22 PRACTICAL SOLUTIONS TO CONNECT THE LAST MILE

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ABSTRACT

Billions of people around the world do not use mobile Internet for stubbornly persistent reasons: lack of network infrastructure, lack of affordable Internet service and devices, gaps in skills and ability, and the perception that the Internet is not relevant. Based on insights from its Last-mile Internet Connectivity Solutions Guide, the International Telecommunication Union calls for more precise data to identify underserved populations and geographies. Sustainable connectivity solutions should then be selected based on their technical and financial appropriateness to the specific context and by balancing regulatory, revenue and usage models. Expanding connectivity requires creativity and collaborative approaches comprising policy and market mechanisms.

This chapter is based on ITU (2020[1]), *The Last-mile Internet Connectivity Solutions Guide: Sustainable Connectivity Options for Unconnected Sites,* http://handle.itu.int/11.1002/pub/8174ed4c-en.

Key messages

- As of 2021, about 38% of the world's population and as many as 73% of people in least-developed countries did not use the internet, excluded from the digital economy and from public digital services.
- Local conditions, affordability and market potential are barriers to broadband Internet provision in underserved areas, and policy and regulations sometimes make these worse.
- Policy makers should support creative, technology-neutral approaches to bridge the access gap, especially when more traditional approaches are insufficient or not financially viable.
- Financing should seek creative and blended approaches to overcome market constraints, including by mixing targeted subsidies and tax incentives with a variety of public, non-profit and private investment.

Globally, the number of Internet users has been growing and this growth accelerated during the pandemic: according the ITU's latest data about 800 million more people were online in 2021 compared to 2019 – increasing from 4.1 billion people in 2019 to 4.9 billion people in 2021 (ITU, 2021[2]). Nevertheless, about 38% of the world's population, or 2.9 billion people, were still offline and excluded from the benefits of the global digital economy (ITU, 2021[2]). About 67% of the population in Africa, 39% in Asia Pacific and 73% in least-developed countries were offline.

Bridging the digital divide is a social and economic imperative given that health, education, government and other services and applications rely on affordable, reliable and high-speed connectivity to serve communities. The COVID-19 pandemic, has shown an even higher value of Internet connectivity for work, health, conferences, and social activities, and hence a higher cost of being unconnected.

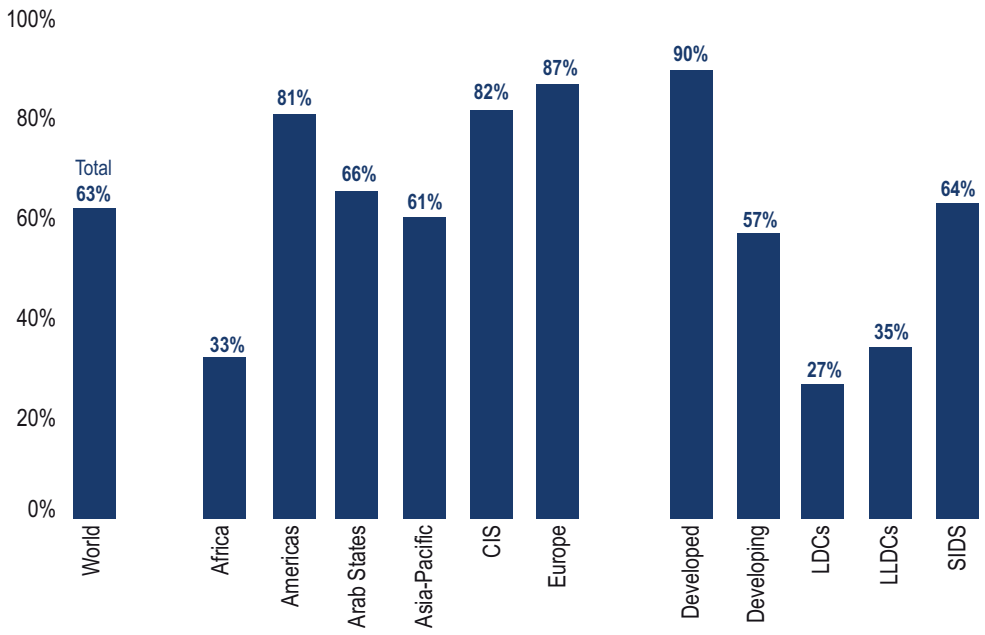
The International Telecommunication Union (ITU) Last-mile Internet Connectivity Solutions Guide (the Guide) proposes a four-step planning and policy development process to encourage deployment of network infrastructure (ITU, 2020[1]). First, more and better data are required to identify digitally underserved geographies and populations. Second, while several technological solutions exist, they should be reviewed for technical and financial appropriateness to each context. Third, identifying the most viable Internet connectivity solution requires balancing regulatory, revenue and usage models. Finally, implementing interventions to expand connectivity will take creative, collaborative approaches that use both policy and market mechanisms.

Inadequate connectivity holds back digital transformation

The digital transformation of economies depends on universal connectivity, itself underpinned by broadband. Sustainable Development Goal (SDG) 9 includes a specific target (9.c) of universal, affordable Internet access in least-developed countries by 2020. Nevertheless, the Alliance for Affordable Internet estimates that SDG 9.c will only be achieved in 2044, 22 years after the intended target date of 2020 (A4AI, 2020[3]). Furthermore, average prices for entry-level mobile broadband service are unaffordable (above 2% of average gross national income for 1 GB of data) for over a billion people in at least 57 countries – almost all of them developing or least-developed (A4AI, 2020[3]).

In 2019, major multi-stakeholder groups emphasised universal Internet access as central to digital transformation. In its June 2019 summary report, the United Nations Secretary-General's High-level Panel on Digital Cooperation recommended "that by 2030, every adult should have affordable access to digital networks, as well as digitally-enabled

Figure 22.1. Percentage of individuals using the Internet, by region and development status, 2021



Note: 2021 values are estimated by ITU.
Source: ITU (2021[2]), *Measuring Digital Development: Facts and Figures 2021*, https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf.

financial and health services, as a means to make a substantial contribution to achieving the SDGs" (UN Secretary-General's High-Level Panel on Digital Cooperation, 2019[4])

There are four main reasons why billions of people remain offline: (1) lack of network infrastructure, (2) lack of affordable Internet service and devices, (3) gaps in skills and ability, and (4) lack of perceived relevancy. Even where telecommunication networks are present, coverage gaps characterise the deployment of all network technologies, but access to the Internet is additionally limited by the high prices of service and devices, the relevance of services and applications, and/or users' lack of digital skills. According to the GSM Association (GSMA, 2021[5]), more than 450 million people (approximately 6% of the global population) are not covered by mobile broadband (3G or higher), particularly in rural and remote areas. This coverage gap is compounded by a usage gap with 43% of the world's population living within a mobile broadband coverage but not using the Internet.

Steps to connect the unconnected

The ITU's Guide to last-mile connectivity solutions proposes four steps to encourage deployment of network infrastructure through planning and policy development in interventions.

Step 1. Identify digitally underserved geographies

Identifying the geographic limits of network infrastructure in relation to a population's location is key to closing the digital divide. However, there is no systematic, publicly available and universal dataset of global connectivity infrastructure.[1] A database for all connectivity-related information made open and available to all would help policy makers, development co-operation providers, private sector actors and other stakeholders

make informed decisions about investments and approaches. The Guide offers a list of mapping resources.

Step 2. Review the options among existing solutions

The next step is to compare existing technologies, business models, and regulations and/or policies for connectivity. The Guide provides summary tables of common wireless, wired and emerging technologies, and assesses their potential throughput and coverage area, the capital expenditure needed to deploy a new network, the ongoing operating expenses and whether a particular technology is suitable for rural deployment, where connectivity is lowest.[2]

Step 3. Match the viability of solutions to contextual constraints

Determining the binding constraints is a prerequisite to designing an appropriate, sustainable, connectivity intervention for a given unconnected geography or community. The most sustainable Internet connectivity solution for a context is a matter of fit across different criteria. This requires refinement to balance the following factors:

- **Affordability:** Technical and financing decisions impact the cost of connectivity. It is important to select characteristics and models that fit within target prices for end users.
- **Usage:** Understanding why and how the connectivity will be used is important to ensure delivery of meaningful access and to determine the network type best suited for a locality. At the same time, the network should be able to accommodate demand growth and changing usage patterns. Understanding usage also means putting in place the services and applications that are best suited to the local population and adapting those to users' needs and local languages.
- **Financial viability:** It is important to measure the economic viability of the investment. Some technologies are better suited to commercial operations, while non-profit entities likely prefer low-cost technologies. Viable solutions depend on the nature of the access gap in the target locality and can impact the choice of operating entity that is most appropriate for the intervention. Financial viability is important for both commercial and non-profit entities.
- **Structure:** Policies and regulations are also key levies for extending connectivity access but often narrow the options for intervention, especially those deployed by non-government entities. While they can be a helpful parameter, understanding how policies or regulations might stand in the way of adopting an appropriate technology or business model can also guide policy makers and regulators to reform and remove structural barriers.
- **Financial sustainability:** A solution's revenue model and expected uptake in the target locality will determine whether the solution can cover the network's operating expenses. For-profit entities will examine the additional question of desired profit within a reasonable timeframe.

Regulatory influence is the starting point for economic viability. Market-expanding interventions increase market efficiency.

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However, when viability cannot be achieved by market mechanisms alone, a government may want to induce universal access by using policy and regulatory interventions such as subsidies, tax alleviation, and free or low-cost licensing.

Step 4. Implement mechanisms that can expand connectivity

The last step is to consider financing mechanisms and market and policy interventions. The Last-mile Connectivity Case Studies Database review of 123 interventions shows several ways to increase universal coverage and service for Internet connectivity.[3] Internet policy and regulatory actions found to increase deployment by encouraging market expansion and addressing market failure include:

- **Authorise licences with simplified procedures for rural areas**. This model is particularly helpful when the regulatory requirements for a full-service operator constitute a barrier to entry for new entities. Tanzania's Micro Mobile Network Operator license encourages cellular service for small populations in rural areas. In Peru, the Telecommunication Investment Fund's subsidy auction lets service providers compete by requesting the lowest subsidy from the government for service in targeted rural areas. This widely replicated model works best with flexible regulatory policies and low-cost technologies.
- **Discount the cost of a license, provide auction credits for frequencies or allocate frequencies for social use**. These interventions reduce financial barriers to deploying wireless technologies where they are appropriate but not viable due to the cost of spectrum licensing. Mexico's Federal Telecommunications and Broadcasting Law of 2014 (Brennan et al., 2014[6]) introduced a "social use" concession for spectrum assignments[4] reserved for community, educational, cultural or scientific purposes. Measures can include co-ordination of radio emissions to avoid interference or allocation of scarce radio frequencies among competing uses.
- **Reduce risk through public-private partnerships that attract new players to the market and encourage existing ones to expand.** By mitigating their exposure to risk, private entities become more willing to invest resources in areas that might not offer as good a return as other networks. Brazil enacted policies that incentivise service providers to deploy networks in areas deemed commercially nonviable, including rural and remote areas. The incentives include state tax credits granted to mobile service providers, limited to the amount proven as invested by the company.
- **Encourage blended finance.** Investment structures that pool commercial capital with public and/or "patient" capital (private capital that seeks sub-commercial returns) reduce the risk of networks in low-return areas. Creative funding strategies can bridge the access gap caused by demand uncertainty or lagging demand growth in rural areas. The ITU-UNICEF Giga initiative (see Chapter 24) uses resource pooling to connect schools to the Internet in underserved regions.[5]
- **Implement tax incentives and reduce costs for service providers**. Reducing taxes on mobile handsets and connectivity devices directly improves access in areas where networks already exist. Kenya's exemption of mobile handsets from the 16% value-added tax, increased ownership and mobile services purchases (Deloitte LLP and GSMA, 2011[7]). Gabon World Telecom Labs, supported by capital from the Universal Service Fund, aims to expand access to 2 700 villages in remote areas following an infrastructure-as-service approach whereby different providers share network infrastructure, reducing their costs (Barton, 2017[8]).

More generally, encouraging competition improves market efficiency. Whether through more players, anti-trust regulation or other mechanisms, competition helps bring down the cost of access for end users. A more competitive market also lowers barriers for new entrants

that might deploy networks in areas unserved by incumbents, directly increasing coverage. For example, to lessen monopolisation of services, Ghana and Nigeria granted new submarine cable licenses to private-sector operators building undersea cable networks, thus increasing the number of players and encouraging competition (Ukodie, 2008[9]).

Box 22.1 provides an overview of how policies, commitments and actions by digital technology companies are key to achieving inclusive digital transformation.

Bridging the access and usage gap: Next steps to universal connectivity

Achieving connectivity for all requires a collaborative approach. Creating networks of stakeholders in each country and globally will enable continuous collaboration, partnership and discussion of evolution opportunities in the sector. Where the barriers are technological, a technology-neutral policy environment encourages creative deployment in areas that need new approaches to connectivity. In many cases, technological solutions exist for technical problems, such as terrain, that prevent access in a locality. Authorising innovative uses of communication technology for commercial and non-commercial service and allowing entities to use new and emerging technologies can bridge the access gap, especially where more traditional technologies prove insufficient or are not financially viable.

But in many cases, policy, regulations and financing remain the biggest barriers to expanding access to connectivity. Bridging the access and usage gaps takes flexible policies and regulation, and innovative

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and collaborative financing of connectivity infrastructure, services and devices.

In both cases, ensuring that enough information is available to Internet service providers and other partners to make informed decisions can help expand coverage and connectivity. Identifying underserved populations and the solutions they need by improving market data on network coverage, infrastructure assets, population density and income, and grid electrification is a foundational step towards market efficiency. While most infrastructure and socio-economic data represent country averages, mapping underserved areas to provide last-mile connectivity requires databases with finer precision and accuracy.

BOX 22.1. CORPORATE ACTION CAN DRIVE INCLUSIVE DIGITAL TRANSFORMATION

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The policies, commitments and actions of digital technology companies are key to achieving inclusive digital transformation. The World Benchmarking Alliance's Digital Inclusion Benchmark rates the most influential digital technology companies on four areas:

- enhancing universal access to digital technology
- improving school connectivity and all levels of digital skills
- fostering safe use and respect for digital rights
- practising open, ethical and inclusive innovation.

In 2020, the average score across 100 companies was just 35% of the possible maximum, with software and IT service companies trailing hardware manufacturers and telecommunications operators. Companies scored lowest on access and skills, and better in the use and innovation measurement areas. Some indicators highlight alarming trends. For example, only 16 companies demonstrated any high-level commitment to child online protection or had guidelines for the ethical development and use of artificial intelligence. Digital companies need to adopt a principled and harmonised approach towards issues such as privacy rights, cybersecurity and child protection online, among many others, raising the bar and working with regulators to drive inclusive digital transformation.

Access initiatives are ad hoc, and transparency around economic contributions varies greatly

The most common initiatives for universal and affordable access often involve distribution of equipment or provision of free or discounted services to vulnerable populations. However, many of these were short lived and it is unclear how many people benefitted from them. Most of the programmes for women and girls involved mentorship and training to inspire interest in science, technology, engineering and mathematics, though some were more innovative. For example, Chinese technology company Baidu, Inc. included a feature on its Baidu Map application to help breastfeeding mothers find nurseries. But very few companies committed to accessibility principles early in the design process for products and services, and only 23 reported soliciting feedback from stakeholders, including disabled persons, during the design cycle.

An indicator in the access measurement area tracks company disclosure of its direct economic contribution, including taxes paid in markets of operation. Only 15 companies disclosed all elements of their direct economic contribution, with European and Asian (excluding Chinese) companies the most transparent, and US companies the least.

Training fails to build the most impactful skills, particularly for women and girls

While most companies had initiatives on technical skills and school connectivity, fewer undertook initiatives for basic and intermediate skills that boost people's livelihoods. The ad hoc nature of many access and skills initiatives, and a lack of impact assessments are common failings. Companies need to provide clearer, more consistent support to improve digital skills, especially for women and girls.

Source: World Benchmarking Alliance (2020[10]), Digital Inclusion Benchmark, https://www.worldbenchmarkingalliance.org/digital-inclusion-benchmark/.

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NOTES

1. Additional information such as population, cost of usage, type of usage, type of devices, base stations, spectrum usage, applications usage would be very helpful.
2. See Tables 17, 19 and 25 of the Guide at: http://handle.itu.int/11.1002/pub/8174ed4c-en.
3. The database is available at: https://docs.google.com/spreadsheets/d/11OX2LEXxzll3N7wOZ21iDxIq-FBda_K3EJsmy6tMbBI/edit#gid=222819063.
4. Frequency spectrum allocation refers to the process of determining the use of a given block of frequencies. Frequency spectrum assignment refers to the determination of who is allowed to utilise that block.
5. For more information, see: https://www.itu.int/en/ITU-D/Initiatives/GIGA/Pages/default.aspx.