that need to be available to the locality, and the level of QoS that those applications and services require
- **Financial viability** – Measuring the economic viability for private investment of the connectivity service, based on estimates of ARPU, availability of backhaul / middle-mile connectivity, options for different local access technologies and the potential level of the service's QoS
- **Structure** – Articulating the service delivery business model and identifying any regulatory constraints on the model and technologies utilized
- **Sustainability** – Understanding of the service's revenue model and of any potential subsidy

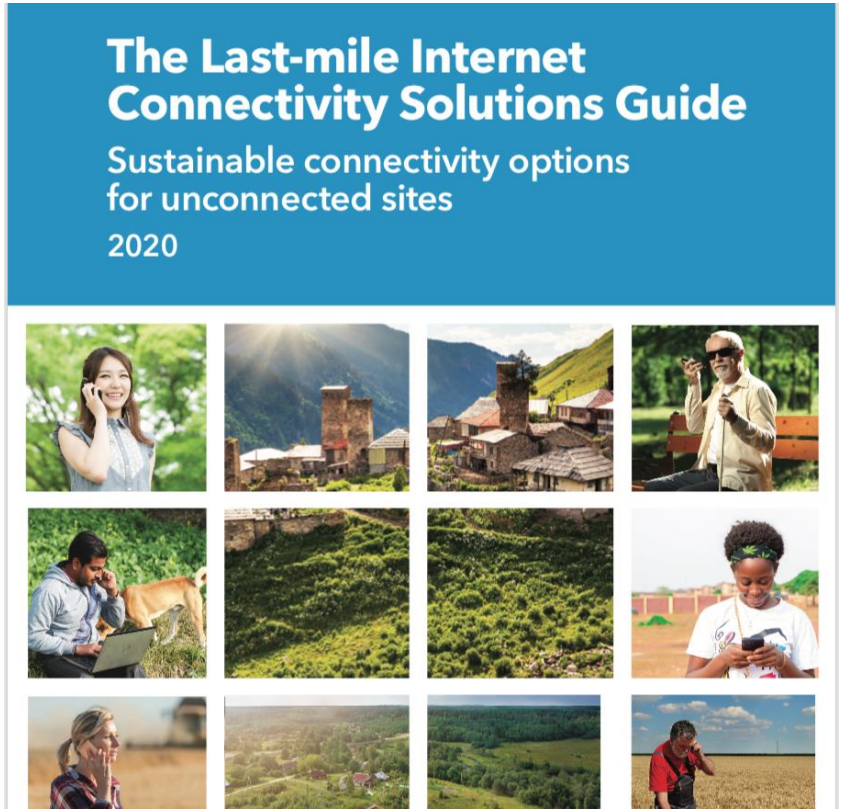


Conclusion

Thanks!

The Last-mile Internet Connectivity Solutions Guide

https://www.itu.int/pub/D-TND-01-2020



Foundations for an Emerging Digital Economy

Affordable & Meaningful Connectivity among LDCs

Teddy Woodhouse, Research Analyst & Advocate
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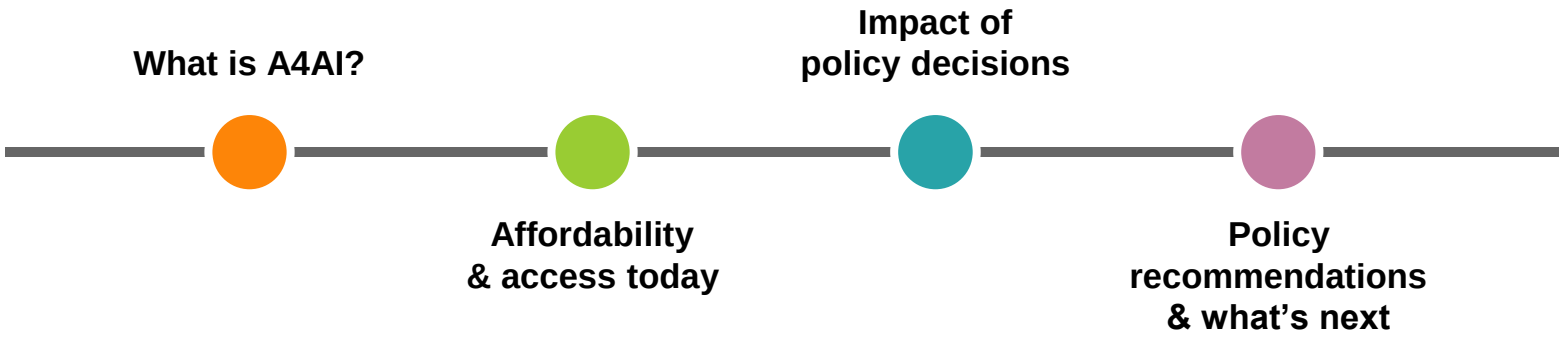
A4AI


What is A4AI?
Affordability & access today
Impact of policy decisions
Policy recommendations & what's next

WE ARE THE

WORLD'S BROADEST TECHNOLOGY SECTOR ALLIANCE

WORKING TO

DRIVE DOWN THE PRICE OF BROADBAND

BY

TRANSFORMING POLICY AND REGULATORY FRAMEWORKS

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All have endorsed one set of **best practices**

- grounded on the principles of internet freedom and the fundamental rights of expression, assembly, and association online -

for making affordable broadband internet a reality.

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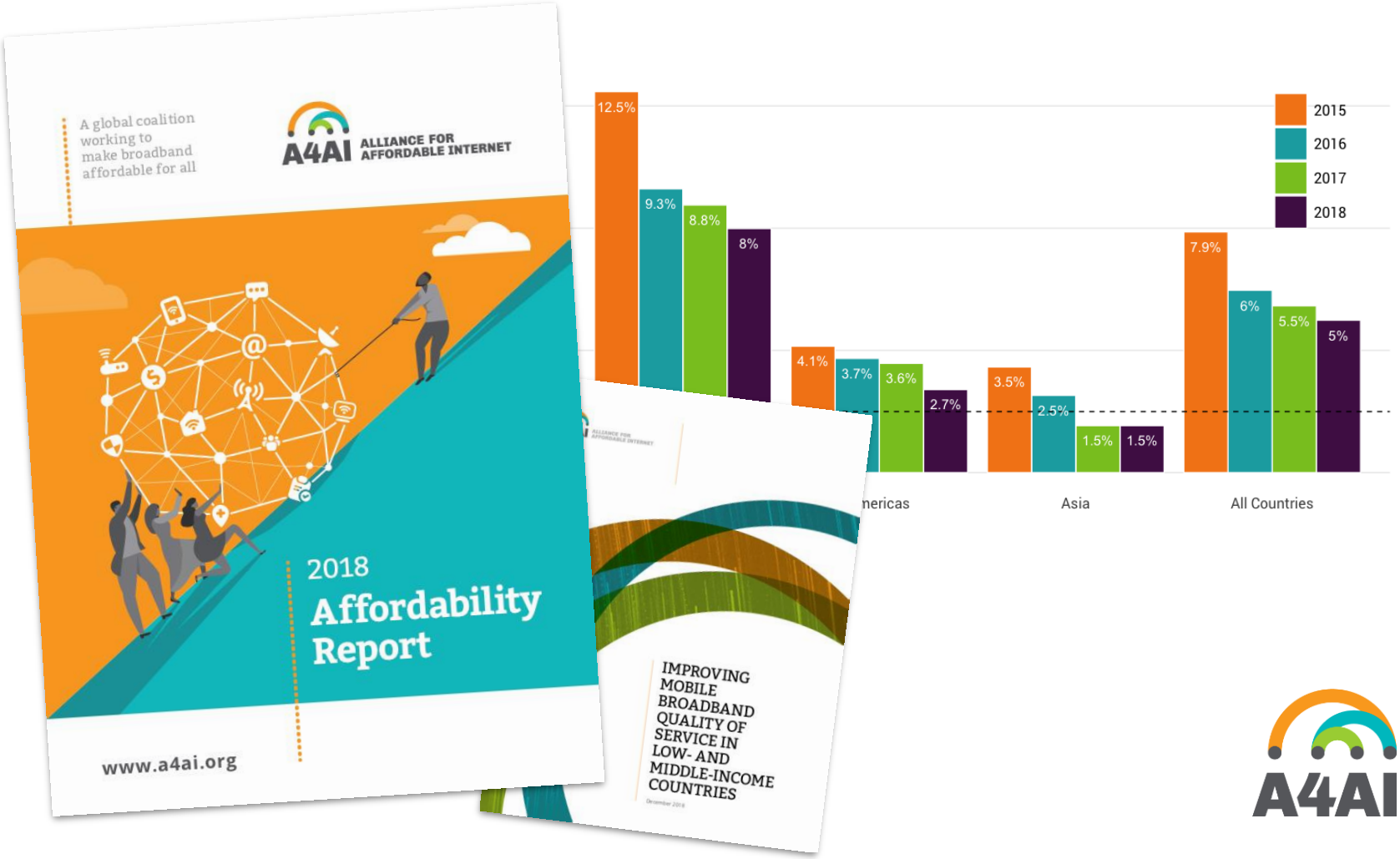
A global coalition working to make broadband affordable for all
A4AI
ALLIANCE FOR AFFORDABLE INTERNET
2018
Affordability Report
www.a4ai.org
IMPROVING MOBILE BROADBAND QUALITY OF SERVICE IN LOW- AND MIDDLE-INCOME COUNTRIES
2015
2016
2017
2018
12.5%
9.3%
8.8%
8%
4.1%
3.7%
3.6%
2.7%
3.5%
2.5%
1.5%
1.5%
7.9%
6%
5.5%
5%
nericas
Asia
All Countries
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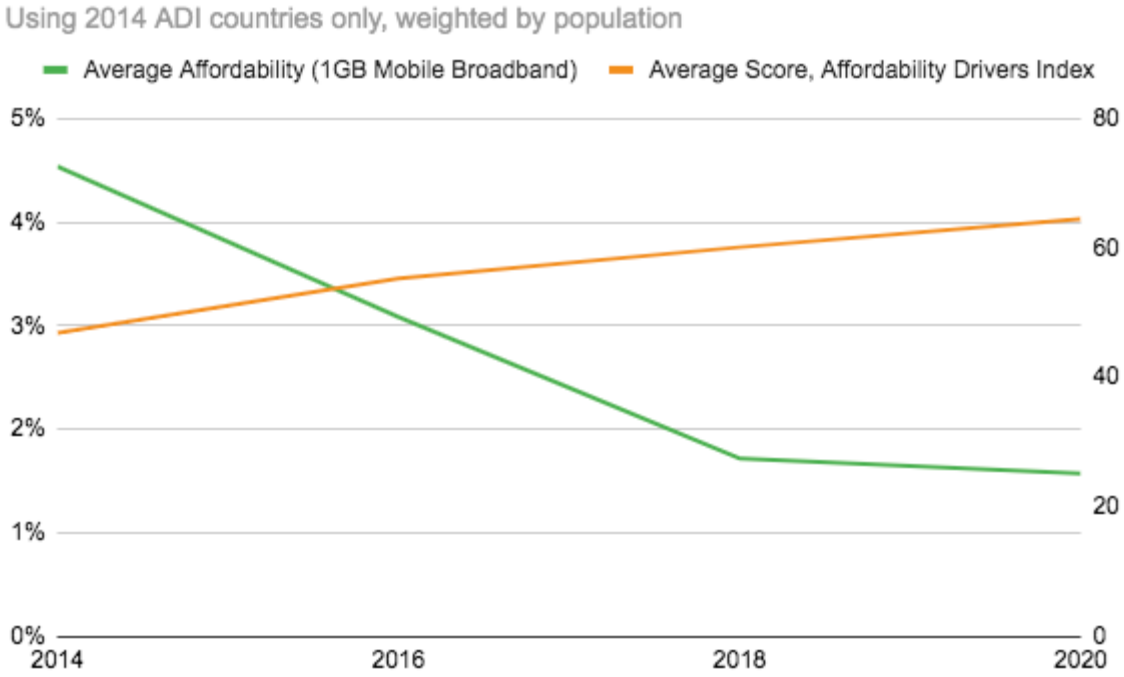
Average affordability and ADI scores over time



Source: Alliance for Affordable Internet

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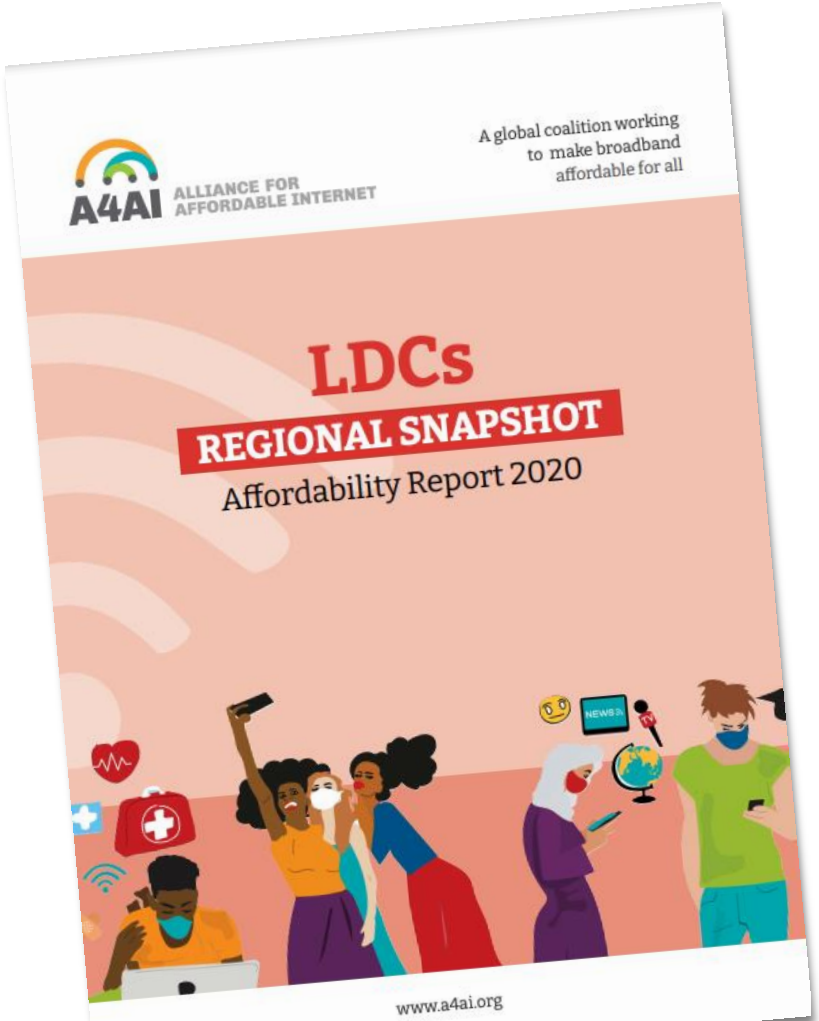

Available at
https://a4ai.org/affordability-report/

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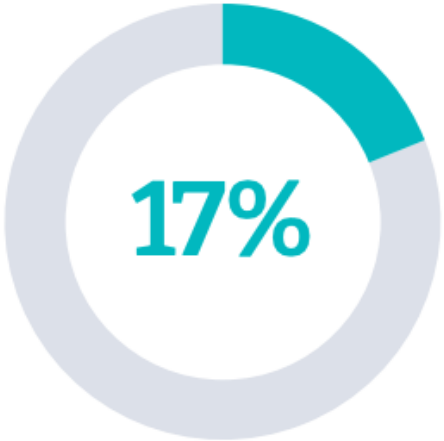
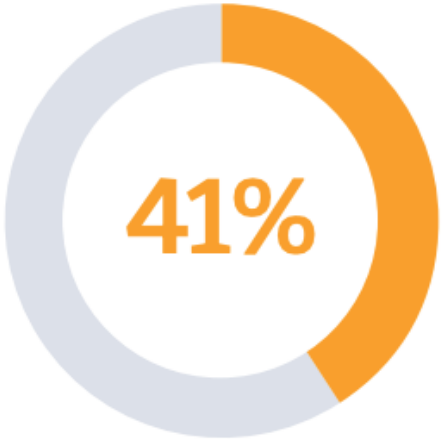
Among Least Developed Countries...



ONLINE POPULATION

Source: ITU, 2019



4G NETWORK COVERAGE

Source: ITU, 2020

INTERNET USE GENDER GAP

Source: ITU, 2019

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10 Highest-Scoring Countries, among LDCs

		Country	Access Score	Infrastructure Score	Index Score (/100)
1st	25th	**Senegal**	62.94	54.67	61.89
2	27	**Benin**	57.56	56.51	60.02
3	29	**Cambodia**	66.37	46.26	59.27
4	31	**Uganda**	57.25	54.19	58.64
5	32	**Rwanda**	63.99	46.59	58.19
6	33	**Nepal**	55.97	54.58	58.17
7	38	**Myanmar**	51.70	50.31	53.68
8	41	**Tanzania**	46.63	53.86	52.88
9	42	**Mali**	53.27	46.35	52.42
10th	45th	**Bangladesh**	48.48	46.91	50.19

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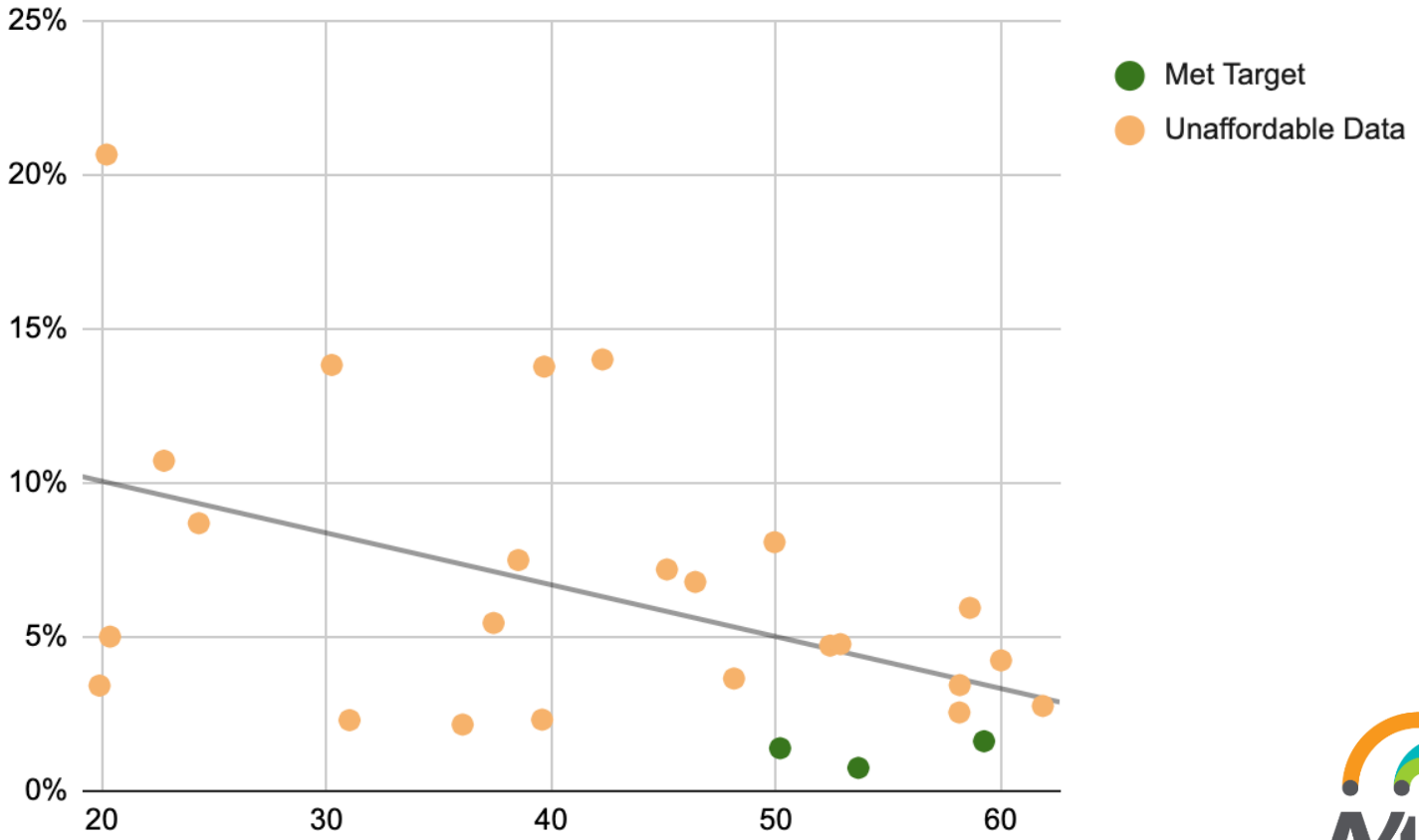
ADI score, compared to affordability of 1GB mobile broadband (LDC countries)



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- On **average**, prices in low- and middle-income countries have become more affordable, moving from 4.54% of average monthly income in 2015 to 1.58% in 2019.
- Countries like **Rwanda**, **Ecuador**, and **India** have seen the cost of 1GB mobile broadband come down by more than 60% during this time period.
- In the case of **Rwanda**, the price of 1GB as a fraction of the average monthly income in that country has decreased from **20.16% to 3.39%** between 2015 and 2019.

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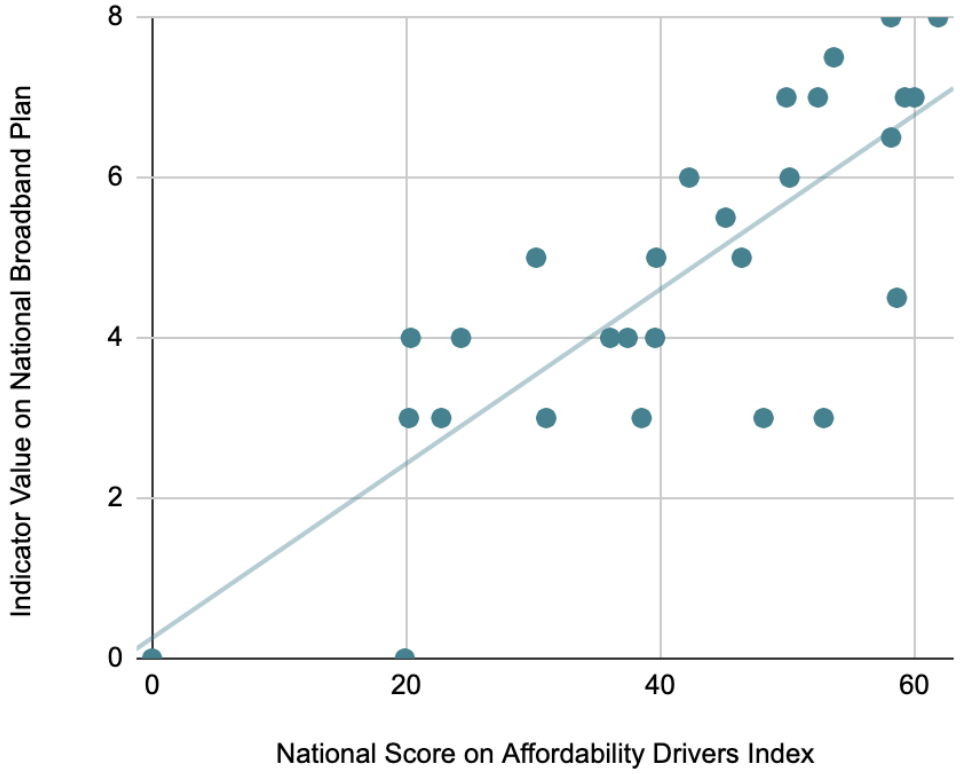
National broadband plans affect quality of policy environment, and in turn, affordability.



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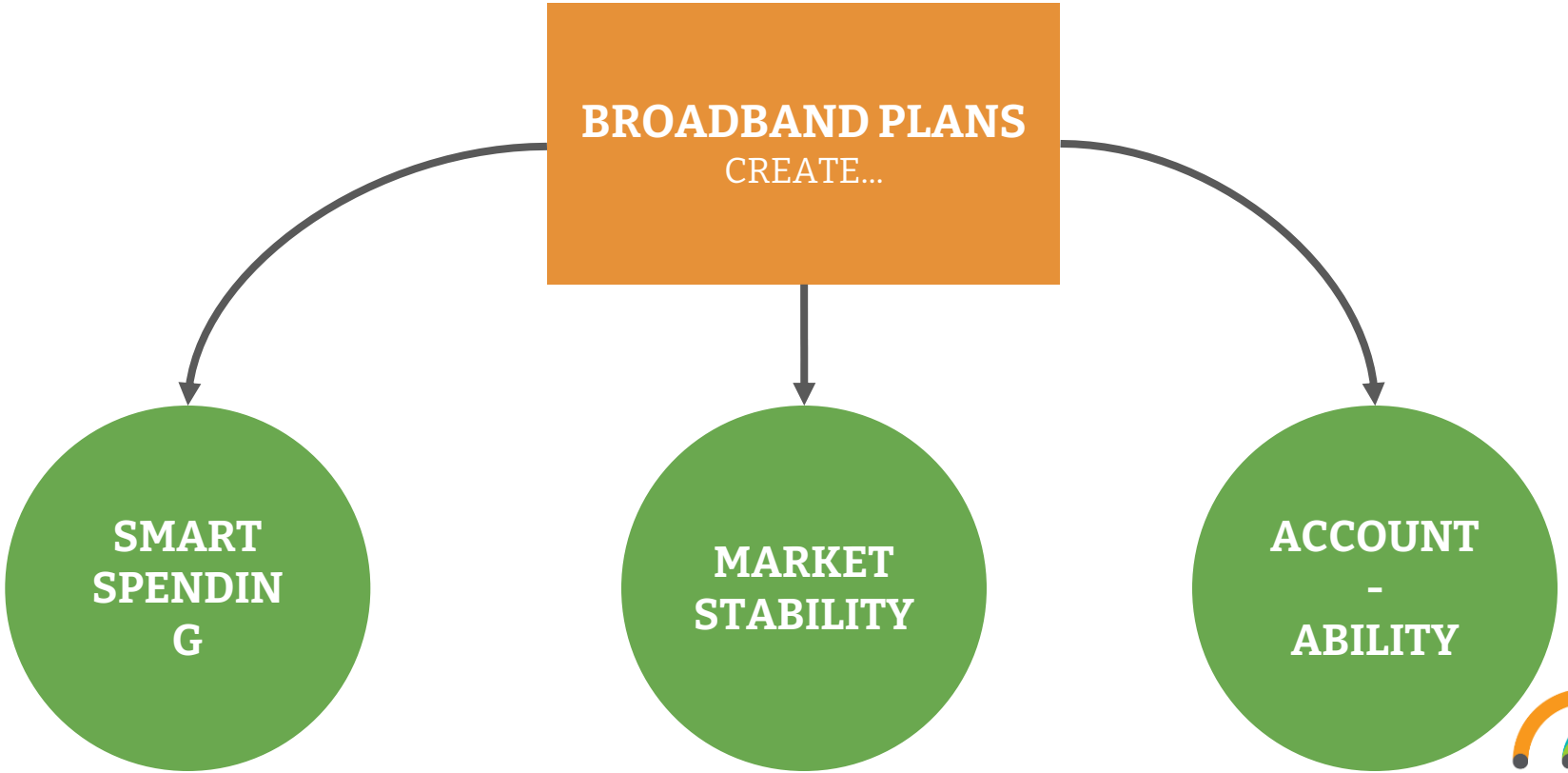

BROADBAND PLANS
CREATE...
SMART SPENDING
MARKET STABILITY
ACCOUNT-ABILITY

» Report Policy Recommendations

1. A plan must have **inputs from a diverse and representative set of players across the private sector, public sector and civil society** before publication.

2. A plan must have **targets that address a country's most critical gaps, have a clear measurement and a time limit**, and at least one target for network coverage and data affordability each.

3. A plan must come with **funding commitments** and a stated plan for transparent **assessment and review** that occurs at least every other year.

A4AI

Teddy Woodhouse, Research Analyst & Advocate
<teddy.woodhouse@webfoundation.org>

Internet Para Todos
was born in Perú to connect more than

6 million people

who do not have internet access in the rural areas of the country, to provide the same opportunities and promote their development

INTERNET PARA TODOS
Conectando a los no conectados

Internet para Todos started operations in Perú in 2019, a country with significant challenges and opportunities.

CHALLENGES FOR RURAL CONECTIVITY

- Complicated geography
- Low income level+ low population density
- Mobile operators focus on urban área due to high traffic demand.
- Poor basic infrastructure
- Tecnology designed for urban market

Áreas Rurales en Perú

- 8 millones de personas.
- Costa, montaña, selva.
- La movilización es vía fluvial, aérea y terrestre.
- 5,000 metros sobre el nivel del mar.
- 3 días de viaje desde la ciudad principal.

OPPORTUNITIES

Rural Mobile Infrastructure Operator (OIMR)

Unique model in the world that seeks to increase mobile coverage in rural areas

MNO
- ✓Users / Marketing
- ✓Specrum
- ✓Core

IPT
- ✓Access
- ✓Transport
- ✓Platforms

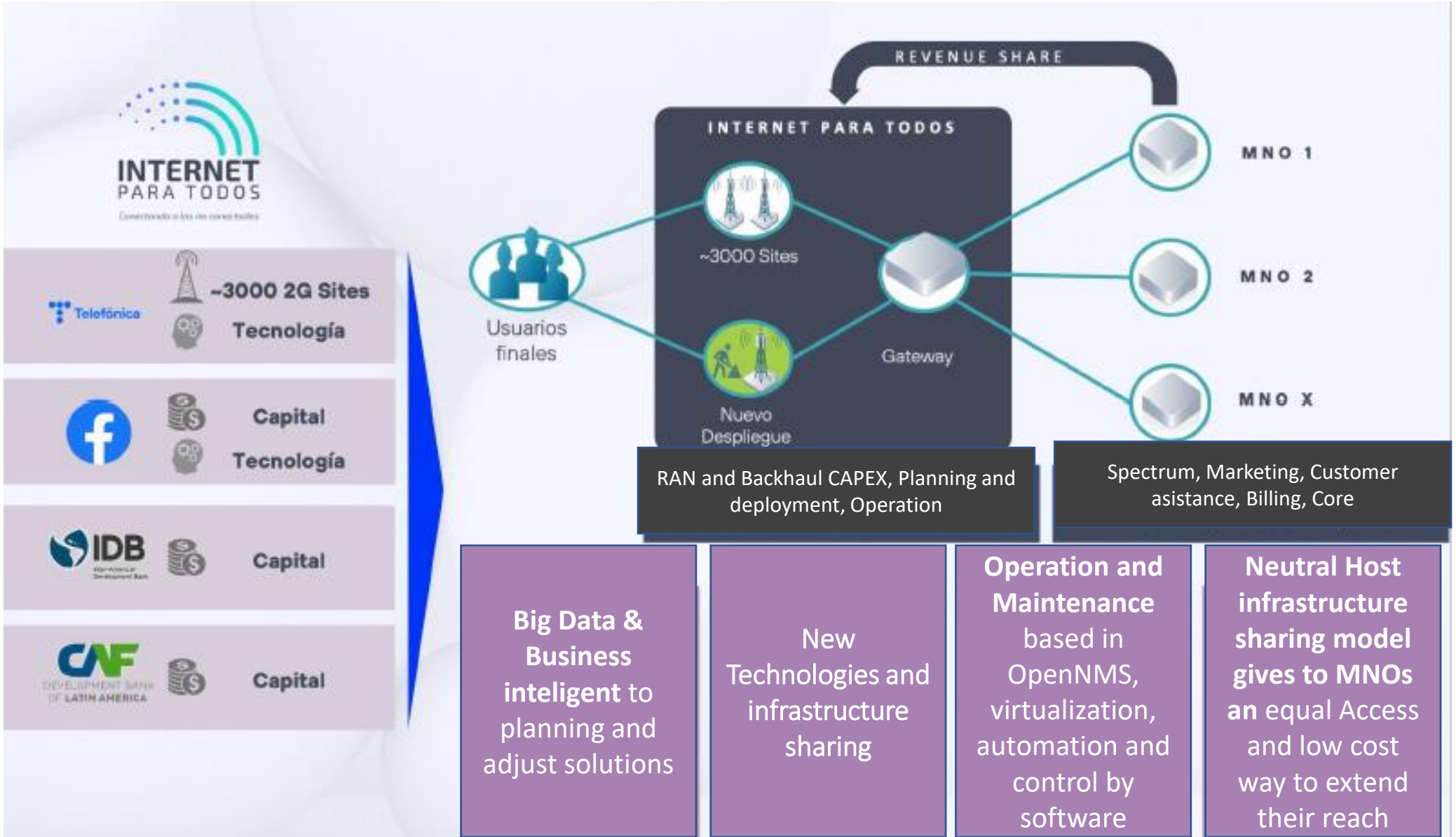
3.2 MM personas
380 Macroceldas
2750 Smallcells

Only Voice 2G
(Overlay)

2.8MM personas

No voice and data
Greenfield)

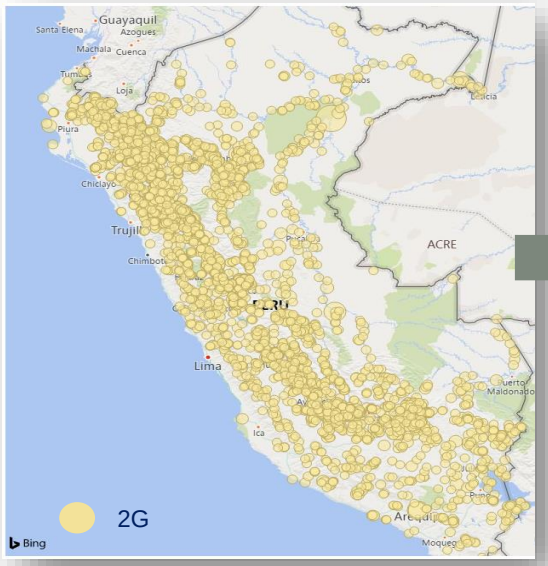
A **neutral-host NaaS infrastructure sharing** model paves the way to connect more people

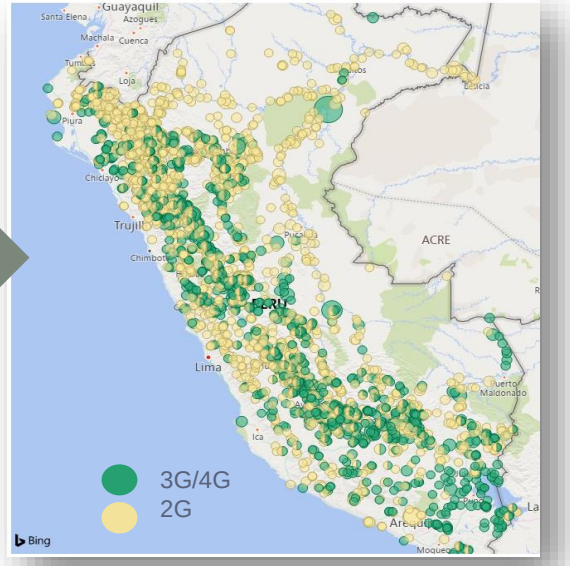


Internet para Todos has **connected more than 2.1MM people** with a deployment of 1600 4G sites

INTERNET PARA TODOS
Conectando a los no conectados

2018	IPT 2021
3139 sites 2G	1681 sites 3G/4G 1523 sites 2G





Satellite Transport 100%

1,533 km
Terrestrial transport

movistar entel

Population (MM)	2.1
CCPP (k)	12
Sites 4G	1610
Sites 4G satellite	793
Sites 4G Terrestrial	817 (51%)

Smart Deployment

With half of them overlay sites it has been possible to cover 66% of the target population (3.2MM).

In 2021 the goal is to connect 2.4 million people and more than 13K CCPP,close with more than 2000 sites with 4G

Cañicuto is a clear example of our **commitment** to build a more inclusive society

Children from Cañicuto (Puno region) had to walk about 10 km to receive classes in the middle of the pandemic.