Addressing the Digital Divide

Taking action towards digital inclusion

UN HABITAT
FOR A BETTER URBAN FUTURE

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Taking Action towards Digital Inclusion

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Foreword

Ms. Maimunah Mohd Sharif

Under-Secretary-General and Executive Director, United Nations Human Settlements Programme (UN-Habitat)

As the agency with the mandate to coordinate urbanisation matters within the UN System, UN-Habitat often highlights that half the world's population - 3.5 billion people - now live in cities. The world is both urbanising and digitising at a rapid pace and we see that digital technologies have great potential to assist Member States in their efforts to achieve sustainable urban development. The 'smart city' as a concept is the lynchpin connecting these two global mega-trends. It can help Member States achieve positive transformative change by harnessing ICTs and digital technologies to improve urban efficiency, quality of life and sustainability.

Whilst digital technology can have enormous transformative potential for positive change, it can also perpetuate existing social and economic inequalities. In 2020, I saw many children struggle to get 'connected' including the students in my rural village with many missing out on their educational needs.

To address this yawning digital divide, the UN Secretary-General has made a strong case for human rights in digital spaces in his 2020 Roadmap for Digital Cooperation, which lays out key areas for action including universal connectivity, promoting digital public goods, and ensuring trust and security in the digital environment. Additionally, in the Connect 2030 Agenda, our colleagues at ITU commit to bridging the digital divide for an inclusive information society and enabling the provision of broadband access for all, leaving no one offline.

For UN-Habitat, the use of digital technologies in cities and by cities must be appropriate to ensure that the prosperity they bring is shared among urban residents, cities and regions. Ultimately, the deployment of technology needs to be grounded in the real needs of people. It should pay particular attention to underserved populations in order to address inequalities and bridge social and spatial divides. Our People-Centered Smart Cities flagship programme was launched in 2020 to provide strategic and technical advice to local, regional and national governments to enable them to take a strategic and proactive approach to digital transformation, while meaningfully engaging their residents and ensuring human rights in digital spaces.

We must address the elephant in the room. People-centered smart cities cannot be built when so many remain outside of the digital world. The People-Centered Smart Cities Playbook Series aims to help cities and communities ensure that urban digital transformation works for the benefit of all, driving sustainability, inclusion and prosperity in the process. Each Playbook in the series represents one of five Pillars of People-Centered Smart City development: Community, Digital Equity, Infrastructure, Security and Capacity. Collectively, the playbooks outline key activities, provide recommended actions, and policy toolkits that provide actionable guidance for cities seeking to ensure a more equitable, inclusive and sustainable future for smart cities.

About UN-Habitat

The United Nations Human Settlements Programme (UN-Habitat) is the United Nations programme working towards a better urban future. Our mission is to promote socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all. We work with partners to build inclusive, safe, resilient and sustainable cities and communities and promote urbanization as a positive transformative force for people and communities, reducing inequality, discrimination and poverty. UN-Habitat provides technical assistance, policy advice, knowledge and capacity building to national and local governments in over 90 countries.

UN-Habitat is coordinating the implementation of the UN System-Wide Strategy on Sustainable Urban Development and in close coordination with national and local governments, the agency leads the monitoring of Sustainable Development Goal 11 (SDG11) on sustainable cities and communities as well as the New Urban Agenda.

UN-Habitat's approach to people-centered smart cities

Launched in 2020, UN-Habitat's flagship programme "People-Centered Smart Cities" acknowledges the transformative potential that digital technologies can have for sustainable urban development. Through the People-Centered Smart Cities flagship programme, UN-Habitat provides strategic and technical support on digital transformation to national, regional and local governments.

Digital transformation is now critical to meet the demands of sustainable urban development. In the past decade, internet connectivity has become a requisite for full participation in society, including access to education, affordable housing, and critical government services -- yet 3.7 billion people were offline in 2019. In recent years, digital innovations like civic technology, geographic information systems, the sharing economy, open data, and digital platforms have changed how people understand, manage and participate in cities. The COVID-19 pandemic introduced even greater urgency for local and national governments alike to bridge the digital divide especially for marginalized groups and informal settlement communities, build more efficient and secure data management systems, and protect citizens' privacy when using digital services. These activities are the foundation for inclusive and resilient smart cities.

Unfortunately, many 'smart city' initiatives have fallen short on sustainability, where technology has been applied uncritically, based on supply rather than demand. Investments in smart city projects that prioritize technology's capabilities over residents' needs have not delivered expected impact. Instead, we see trends towards surveillance, private ownership of digital public goods and infrastructure, and the perpetuation of discrimination through automated decision-making powered by artificial intelligence. As cities have become testbeds for these new technologies, there is growing concern about a lack of oversight, transparency, and potential human rights violations in smart city frameworks.

Smart cities can have a tremendous positive impact on people's lives, but only when people are at the center of the development process. This is why UN-Habitat is introducing the '**people-centered smart cities**' approach, which aims to show how smart cities can be an inclusive force for good, if implemented with a firm commitment to improving people's lives and building city systems that truly serve their communities. This requires engaging deeply with the needs of all residents and urban stakeholders through meaningful community participation, bridging the digital divide, developing essential digital infrastructure and governance, and building capacity through multi-stakeholder partnerships. It also requires governments to take a strategic approach to digital transformation, understanding its potential, and ensuring that it aligns with existing priorities as outlined in the 2030 Agenda for Sustainable Development, including sustainable transport, inclusive neighbourhood planning, providing affordable housing and reducing carbon emissions.

This new series of playbooks is a key normative component of UN-Habitat's People Centered Smart Cities flagship programme that aims to empower local governments to take a **multi-stakeholder approach to digital transformation that realizes sustainability, inclusivity, prosperity and human rights for the benefit of all.** To that end, local, regional and national governments will find pragmatic guidance for how to develop smart city strategies that are more inclusive, sustainable, and aligned to the actual needs of residents. We look forward to working with a wide variety of partners to implement the recommendations from the playbooks in a collaborative manner.

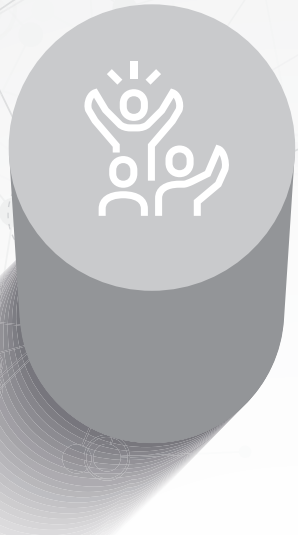
3.7 billion people

were offline in 2019

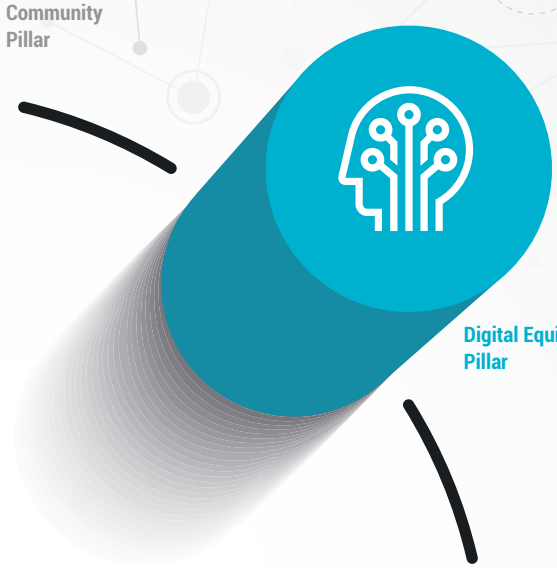
In the past decade, internet connectivity has become a requisite for full participation in society, including access to education, affordable housing, and critical government services

The People-Centered Smart Cities framework

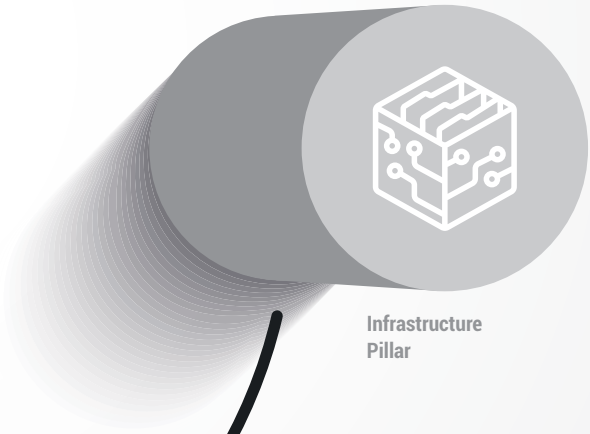
presents a holistic approach to developing smart cities that leverage data, technology, and services to empower people. The framework rests on five pillars: Community, Digital Equity, Infrastructure, Security, and Capacity. Each pillar consists of core values, key activities, and recommended actions compiled from international best practices in government, the private sector and civil society. These activities are outlined in a series of Playbooks which when taken together help local governments develop smart cities for people that are more inclusive, safe, and sustainable.



Community Pillar



Digital Equity Pillar



Infrastructure Pillar

Security Pillar

Capacity Pillar

Digital Equity Pillar

This pillar addresses how to build equitable access to ICTs with a focus on internet connectivity, digital skills, and digital devices.

- **Activity 4:** Build a foundation of universal access to affordable internet, digital skills and digital devices.

Core Values

- Meaningful participation in today's digital age requires a high-speed broadband connection to the Internet.
- Bridging the digital divide requires tackling access to connectivity, skills and devices.
- Hyperconnectivity is not the same as digital inclusion. Connectivity is a vehicle for increasing access to ICTs, but digital inclusion is about opening doors, increasing knowledge, and broadening horizons to help communities become more proactive, engaged, and aware.

Who is this playbook for?

This playbook is for local governments, policymakers, civil society and non-governmental organizations operating in urban and rural environments seeking to take action to bridge the digital divide in their communities. This playbook provides these groups with support to contextualise their efforts within the broader framework of the UN's resolutions, the Sustainable Development Goals, the New Urban Agenda, and follows the core values outlined under the Digital Equity Pillar of *Centering People in Smart Cities: A Roadmap for Local and Regional Governments*. If you intend to use this playbook, please consider reading the accompanying playbook Assessing the Digital Divide: Understanding internet connectivity and digital literacy in cities and communities, as the activities in this document build on the previous one. Finally, the playbook prepares these organizations to take action to develop solutions for the digital divide, starting by creating a comprehensive digital inclusion plan that is appropriate for the digital divide taxonomy readers learned to identify in the previous playbook. At the end of this playbook, readers should be prepared to take the first steps towards developing a digital inclusion plan and mobilising partnerships to take action to solve their community's digital divide.


INNOVATION
FOR BETTER LIVES

01

Overview: The global digital divide

Access to the internet, digital skills and devices is necessary for communities to thrive in today's world.

As our connections to each other, our governments and the services that we buy, build, share or consume increasingly go online, communities across the globe are finding internet connectivity to be a requisite for full participation in society. These trends were solidified once the global COVID-19 pandemic took hold and communities worldwide struggled to access fundamental services like critical public health information, remote education and telecommuting opportunities that had moved exclusively online. Perhaps the greatest lesson learned from the COVID-19 pandemic is that access to internet connectivity can no longer be considered a luxury but is instead a cornerstone of society's resilience.

The **digital divide** is the gap between those who have access to and use ICTs including internet connectivity, internet-enabled devices and digital literacy skills and those who do not. Access to all three are fundamental for communities to establish a robust and sustainable connection to the digital world, particularly as fundamental pillars of society such as education, workforce development and innovation move online. Internet connectivity is widely regarded as the foundation for participation in a digital society, and a pillar of **digital human rights**. Without robust, affordable, sustainable and inclusive internet connectivity, the benefits of digital technologies, participation in digital society and access to digital service offerings are systemically exclusive.

The digital divide is a global phenomenon. Over 1 billion new internet users have been added over the last five years. However, nearly 3.7 billion people were still offline in 2019. Meanwhile, 5G subscriptions are forecasted to reach 3.5 billion in 2026, accounting for an estimated 54 percent of total mobile data. Despite the promise of 5G for enterprise settings, by 2025 the majority of the world will still be on 4G (and likely 3G, or even 2G). Globally several trends are emerging with respect to the digital divide:

Africa and the Commonwealth of Independent States (CIS) regions face the largest gaps.

- 87% of people are using the internet in developed countries, compared with 44% in developing countries.
- Africa is the region facing the biggest gap in connectivity, where 23 percent of the population has no access to a mobile-broadband network. Eastern Europe and the Commonwealth of Independent States (CIS) are the second regions with the largest gaps, with 11 percent of the population lacking access.
- Affordability remained a major barrier in LDCs to internet uptake in 2020.

Much of the world's digital divide is urban/rural.

- Many connectivity gaps persist in rural areas. In LDCs 17% of the rural population has no coverage at all. 19% of the rural population is covered by only a 2G network.
- Globally, 72% of households in urban areas had access to the internet in the home in 2019, almost twice as much as in rural areas (nearly 38%).

HELPDESK

Introduction to the Digital Helpdesk

The Digital Rights & Governance Helpdesk is a technical and policy-related support service set up by UN Habitat and the Cities Coalition for Digital Rights, which helps local governments address inclusion and human rights aspects of their local digital strategies, policies, projects and services by providing contextual, tailored assistance and advice. The acceleration of digitalisation requires cities to consider how human rights relate to digital technologies but often lack capacity, tools and access to best practices. The Helpdesk reinforces a comprehensive governance-based approach towards people-centered smart cities, leaving no one and no place behind, to guide the development of these frameworks.

For more information Click here

The digital divide persists within well-connected cities, megacities and regional centers.

- Globally, 28% of urban households lack internet connectivity, and 37% do not have access to a computer.
- In developed countries, 13% of urban households still do not have internet connectivity at home, compared to 19% of rural households.
- Connectivity remains limited or absent in informal settlements around the world.

Young people feel the burden of the digital divide.

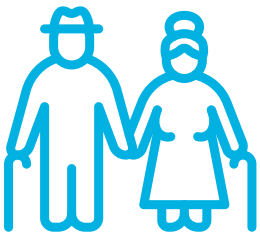
- At the end of 2019, just over half the world's population was using the internet, but this proportion increased to over 69% among youth (15-24 yo).
- In 2019, 3.7 billion people were offline, and 369 youth were offline.
- In developing countries 66% of youth are online, compared to 98% in developed countries.

Women are under-represented online.

- In 2019, globally, 55% of the male population is using the internet, compared to 48% of females.
- LCDs have the largest gender gaps.

The urban elderly are disconnected.

- Studies have shown up to 27% of the urban older population lack internet connectivity.
- Older people who are most vulnerable in terms of poor health and low economic status are least likely to be using computers.



27%
of the urban older population lack internet connectivity

The global poor are disconnected.

- Four of the UN's six regions have internet costs that exceed the Broadband Commission's Affordability Target.
- Fixed broadband access is unaffordable in 111 countries (56%).
- Across Africa, the average cost for just 1GB data is 7.12% of the average monthly salary.
- In some LCDs, 1GB costs as much as 20% of the average salary.

Digital illiteracy persists.

- In 40% of countries reporting data, less than 40% of individuals reported being able to carry out a digital activity considered as a "basic" **information communication technology** (ICT) skill.

The importance of internet connectivity

With an increased recognition of the tremendous impact internet connectivity can have on equity, innovation and economic development, affordable and accessible internet becomes crucial. Because so many fundamental aspects of society are now tied to internet access, accessible digital infrastructure has become an essential standard of living similar to water, energy and housing. The UN Secretary-General has called for all the world's people to be connected by 2030 and made global connectivity, digital inclusion and digital human rights key pillars of his Roadmap for Digital Cooperation.

The Sustainable Development Goals (2015), The New Urban Agenda (2016), The Connect 2030 (2018) and the UN Secretary General's Roadmap for Digital Cooperation (2020) all consider digital connectivity and digital inclusion to be crucial infrastructure and services. These and other resolutions demonstrate that the international ecosystem is supportive of leveraging **digital inclusion** to achieve equitable outcomes for all.

Why digital inclusion matters

The internet has fundamentally transformed how we connect to the institutions that serve us, and to each other. Overtime, **digital services** have become more deeply integrated into daily life in a way that threatens to exclude a significant proportion of the population. Industries fundamental to society like education, workforce development, finance, government, innovation and even community building now have online analogs that can provide greater convenience and opportunities to connect to critical information and services online.

Furthermore, the systemic lack of internet access for indigenous and rural communities obstruct these groups from developing and advocating for digital services that meet their unique needs. The absence of these groups online risks their further marginalization.

Increasing internet connectivity enhances people's visibility online and through their ability to participate in digital services. This can provide new opportunities for residents to be represented in data who would otherwise be excluded from key analyses contributing to policy and programme development. However, connectivity can also introduce new vulnerabilities to communities who may not directly benefit from visibility by the local government, such as undocumented immigrants and people who are targets of state-sanctioned violence.

The dimensions of society that have digital twins, or show significant analogous online activity are many fold and include:

- Education
- Workforce development
- Financial inclusion
- Participation in digital services & e-government
- Innovation
- Community building & collective action

Who experiences the digital divide?

The disconnected largely belong to historically disadvantaged communities. While every community is different, the digital divide consistently reflects and amplifies existing social, economic and cultural inequalities such as gender, age, race, income and ability. Communities that are known to be disproportionately affected by the digital divide include:

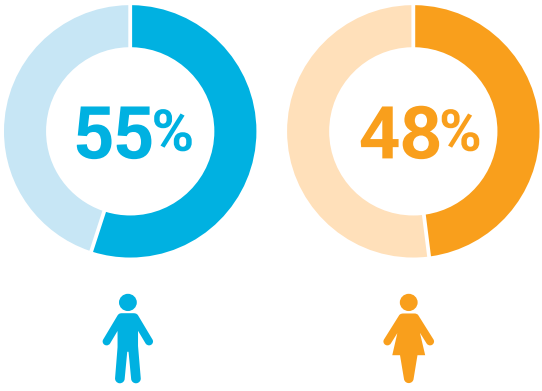
- Women and girls
- Children and youth
- Older people
- Urban and rural poor
- Marginalised or minority communities
- Persons with disabilities
- Indigenous communities and First Nations
- Refugees and persons on the move

Understanding the digital divide

There are many dimensions of the digital divide, which can vary from the physical to the psychological. The previous playbook, *"Assessing the Digital Divide"* identified six main types, though any city can display a combination of them. In order to take steps to study the digital divide, and ultimately attempt to resolve some of its effects, it is important to have a fundamental awareness of the many ways that the digital divide can occur. Please refer to Section VII of *Assessing the Digital Divide* for a detailed look at each of the following:

- The connectivity divide: Urban vs. rural
- The infrastructural divide: Infrastructure and access
- The socioeconomic divide: Affordability
- The demographic divide: Gender, ethnicity, age & disability
- The cultural divide: Motivation & social acceptability
- The literacy divide: Awareness & education

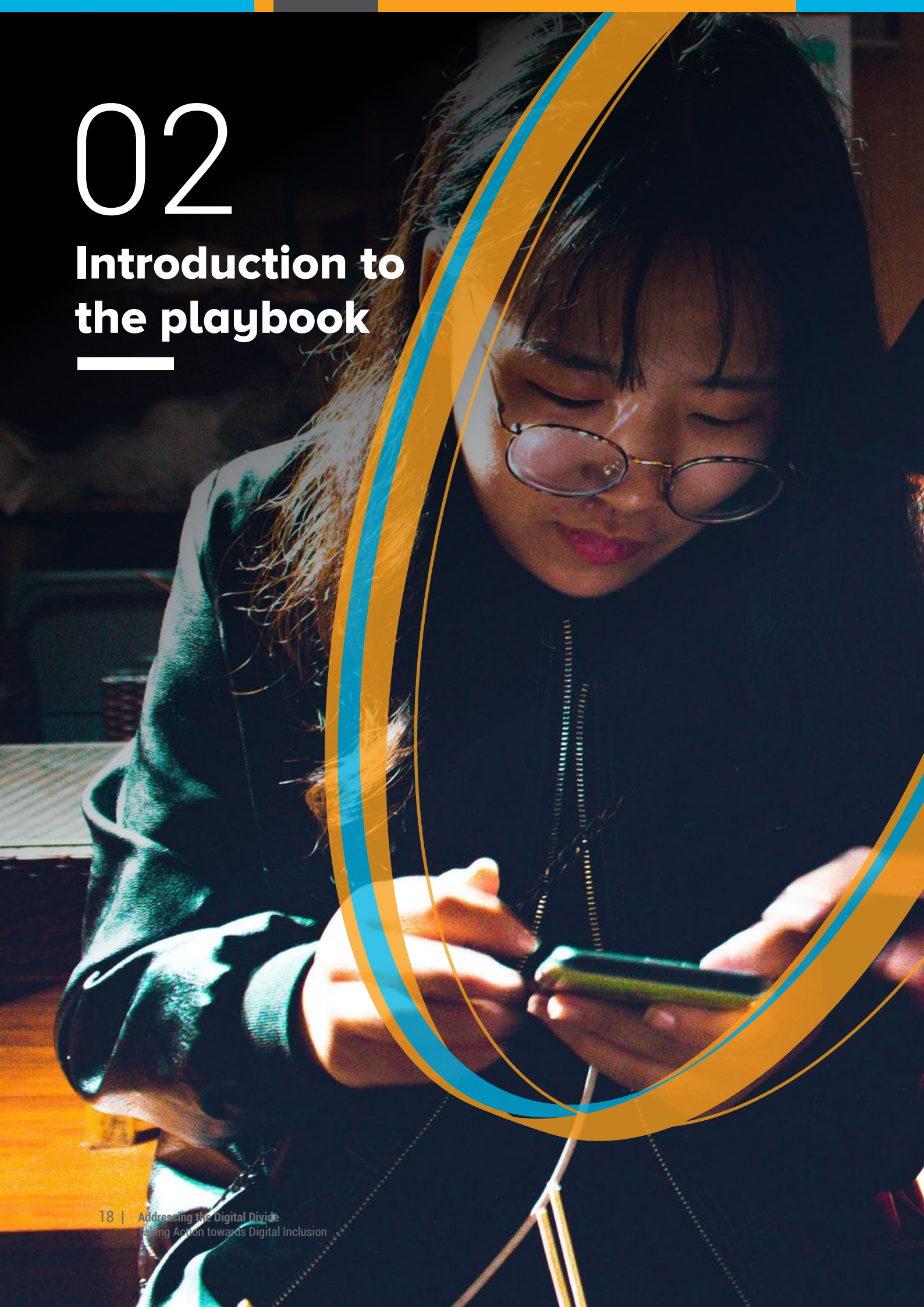
Increasing connectivity is not enough to solve digital inclusion. Connectivity is a vehicle for increasing access to public services and enhancing opportunities for residents to become active citizens, but digital inclusion is really about opening doors, increasing knowledge and broadening horizons to help communities become more proactive, engaged and aware. The struggle to do so can transform residents from being passive consumers of technology and urban environments, to being active users of them.



Globally, 55% of the male population is using the internet, compared to 48% of females.

02

Introduction to the playbook



Internet access is increasingly understood as not just a technology problem, but rather as an intersection of several socio-economic conditions that influence access and use of information communication technologies (ICTs).

Today, the most successful digital inclusion solutions attempt to reduce social and digital inequality simultaneously[1]. Likewise, urban policy perspectives that address the digital divide need to be multidimensional: solving a combination of technological, geographic, economic, educational, social and cultural reasons for the divide.

The impact of the digital divide and its disproportionate burden on disadvantaged groups have encouraged public and private sector organizations to advance digital inclusion efforts. Digital inclusion refers to the activities required to ensure that all communities have access to ICTs. Digital inclusion efforts can include building affordable, robust broadband internet service; providing internet-enabled devices that meet users' needs; providing access to digital literacy training; and creating applications and online content designed to enable participation and collaboration[2].

Until recently, digital divide policy was focused primarily on physical access to infrastructure. While the cost and affordability of ICT remains a big issue in many countries, a larger problem is the lack of knowledge and understanding of information technology itself. Some studies show over 40 percent of the world population have not been given the opportunity to learn how to use a computer[3]. Consequently, emerging digital inclusion policy focuses more on improving digital skills, better internet usage opportunities and building awareness of positive attitudes of the internet.

This Playbook is structured around six main steps that public authorities, NGOs or communities can take towards taking action to address the digital divide. These steps build on the foundation laid by UN-Habitat's previous playbook, "*Assessing the Digital Divide*," where readers learned how to collect, analyse and report grassroots data about the digital divide in the form of a **digital divide assessment** (Step 1). Following their assessment, readers should be able to identify their **digital divide taxonomy** (Step 2), or the unique conditions of their communities' digital divide. This playbook picks up from there, guiding readers through four additional steps towards translating data into action:

1. **Co-creating a digital inclusion plan** - How to develop and execute an evidence-based, community driven approach to developing a comprehensive digital inclusion plan.

2. **Choosing a framework for taking action** - An overview of the various types of models for taking action including government owned and operated Networks, public private partnerships and facilitating community networks.

3. **Choosing a finance model** - An overview of types of finance strategies that can be leveraged to achieve your goals.

4. **Executing your plan** - Examples of best practices around the world of successful strategies targeting each type of digital divide taxonomy.

Throughout the playbook readers will see boxes that highlight real world examples of some of the strategies presented, with a special focus on developing, rural and informal contexts.

40% 

of the world population have not been given the opportunity to learn how to use a computer

03

Key stakeholders in the digital divide landscape: At a glance

There are several key stakeholders involved in building, operating and maintaining internet connectivity infrastructure, delivering internet connectivity services, building public support for connectivity initiatives and taking action to study and address the digital divide. The roles outlined below reflect some, but not all the possible roles each group can take.

National governments

- Establish national-level policies and regulation governing internet connectivity
- Coordinate large scale investment in internet infrastructure
- Provide legislative frameworks that shape local government intervention
- Deploy physical connectivity infrastructure
- Create frameworks for connectivity provider competition, or opportunities to lease infrastructure

Regional governments

- Can be responsible for the coordination of service delivery at the regional and local level
- Shape regional policy for the approach to building, maintaining or operating connectivity infrastructure in cities.
- Can coordinate a regional broadband plan to attract resources and investment to the region

Local governments

- Can use several strategies to address the digital divide including government-owned networks, public private partnerships (P3s) or facilitating community networks
- Act as stewards of digital inclusion plans, and are the primary stewards of community engagement that drives improved services and connectivity
- Can work to protect digital assets (data and infrastructure) from exclusive private sector ownership
- Can enable equitable access to ICT
- Can open channels to harness residents' capacity and knowledge regardless of demographics or class to influence government activities or develop digital inclusion activities on their own terms

Private sector

- Can provide large scale investment in internet infrastructure and services
- Small scale businesses, local companies and start-ups can also support internet connectivity in a local context through business solutions such as mesh networks, WiFi, small cell deployment and other combinations of innovation and emerging technology
- Can provide consulting services to support the development of digital inclusion plans, reports and expertise

Nonprofits & community-based organizations

- Can build programming to connect residents to digital skills development opportunities, internet infrastructure or digital devices
- Are critical partners for local governments seeking to develop a localised plan for addressing the digital divide, as they often have intimate knowledge of the communities they serve
- Can coordinate resources, tools and policy guidance to inform best practices at the local level

The educational sector

- Can offer facilities, personnel and technical expertise about the digital divide to local governments
- Research organizations and institutions like universities can offer expertise in both studying the digital divide, collecting and analysing digital divide data and performing scientific analysis or policy recommendations for resolving it

Cooperatives, community advisory groups, local alliances

- Can self-organize to develop their own solutions to the digital divide and the issues that stem from it, such as rural broadband cooperatives
- Local internet connectivity alliances and advocacy groups can also provide important contextual information and galvanise public support for connectivity initiatives
- Community advisory groups, made up of community members and expert stakeholders can be formed to guide the development of any digital inclusion or digital infrastructure plan developed by a local government

HELPDESK

Multi-level governance and partnerships

Multi-level stakeholder engagement strengthens local governments' initiatives by applying cross-sectoral collaboration and knowledge sharing into the development of solutions. By including different groups in the co-creation and co-design process of an initiative, solutions have a strong focus both on addressing people's needs and generating societal impact. Because of the complexity of the digital divide challenge, cities must prioritize cooperation, not only at the local level, but also regionally and internationally. This can enhance the strategic position of cities to coordinate and mobilise resources to address the divide, while contributing to the development of standards and people-centered practices globally.

For more information Click here

04

Best practice principles for a digital inclusion plan

Designing and executing digital inclusion efforts is challenging. Cities lacking budget, capacity and sometimes expertise, often struggle to build digital inclusion processes that are feasible, equitable and effective. Before we dive into the six steps towards crafting a digital inclusion plan, consider some best-practices derived from a global perspective that can help guide your work towards building a strategy that effectively navigates the nuances of your community's digital divide.

Center the community

In most communities there are leaders who serve the communities you seek to impact, and there are service providers who likely already work on digital inclusion efforts. Embedding these community leaders in an inclusive and transparent process is strategic for two reasons: 1) your reach can be expanded by working with leaders who serve, are part of, or have relationships with those you seek to impact, 2) your efforts can complement existing efforts rather than wasting effort building services that may already exist.

Examples of community leaders in digital inclusion include non-profits that have digital inclusion programming, community groups that build internet infrastructure or refurbish and supply devices to community members. To ensure effective implementation, the International Telecommunications Union Broadband Commission recommends assigning a coordinating agency that "owns" the plan and is ultimately responsible for its implementation in conjunction with other stakeholders[4].

Escape silo thinking

The digital divide is a complex, multifaceted problem requiring solutions that address both technological and social challenges. Therefore, when planning your strategy, avoid framing the issue from a single perspective and consider the various stakeholders and sectors that should be involved in solution building. For example, Bogotá's "Território Inteligente" (Smart Territory) effort worked with 683 people from vulnerable groups, such as conflict victims, disabled people, ethnic groups, women, youth and rural residents to define digital inclusion priorities for the community[5].

Leverage data

The first playbook in this series, *Assessing the Digital Divide,* outlined a process for gathering local data from your community that characterises the digital divide experienced by your residents. Whether relying on national or regional statistics, or building your own grassroots data, consult your data before building a strategic plan and share your findings with stakeholders and community members as a first step towards driving the development of your strategy. Doing so has the effect of grounding your community's efforts in evidence-based decision making.

Maximise the ecosystem

Most organizations operate within an ecosystem of other organizations with similar goals. By studying your network of philanthropists, service providers, non-profits, regional and national governments, and industry partners you can identify shared infrastructure, goals and resources that can mutually benefit from a coordinated strategic plan. Public private partnerships (P3s) are common vehicles for the development of digital inclusion initiatives, though sometimes with mixed results. For example, the City of San Jose in the US launched a digital inclusion fund that partners with the private sector and local nonprofits to make and award grant funds for local area digital inclusion projects and infrastructure[6].

Know your opportunities & constraints

Local governments and NGOs have different jurisdictions over internet connectivity infrastructure varying by region. In several states in the United States for example, it is illegal for local governments to deliver broadband internet connectivity to the home, as it is considered to be in competition with private connectivity providers[7]. Make sure to address related legislation including privacy, data

protection laws and telecommunications regulation that may impact your solution space. Consider regulation of public and private space including land ownership, the public right of way, access to public and private buildings or supporting infrastructure and construction permitting.

Prioritise equity

Prioritise minorities, persons with disabilities, traditionally marginalised groups, low-income and rural areas or small businesses when designing your plan as these groups often suffer the most from lack of connectivity. Doing so requires effective community engagement that targets these groups to understand their lived experiences. For example, the City of Portland's Smart City Priority Principles were developed using community engagement to develop an equity lens by which to assess and prioritise smart city projects and investments.

Leverage existing service infrastructure

Existing service infrastructure can be more than internet fiber buried underground. Community organizations, schools and libraries are also a form of social infrastructure that often support digital literacy initiatives helping to reduce barriers to internet connectivity. Consider your own resources as well, including dedicated staffing that can potentially coordinate strategy development and community engagement. Sometimes, physical infrastructure shared by other entities such as streetlights or energy & water monitoring systems are powered by their own internet networks and can be leveraged to achieve last-mile solutions to internet connectivity.

Pilot & pivot

It can be challenging, if not impossible for local governments to justify making large investments in untested solutions. By leveraging pilot programs with clear evaluation criteria, stakeholders can identify lessons learned in a low-risk environment at a small scale. This can later inform a potential solution at a larger scale. If the solution is not successful, consider why this is the case and pivot to an alternative.

Create metrics to evaluate progress

Create detailed, measurable goals and strategies that enable an evaluation of progress. These metrics should include the perspective of special interest groups including school districts, hospitals, universities, minorities or persons with disabilities or specific needs. Collectively shared and clearly defined metrics must be in place in your plan to effectively evaluate progress towards a shared vision of digital inclusion.

Strive to be technology neutral

Your plan should contain a mixture of solutions that doesn't depend on a single type or source of technology. Strategies can include technology-specific measures, but should not favor specific technologies or providers. Your plan is like a blue-print for the solutions your community has identified to address the digital divide. Many types of organizations including NGOs, private sector organizations and nonprofits should be able to offer solutions based on your community's blueprint. Given the fast-pace of technology development, consider planning on a 3-5 year timescale.

Adopt standards

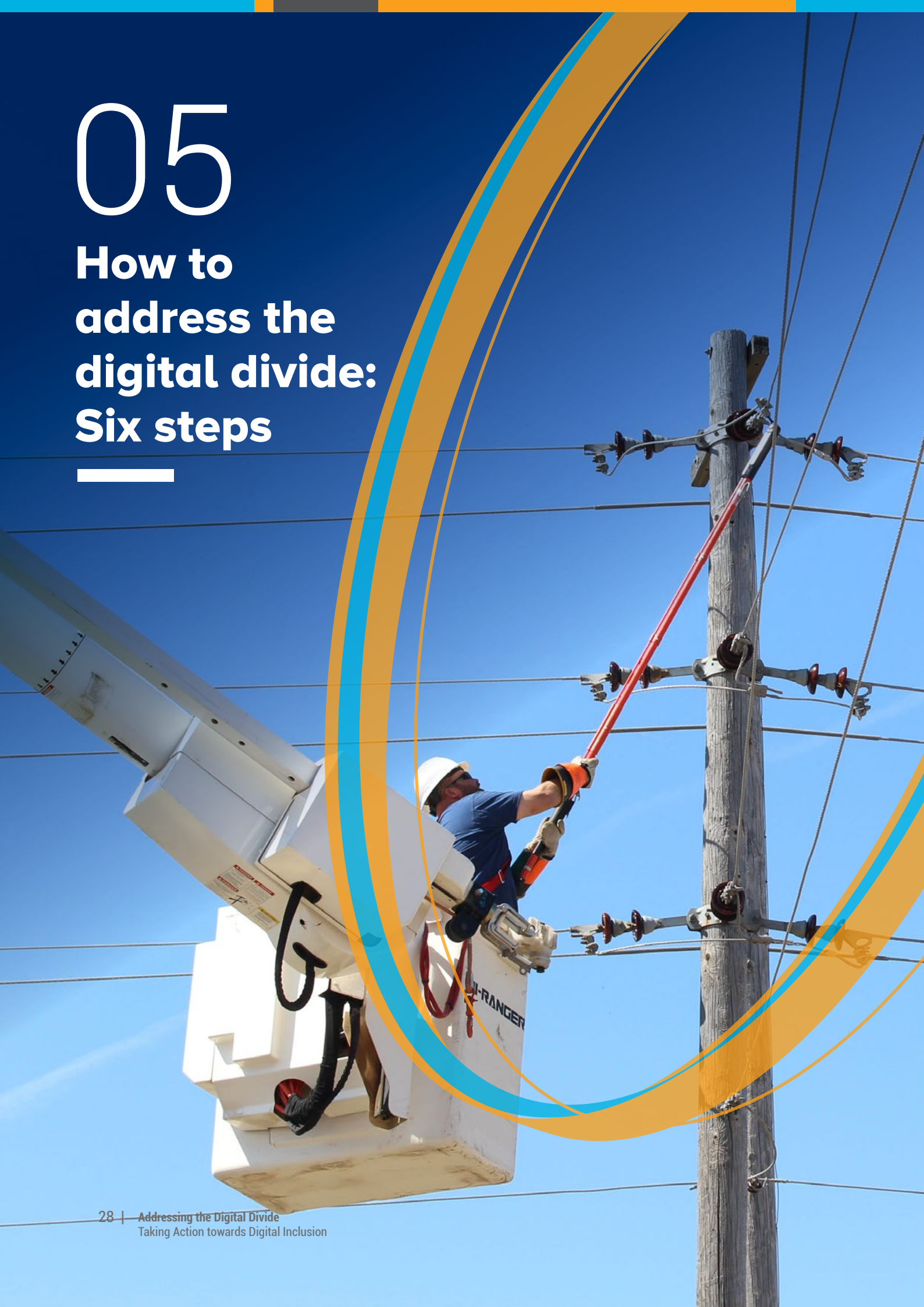
Adopt high-quality international standards for ICTs and digital technologies, and ensure an inclusive standardization process that can support growth and innovation while overcoming development divides.

Assign Roles for Enforcement

A successful Digital Inclusion strategy should account for enforceability and execution. Identify roles and responsibilities including who will be responsible for executing the plan, monitor progress, market the plan, or identify funding.

05

How to address the digital divide: Six steps



Together, this playbook and UN-Habitat's first playbook of this series, Assessing the Digital Divide, outline a six step strategy for studying and taking action towards bridging the digital divide, starting with conducting a digital divide assessment. The strategy is summarised in the graphic below:

Steps to address the digital divide

Step one

Conduct your digital divide assessment

A study of the digital divide in your community should identify the symptoms of the digital divide, the location where a lack of connectivity or digital literacy is occurring, and the underlying cause of the problem. We call these three key areas: gaps, locations, and roots. For a detailed overview of how to conduct an assessment of your community's digital divide, please consult the first playbook in this series, "Assessing the Digital Divide: Understanding internet connectivity and digital literacy in cities and communities," where you will find an overview of processes, methods and tools to guide your study.

Step two

Identify your city's digital divide taxonomy

In the previous Playbook, readers learned how to take steps to identify three components of the digital divide: gaps, location and roots.

Broadly, there are three ways that the digital divide manifests. These connectivity **gaps** are widely recognised as: connectivity (access to physical infrastructure), digital literacy and devices (access to digital devices that use the internet).

- **Connectivity –** Access to usable broadband internet in the home, or a means by which to conveniently and reliably access the internet whether by mobile phone or a public service center such as a public library. Usable internet is typically defined as a download speed of 10 megabits per second (Mbps). Remote learning or telecommuting typically requires between 5 and 25 Mbps[8].

- **Digital literacy** – Digital literacy is the ability to use information and communication technologies to find, evaluate, create and communicate information, requiring both cognitive and technical skills[9].

- **Access to devices** – Access to devices refers to affordable, sustainable access to internet-enabled devices that meet the needs of the user.

Ideally, a plan to bridge the digital divide should address all three. However, based on local data and information from stakeholders in your community, you may choose to emphasise one component over the other in proportion to the relative strengths and weaknesses of your community's current digital inclusion efforts, and the conditions of your unique digital divide.

Understanding **locations,** or where these symptoms are being experienced and by whom, is also critical for the design of your plan. This is the case not just for allocating resources to targeted areas, but also for leveraging the political leadership that represents these areas. In the playbook ***Assessing the Digital Divide: Understanding internet connectivity and digital literacy in cities and communities***, readers identified four types of locations that have different strategic advantages for capturing data:

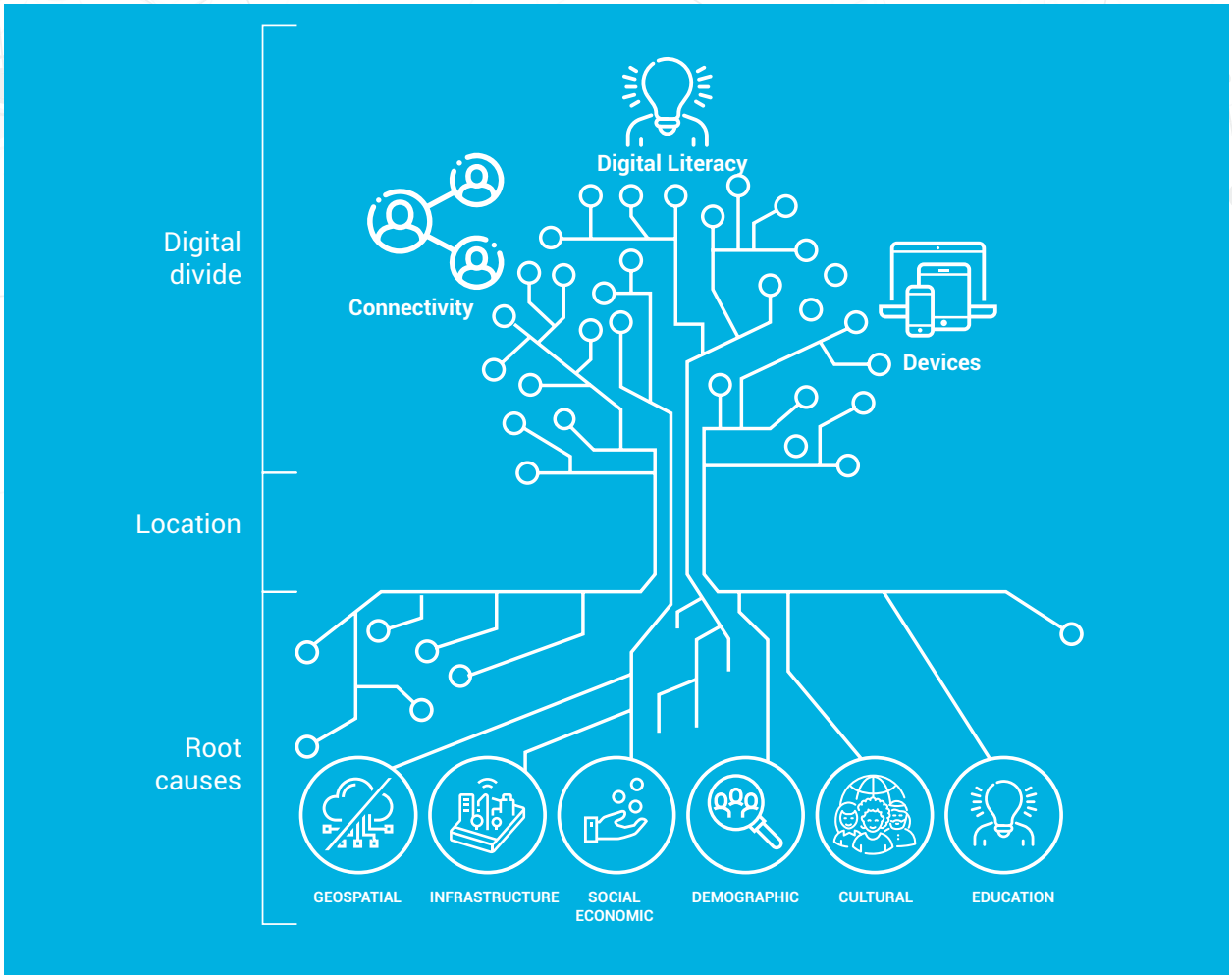
- **Political boundaries:** Political boundaries can include council districts, innovation zones or voting districts. Surveying the digital divide within political boundaries can be instrumental to gather the political support needed to attract resources for solutions development.

- **Addresses:** Address location data is the most precise for determining household internet connectivity, however surveys should take into consideration privacy requirements when collecting address data, and provide residents with both the opportunity to consent or "opt-out" of data collection, and a clear understanding of how the data will be used.

- **Geo-coordinates:** Geo-coordinates, or latitude/longitude is useful location data to collect for surveying informal settlements or remote rural areas where address data is not available.

- **Administrative boundaries:** Administrative boundaries are non-partisan boundaries set by organizations that administer services such as zip codes, prefectures, provinces or counties.

Perhaps the most important component of your plan is how your solutions will address the root cause of the digital divide. **Roots** address ***why*** some residents experience the effects of the digital divide and include:



- **Geospatial conditions** – Limited access to connectivity infrastructure, skills and devices based on the availability of resources and infrastructure in rural areas, informal settlements or areas with unique topography.

- **Infrastructure accessibility & availability** – The accessibility of internet connectivity infrastructure due to physical location, historic lack of public sector investment or informality.

- **Socioeconomic conditions** – Limited access to connectivity infrastructure, skills and devices based on affordability and need.

- **Demographic experiences** - Limited access to connectivity infrastructure, skills and devices based on gender, ethnicity, disability and age.

- **Cultural practices** –Limited access to connectivity infrastructure, skills and devices based on cultural practices, societal conditioning and perceived need as shaped by the experiences of a community or cultural group.

- **Education** - Limited access to connectivity infrastructure, skills and devices based on education level, awareness, familiarity with the internet and digital literacy levels.

Your community's unique digital divide conditions reflect your **digital divide taxonomy.** Any successful strategy you develop should take steps to target these unique conditions. Based on your digital divide taxonomy, different solution combinations may be appropriate. See Table 11.1. Digital divide solution typology, for a set of solutions that address each type of **root** cause for the digital divide.

Step three

Co-create a digital inclusion plan

Developing a digital inclusion plan is a multi-stakeholder, multi-step process. These strategies are most successful if they are evidence-based, community driven, involve multiple diverse stakeholders, outline responsibilities, and have clear levers for execution. The approach outlined below highlights six **actions** that can be followed to achieve a successful digital inclusion plan:

1. **Build your capacity:** Determine what financial, staffing, or infrastructural resources are required to be successful.

2. **Establish a baseline:** Your baseline is formed from all the existing research including your digital divide assessment.

3. **Build a community advisory group:** A community advisory group convenes leadership from stakeholders in digital inclusion to inform digital inclusion plans, policies and projects.

4. **Create an inventory of digital inclusion activity:** Compile known services, programs, or projects that develop digital inclusion in your community.

5. **Make a digital inclusion activity map:** Your digital inclusion activity map shows the geographic distribution of existing services and projects and the known digital divide.

6. **Build a digital inclusion plan:** A digital inclusion plan is developed with the community and service providers and sets forth guiding principles, definitions, activities, roles & responsibilities and funding for reaching a shared vision of digital inclusion.

Recommendations for resource-constrained environments or secondary cities are made in the boxes accompanying each action.

Action 1: Build your capacity

Building capacity refers to identifying and accumulating the necessary resources that will make digital inclusion work successful. This includes several aspects of programme development: funding, dedicated staff, leadership buy-in, infrastructure and branding/marketing or outreach resources.

The Broadband Commission for Sustainable Development recommends dedicating an office or staff within the local government to coordinate digital inclusion efforts[10]. Having dedicated staff ensures the continuity of the planning effort and enables cross-coordination across multiple stakeholders. Additionally, the local government can support an external nonprofit or staffed community organization to lead the effort.

BOX 10.1

Broadband public private partnerships: A gradient of risk, benefit and control

Broadband internet enables data transmission at high speeds and opens wide economic opportunities for communities with equitable access. Broadband is considered the most substantial form of internet connection to date, outperforming traditional dial-up, most wireless internet or mobile. However, the installation of broadband internet infrastructure is expensive and operationally complex. As a result, deployment of Broadband infrastructure often requires sustainable and innovative financing schemes that can be achieved through collaboration between municipalities and private internet service providers (ISPs).

These Public Private Partnerships (PPPs) have emerged in the past two decades as a vehicle to finance and scale broadband networks. PPPs can be structured in different ways that vary across three levers : 1) Risk, or the distribution of risk across the participating partners, 2) Control, or the level of control each partner has over various aspects of infrastructure deployment, maintenance, and operation, and 3) Benefit, or the level of benefit achieved for the community. Allocating responsibility for different phases of deployment is an important strategy municipalities can adopt that helps incentivise private sector partners to perform. For example, an ISP will be more likely to consider life-cycle costing during the construction phase when it is also responsible for later maintenance of the asset.

PPPs are challenging to bring about, often requiring a minimum of two years to develop. This is in part because such partnerships are vulnerable to various legal issues that must be addressed in advance. Issues such as access to public rights-of-way (PROW), clear financing expectations between the public and the private entity, and compliance with existing governmental regulation are common issues in PPPs. When properly configured in advance, PPPs have the greatest chance of achieving long term infrastructure benefits both for the public and the business sector.

BOX 10.2

Challenges using P3s for digital infrastructure in Tunisia

In the past, P3s have been sought by local governments for a variety of reasons including to acquire expertise, optimise public funds, improve quality, or support broad administrative reforms. Often P3s were used for key sectors like clean water distribution, energy, environment, and defense. However, more recently P3s have been leveraged as novel collaborative arrangements for IT projects, resulting in a global evaluation of their applicability to smart cities projects and programs.

A study by researchers at Ecole Supérieure de Commerce de Sfax, Tunisia and the Université Laval, Quebec City, explored what types of risk factors were incurred by P3s used specifically for IT projects by examining three case studies of P3s in Tunisia: the SAE (Operations Assistance System), GPS (Global Positioning System), and MailPost. Each project was undertaken by a national government body in Tunisia.

The SAE and GPS projects aimed to integrate information technologies in transportation infrastructure and motor vehicles. In these projects, policymakers sought to optimise the overall management of vehicles, transport loads, and transport routes. MailPost was initiated by the Ministry of IT and Communication and sought to facilitate administrative and commercial transactions within the national post office by enabling its retail and commercial customers to have access to e-messaging and other digital products.

The study identified three major risk factors and the adverse effects incurred by IT P3s in Tunisia:

- Strategic risk factors: Factors associated with high-level decision making, ranging from the difficulties in managing a political agenda and potential political instability, to the possibly inappropriate choice of a private sector partner.
- Operational risk factors: Factors associated with the implementation of projects. These factors concern the size and complexity of projects, communication problems among partners, and the lack of involvement of users and senior management.
- Key-resource risk factors: Factors related to the organizational, technical, and technological capabilities of the partners involved. Lack of experience and insufficient expertise with regards to P3 procurement or the system at hand are typical of this category of factor.

Altogether, the authors identified 13 risk factors and several adverse effects that can occur in IT P3s falling into each of the three categories. The authors conclude that more study is needed to truly assess the viability of P3s for IT projects, to better identify the potential pitfalls local governments should be aware of in order to create successful long term partnerships with the private sector for technology endeavors.

TABLE 10.1: Digital Helpdesk: international digital inclusion resources

Resource	Organization
How to Run a Citizen's Assembly: Handbook	Democratic Society - DemSoc
Digital Inclusion Toolkit	Ministry of Housing, Communities and Local Government, Croydon Council and Leeds City Council, UK
Data collection, hosting virtual events and Social Media Monitoring tutorial	Digital Human Rights Lab
The SDG Partnership Guidebook	The Partnering Initiative and UNDESA
Long Beach Equity Toolkit for City Leaders and Staff	City of Long Beach, USA

Depending on the legislative framework in which they sit, local governments have a variety of tools for developing internet connectivity in their communities at their disposal. Such flexibility allows local governments to use several strategies to address the digital divide including government-owned networks, public private partnerships (P3s) or facilitating community networks. In most cases, local governments should act as stewards of digital infrastructure plans, and be the primary stewards of community engagement that drives improved services and connectivity. See Section X.X, "Choosing a framework for action," for a review of the capacity-building tools available to local governments.

Several international resources and networks are also available for organizations seeking to build digital inclusion strategies. The table below highlights a few.

Action 2: Establish a baseline

A baseline provides supportive evidence that justifies the need for a digital inclusion plan. It frames the current digital divide landscape in detail and is formed from all existing and related research including:

- Your digital divide assessment
- Existing data and research from other service providers, local area governments, non-profits, or NGOs
- Regional, national and global data sets that inform your local context

Refer to Section X.X. in "*Assessing the Digital Divide*," for a list of data resources you can use, and a primer on how to develop your own digital divide assessment. Your baseline can include current data about internet connectivity and digital literacy rates in your community, the geospatial distribution of the divide and the demographics of people in your community that experience it.

Action 3: Build a community advisory group

A community advisory group convenes local leadership from stakeholders in digital inclusion to inform digital inclusion plans, policies and projects and includes existing service organizations, community alliances or advocacy groups, local and regional governments and private sector providers.

In a digital inclusion plan, the role of a community advisory group is to:

- Provide guidance, feedback and possibly approval regarding the plan's development
- Lend resources to achieve strategic outcomes of the plan
- Commit to roles and responsibilities defined by the plan
- Provide redundancy in the event that administrative priorities change within local government
- Define a shared vision on a pragmatic timeline

For example, the City of Portland developed a "Digital Divide Response Workgroup" including both city staff and residents to steward federal stimulus funding to appropriate Covid-19 recovery projects addressing the digital divide.

Action 4: Create an inventory of digital inclusion activities

One of the pitfalls of digital inclusion strategies that are not conducted in partnership with the community is that they allocate resources to build programmes that already exist. To avoid expensive redundancies, compile an inventory of known services, initiatives or projects that develop digital inclusion in your community.

Your inventory should be directly informed by your community advisory group. Important information to identify about the any digital inclusion services that already exist in your community includes:

- What the digital inclusion activity is
- What organization is delivering the service, and their type (private, non-profit, volunteer, church etc.)
- The target audience of the service or project
- Partnerships that support the service or project
- Performance measures used to evaluate the service or project
- Funding sources for the service or project
- Location of the service or project (gather an address, or geolocation i.e., latitude/longitude)
- The timeline of the service or project (is it ongoing or has a projected termination date)

Action 5: Make a digital inclusion activity map

Mapping your community's existing digital inclusion services and projects is a useful way to identify the reach of those services in relation to existing geospatial data you may have about the digital divide. You can refer to Chapter 09. of ***"Assessing the Digital Divide"*** for a discussion about how to map data from a digital divide survey using geospatial mapping tools. Broadly, a map of local digital inclusion activities should include:

- Service locations and known digital inclusion projects
- Data from your digital divide assessment, particularly internet connectivity rates
- Identify redundancies, gaps in service or other opportunities

The table below provides some examples of software you can use to map your digital inclusion initiatives, as well as data about the digital divide.

Table 10.2: Mapping software for digital divide data

Tool	Description	Price	Link
ArcGISOnline	Possibly the most widely used geospatial mapping tool. Includes data visualization tools, API integration, and ability to create a team of collaborators. Features robust data security and cloud-based analytics.	$$$	https://www.esri.com/en-us/arcgis/products/arcgis-online/overview
QGIS	Free and open source GIS software for Apple/Mac users only. Mimics most of the features of ArcGIS.	Free.	https://qgis.org/en/site/
Ushahidi	Free and open source mapping software. Ushahidi maps survey responses, but does not provide data visualization tools like the production of charts and graphs.	Free.	https://www.ushahidi.com/
CARTO	CARTO is an intuitive and user-friendly mapping software with a high degree of UX design. Subscription required. CARTO can easily integrate APIs, and includes access to data sets of choice for your region.	$$$	https://carto.com/
Tableau	Tableau provides both mapping and data visualization. The tool is very accessible for almost anyone, and includes easy to use tutorials.	Free version and paid version that unlocks additional features.	https://public.tableau.com/en-us/s/
Mapbox	Mapbox is a mapping tool that allows you to integrate your data with other map sources like satellite imagery. Mapbox is heavily customizable, and maps can be published to mobile, web, and even AR.	Free version and paid version that unlocks additional features	https://www.mapbox.com
R	R is a statistical software that allows you to perform complex statistical calculations on data in a "terminal" interface. R requires that you learn the "R" coding language. Outputs include standard statistical data visualizations.	Free and open source	https://www.r-project.org

BOX 10.3

Leveraging Geographic Information Systems (GIS) or urban management

GIS technology is a set of software and hardware tools for managing spatial data. GIS processing software enables the visualization of spatial data, extracts trends and patterns, and can run advanced statistical analysis. GIS programs are designed for data relevant to landscape management, urban and rural planning, and infrastructure engineering. Some application areas include environmental monitoring, resource management, urban development and demographic analysis.

The advantages of GIS software are cost savings, accuracy, efficient collaboration opportunities, and transparency of data-based decision-making. For example, mapping the distribution of certain resources across an urban area (roads, schools, emergency facilities etc.) can detect potential disparities in access to resources between certain neighborhoods.

The challenges associated with GIS are the need for technical training, computer resources, as well as reliable and comprehensive data sources. The most commonly used software is ArcGIS developed by the software company ESRI. Other software includes QGIS (open source) Atlas GIS, MapInfo Professional, IDRISI, Map Maker Pro, and Intergraph.

The GIS Handbook for Municipalities published by UN Habitat offers tremendous resources for how to leverage GIS for local government goals, and outlines requirements for establishing GIS in your municipality.

Action 6: Build a digital inclusion plan

Based on your insights from the community advisory group, baseline, digital inclusion inventory and digital inclusion activity map you can begin to develop a digital inclusion plan. The plan should set forth guiding principles, definitions, activities, roles & responsibilities and funding for reaching a shared vision of digital inclusion. Broadly, the plan should include:

- **Guiding principles:** The values that guide your digital inclusion efforts, such as equity, economic development or resilience.
- **Shared definitions:** Terminology describing elements of your plan where definitions of terms and solutions are agreed upon by the community advisory group.
- **Priorities:** The plan's key priorities for your community's unique situation, for example: cost reduction, equitable internet connectivity, increased digital literacy for seniors or accessible devices for persons with disabilities.
- **Goals, outcomes:** The goals and outcomes expected to be achieved by the plan's activities. This can include targets with measurable outcomes, such as a certain percentage of neighborhoods gaining access to broadband internet, or a percentage of a specific demographic receiving digital literacy training.
- **Timeline**: Include the expected timing and phasing of activities.
- **Roles & responsibilities:** Assigned activities and responsibilities with commitments made by each designated group.
- **Cost of the plan and funding:** Define the cost of the plan. Describe funding resources currency available, or expected to be available in the future. In many cases, the plan itself can be a vehicle for attracting philanthropic investment, federal grants, or support from NGOs.
- **Performance measures:** The metrics by which you will evaluate progress towards your goals.
- **A transformative kick-off project:** High-impact projects can demonstrate how the plan is put into action, and avoid a situation where the plan "sits on a shelf." A kick-off project could include high impact, low investment opportunities such as creating free public wifi spots, organizing a youth coding camp or getting donations of laptops to schools.

Step four

Choose a framework for taking action

Once you have developed a detailed plan with the community that aligns stakeholders on digital inclusion priorities and values, you can begin to choose a framework for taking action.

Fundamentally, there is no "one-size-fits-all" solution for expanding broadband access, funding and financing broadband deployment and digital inclusion programming. However, frameworks for building solutions to the digital divide broadly fall into two categories: **supply-side solutions**, which work to increase the availability of internet infrastructure such as broadband, fiber or mobile networks, and **demand-side solutions**, which focus on increasing the demand for internet connectivity by reducing or eliminating barriers to access. Supply-side solutions typically require financial investment to target gaps in service by building infrastructure, while demand-side solutions involve more social and educational programming or awareness campaigns. Supply-side solutions are appropriate for situations where internet infrastructure is lacking, while demand-side solutions are more appropriate where internet infrastructure is available, but there are significant gaps in uptake that need to be addressed. Sometimes, a combination of both types of solutions is required.

How digital infrastructure is financed shapes who controls digital assets and the data they produce. The public sector's role in developing digital divide solutions should not just be to correct market failures, but should primarily be to drive innovation by identifying participatory financing models that allow greater stewardship of outcomes benefiting the public[11]. Should a local government lose control over its digital assets through contract negotiations favouring privatization, it also loses access to the data those assets generate and likewise visibility of the urban condition and the issues faced by the community. Likewise, when a local government loses control over digital infrastructure it also relinquishes the ability to make decisions in the long term that can improve quality of life for residents and achieve equitable outcomes. Depending on how contracts are negotiated with private providers, local governments can risk incurring long term costs associated with subscription access to digital infrastructure, digital services and data that the public expects local governments to steward[12].

Below is a summary of the types of existing and tested digital divide solutions where local governments are most likely to have influence and levers of control. They are not exhaustive of all the possible models for the delivery of internet connectivity such as broadband cooperatives or other self-organized models. That being said, local governments can facilitate self-organized, community driven models through a variety of tangible means discussed in Section C, "Community networks."

BOX 11.1

Using targeted policy to bridge the digital divide: Ugandan refugee SIM card policy

Displaced people and refugees are among those who are most often excluded from telecommunication services and internet resources. This is often due to legal challenges, such as an inability to obtain sufficient personal identification documents to obtain a phone number and purchase a phone. According to a study by GSMA , forcibly displaced persons are required to show proof of identity in order to register a SIM card in 150 countries globally. This barrier poses a significant obstacle to the inclusion of refugee communities into local economies and the global information network.

This issue is even more problematic in countries with large populations of displaced persons and long histories of refugee settlements. In Uganda, 1.38 million displaced persons live within the country, but very few qualify for access to mobile services because additional state-issued identification is required to obtain a SIM card. As a result, SIM cards are often obtained illegally, either by registering multiple cards for one person or buying them through the black market. The scale of this activity demonstrates the refugees' tremendous demand for mobile services.

To address this issue in Uganda, the UN Refugee Agency (UNHCR) initiated a Technical Working Group bringing mobile operators, ISPs, and humanitarian response actors to improve connectivity for refugee communities in Uganda. As a result of the discussion, the Uganda Communications Commission adopted a policy allowing SIM card registration for individuals with refugee identity cards and attestation letters. As a result of this policy intervention, over 600,000 refugees in Uganda qualified for SIM card access, and mobile subscriptions among refugees increased by 50%. Under the policy, refugees qualify for the same automated biometric and biographic verification as nationals, which ensures secure access to their mobile data. This case study demonstrates the impact a target policy intervention can have on the connectivity, and ultimately economic inclusion of marginalised groups.

Table 11.1: Digital divide solution typology

Solution Type	How it Works	Solution Category	Mile Type	Root Addressed
Government-owned & operated networks and direct public provision (DPP)	A public authority or municipality designs, builds and operates internet infrastructure or a broadband network. Infrastructure deployment is directly managed and controlled by the public authority.	Supply	First, Middle	Infrastructure access & availability
Open access networks	A type of government-owned and operated solution where physical access to network infrastructure and the delivery of services are separated. For example, a public authority that owns and operates internet infrastructure outsources retail and customer service "layers" to the market.	Supply	Middle	Infrastructure access & availability
Public facilitation - private investment (P3)	Where the private sector can finance, operate or maintain internet infrastructure deployment, and the public sector publicly supports the effort through community outreach and supportive regulation.	Supply	First, Middle	Infrastructure access & availability
Public funding - private execution (P3)	Where a public authority negotiates a formal partnership with a private actor with public funding and private execution, similar to toll-road construction projects.	Supply	First, Middle	Geospatial, infrastructure access & availability
Public infrastructure - private service (P3)	Where a public authority and private partner share capital, operating and maintenance costs in dynamic, customised ways.	Supply	First, Middle	Geospatial, infrastructure access & availability
Community-driven networks	In this bottom-up approach, internet infrastructure deployment is carried out as a private initiative by local residents or community groups. These projects have shown to be particularly successful in offering inclusive and affordable internet access at smaller, "last mile" scales.	Supply	Last	Geospatial, infrastructure access & availability, socioeconomic
Increase digital literacy	These solutions are aimed at developing policies, projects and programming that increase opportunities for digital literacy education and improve digital literacy outcomes.	Demand	First, middle, last	Socioeconomic, demographic, cultural, education
Enhance accessibility of digital services	These solutions are aimed at developing policies, regulations, projects, and programming that increase the accessibility of devices to marginalised groups and persons with disabilities.	Demand	Last	Socioeconomic, demographic, cultural,
Increase affordability of digital skills, connectivity & devices	These solutions are aimed at developing policies and regulations that increase affordability of internet connectivity and digital devices for everyone.	Demand	First, middle, last	Socioeconomic, demographic

Table 11.2: Internet connectivity infrastructure typology

Infrastructure Type	Description	Application
Small Cell	Low-powered cellular radio access nodes operating in licensed and unlicensed spectrum that have a range of 10 meters to a few kilometers.	Typically used by internet service providers to fill in "last mile gaps" and densify their networks. Used to increase capacity to handle 5G bandwidth demand.
Broadband - Wired	Wired refers to any physical medium consisting of cables such as copper wire, twisted pair or fiber optic. A wired network is used to carry different forms of electrical signals from one end to the other. Wired Broadband includes: Digital Subscriber Line (DSL), Cable Modem, Fiber, and Broadband over Powerlines (BPL) technologies.	Broadband is considered to be the most common set of internet technologies available. Some broadband solutions like Fiber, DSL and BPL require significant financial investment and access to public infrastructure. Wired broadband is more expensive to build, but typically offers greater speeds than Wireless.
Broadband - Wireless	Telecommunications technology that provides high-speed wireless internet access or computer networking access over a wide area. The term comprises both fixed and mobile broadband. Wireless broadband includes Wireless (WiFi), Satellite, LTE (4G), HSPA (3G), 5G, internet Balloons, and LiFi.	Wireless technologies are more flexible, cheaper, and can be developed using existing infrastructure like streetlights or buildings. Wireless technologies can cover large areas, but quality suffers at the extent of coverage requiring overlapping coverage in infrastructure. For a comparison of Wired and Wireless technologies, please visit the European Commission's Comparison Table.
Cellular Networks	Cellular networks enable the transmission of data using radio frequencies over a distributed network of transceiver stations, or "cellular towers." These base stations are typically organised over land areas called "cells," which when joined together, provide network coverage for a large region.	Cellular networks typically power mobile phones, and digital devices such as laptops or tablets. Their greatest advantage is that their distribution can cover a large area. Typically construction of a wireless cellular network requires public private partnership.
Mesh Networks	Mesh networks are highly interconnected networks of computers or communication devices. These networks consist of nodes (like computers, routers, radio base stations and mobile phones) that are structured in such a way that each node acts as a switch or a router deciding how to forward the information they receive.	Traditionally telecom networks are hierarchically structured with centralised control systems. Increases in the number of wireless mobile devices requires a distributed architecture with intelligent nodes like in Mesh networks to manage bandwidth, optimally use spectrum and device power consumption, and as a result are optimal for settings where relying on a central internet provider is a challenge.
Smart Grid or Automated Metering Infrastructure (AMI)	"Smart grid" technologies are made possible by two-way communication technologies, control systems, and computer processing. This technology allows energy grid operators to assess grid stability, and features advanced digital meters that give consumers better information and automatically report outages.	The Smart Grid is typically deployed as an upgrade to existing energy utility networks that require manual meter readings. With a Smart Grid, meters can be read automatically, introducing significant cost savings to the utility.
TV White Space	Television stations are often operated in geographically separate areas. As a result, there are areas where, because of population density, not all television channels are utilised. This unused spectrum between TV stations is called "White Space" and its spectrum can be used to deliver broadband to wireless devices.	This type of internet infrastructure is especially useful for providing broadband to rural areas, or areas with low population density. This is primarily due to the technology's capability of using a low power frequency that is able to penetrate obstacles such as mountainous terrain and densely wooded regions.

BOX 11.2

Innovating through regulation: Citynet Amsterdam's challenge to European Commission state aid regulations

While the lionshare of broadband network development and investment has occurred by the private sector, private sector actors are not the only organizations capable of making investment in broadband networks. Public authorities can also engage in investment and support schemes to deliver affordable internet services to residents.

In the EU, the involvement of municipalities in this process has raised legal questions, particularly regarding the application of State aid regulations. These EU regulations specify that public authorities can invest in broadband deployment where they can demonstrate a true market failure to deliver services. However, the regulations also protect private sector competition by specifying that no public intervention can take place where private operators credibly plan to invest in broadband infrastructure.

In a recent case, the electronic communications sector reviewed the roll-out of a high-speed broadband fiber network, "Citynet" by the City of Amsterdam. Citynet offered a unique model where the City of Amsterdam invested in the passive layer of a broadband network (i.e., infrastructure such as fibre, street cabinets and ducts), along with two private investors (ING Real Estate and Reggefiber) and five housing corporations . The passive infrastructure was owned and managed by a company (Glasvezelnet Amsterdam) in which each partner group owned a third of the company totaling about 18 million Euro in equity. By investing in the passive infrastructure, the City of Amsterdam was able to create an "Open Network" model where commercial operation of the network was conducted through an open, competitive procurement.

Because the City of Amsterdam participated in the project like a private investor, rather than a subsidiser of private infrastructure, it was determined that no State aid was present and the project did not violate the European Commission State aid regulations. The case study provided an important precedent for Municipally-Owned networks in the EU, demonstrating opportunity for municipal investment that does not violate regulation.

Supply-side solutions

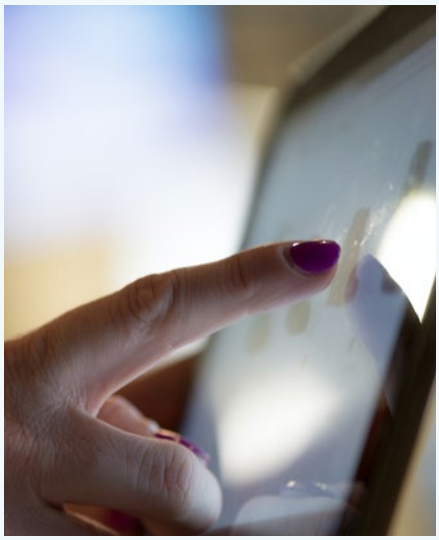
Supply-side solutions deal with the development of internet infrastructure including small cell, broadband, WiFi, fiber and mobile networks. Supply-side solutions address two types of digital divide: the connectivity divide and the physical divide. The supply-side solutions discussed in this section include: government owned & operated solutions, **community networks** and **public private partnerships (P3s)**. These typologies are not exhaustive of the types of strategies emerging for varying contexts. For example, national governments in Africa are experimenting with leveraging Value Added Taxes (VAT) on e-commerce transactions to finance internet connectivity infrastructure and digital inclusion activities[13].

Different combinations of connectivity infrastructure are appropriate for different levels of internet provision, namely the first mile, middle mile and last mile of internet connectivity. The first mile refers to how the internet enters a country or a macroscale region, the Middle Mile refers to how the internet passes through a county, city or territory and the Last Mile refers to the final stretch of internet delivery direct to the user14. Broadly, First Mile and Middle Mile solutions involve exclusively public or private investment, or P3s because they involve tremendous financial investment and coordination at large scales. However, Community Networks are often more appropriate for Middle and Last Mile solutions, particularly in rural or informal settlement areas where investment in internet infrastructure may be less feasible or financially viable.

There are several main types of internet infrastructure summarised in the table below. Broadly, broadband is known to be the most sustainable option for internet connectivity because of its relatively high bandwidth compared to its cost. WiFi hotspots are another popular solution that typically requires less overall investment than building broadband infrastructure.

BOX 11.3

Municipalities establishing non-profits to develop digital inclusion solutions: Suupohja Fiber-to-the-Home (FTTH) program



The Suupohja FTTH network began in Western Finland with the aim of bringing broadband to rural regions. The program enabled municipalities to bring fiber connections to homes, businesses, and institutions across areas that were formally deprived of broadband access.

In 2004, nearly 50 per cent of villages in Suupohja County lacked access to broadband. To meet the demand, municipalities paid hefty prices to rent copper wireline connections. In 2005, several municipalities founded "Suupohjan Seutuverkko Oy" (SSV), a non-profit limited company with a goal to cut broadband costs. This municipally-owned fibre network was able to provide services to local residents and has enabled thousands of households and businesses to be linked with fiber. In addition to facilitating business operations, the network has also increased the property values, boosted GDP growth, and enabled new services that contributed to a better quality of life. SSV owns the network infrastructure and handles maintenance-related duties. It allows service providers to use their networks for free, which reduces end-user prices and increases service quality.

To bridge the digital divide, it is crucial for local governments to share knowledge and strengthen collaboration. In doing so, municipalities can best address supply gaps unmet by national providers. It can also reduce costs, increase service quality, and contribute to the socioeconomic development of the region.

A. Government owned and operated solutions

In this model a public authority or municipality designs, builds and operates internet infrastructure - such as conduits and ducts - or a broadband network. Infrastructure deployment is directly managed and controlled by the public authority. This can be through an existing city department, or local utility that deploys the network directly or through procurement on the market. Typically, the public authority will design the procurement specifications for procurement. If a company, non-profit or otherwise is procured to carry out the deployment, the public authority will keep ownership of the network and perform ongoing operation and maintenance of the network. The public authority can also manage any services layered over the network infrastructure, or outsource those services to the market (referred to as an **Open Access Network**). In some contexts, National Governments develop and deliver the internet infrastructure.

The Government Owned and Operated model is common in several EU countries for example in Amsterdam, Netherlands and Suupohja in rural Finland.

B. Facilitate community networks

Public authorities also have the option of supporting the development of internet networks by the community itself. In this bottom-up approach, internet infrastructure deployment is carried out as a private initiative by local residents, nonprofits or community groups. These projects have shown to be particularly successful in offering inclusive and affordable internet access for the Last Mile. Projects developed and promoted by communities can leverage an Open Access Network model, a **vertical integration** model (where a nonprofit or community group owns and operates the infrastructure), or a procurement model (where the community procures internet infrastructure deployment and services from a private operator).

Local governments or public authorities can support communities in developing this model in several ways:

- **Introduce supportive policy or regulation** - Design policy or regulation that is friendly to community development of internet infrastructure.
- **Grant public right-of-way (RoW) permissions** - Grant the community group or private operator access to the public RoW to build network infrastructure.

- **Co-finance the effort** - Provide financial support for the initiative.
- **Coordinate with other infrastructure deployments** - Leverage existing infrastructure deployments under control by the public authority as an opportunity for the community to build from.
- **Provide access to other public infrastructure** - Unlock access to public infrastructure to provide backhaul connections.
- **Establish fair competition for operators** - Create processes that support open competition for community operators seeking access to the infrastructure (Open Access Network model).

For example, the Mexican government issued a concession to the nonprofit Rhizomatica that grants access to cellular spectrum all over the country for the purpose of helping rural communities build their own cellular networks[15]. Rhizomatica specialises in providing technical expertise to rural and informal communities seeking to build their own networks.

C. Public private partnerships (P3)

Public authorities that choose to involve the private sector to a greater extent including financing, building, operating or maintaining the infrastructure can leverage key assets in partnership with the private sector. P3s bring public and private sector actors together to co-develop digital divide solutions in an attempt to distribute cost, risk and benefits. These partnerships can be structured in different ways, which makes them flexible for a variety of unique conditions, however they can take several years to establish and often require repeated contract renegotiations[16]. For local governments in developing countries that lack capacity to engage in traditional public procurement, P3s may be highly risky and prone to failure. With each type of P3 there is a tradeoff between the amount of risk and cost incurred by the public authority and the level of control and public benefit that emerges as a result. P3s are globally popular, but their performance is contested due to strategic, operational and resource risk factors typically incurred by the public partner[17].

BOX 11.4

Coordinating regional government partnerships for digital equity: Baltimore's Inter-County Broadband Network (ICBN)

The City of Baltimore recently supplemented existing cable along sections of the city's public safety radio backbone . New conduit and fiber were constructed in many additional routes as a result. But for some existing conduit, fiber was set aside for future leasing to commercial providers. The fiber and conduit, which connect the Baltimore Technology Park to other parts of the city, were designed both to meet the city's own internal communications needs and to enable new private partners to build or expand broadband facilities in Baltimore. The Inter-County Broadband Network, in collaboration with the On Maryland Broadband Initiative, has installed more than 1610 kilometers of fiber optics and associated electronics to create a robust network. This statewide network covers nine Central Maryland jurisdictions and connects around 1,000 community anchor institutions, including libraries, schools, hospitals, and fire and police stations. The network passes 71,000 businesses, services 1.8 million households, and delivers broadband to every county in the state.

The network was partially funded by the United States Federal Broadband Technology Opportunities Program (BTOP), with matching funding from every participating jurisdiction. It is the only network in the United States that is completely owned by state and local governments. This collaboration between the different administrative branches is yet another case study that exemplifies the importance of cooperative efforts between relevant entities. Affordable, accessible data-related initiatives can be best facilitated by continued coordination and strengthened collaboration between multiple stakeholders.

BOX 11.5

Community-driven networks: The Tegola project in Scottish regions

The Tegola project began as a joint initiative between the University of Edinburgh and the University of the Highlands and Islands in 2007. It installed a testbed that covered some of the most remote parts of the UK mainland. One of the primary reasons for a lack of investment by commercial providers in this region is its small client base, and rurality. To mitigate the high costs of broadband deployment in the area, the Tegola project leveraged terrestrial wireless and engaged community involvement. Volunteers helped erect masts, set up power cables, and assisted in the maintenance of the distribution networks.

The project was successful in providing network coverage to around 1,000 people in six rural communities. In addition to boosting the performance of local businesses, access to high-speed internet has also facilitated emergency health services. This test project has also incentivised other rural villages to initiate similar projects through community-based efforts.

For remote areas to achieve internet connectivity, access to affordable backhaul is vital. In this context, backhaul can be established with conventional home broadband connections for providing shared connectivity, a collective subscription to a business broadband connection, or by securing a high-speed leased line from a local network service provider. Whichever the case, it is important to adopt a deployment model that involves community involvement in remote areas, as it can prompt the cost-effective and time-efficient implementation of broadband for those underserved.

BOX 11.6

Native innovation for digital sovereignty: four tribal broadband case studies

Native Nations refers to indigenous land with territorial history in the United States, where there are land reservation boundaries by law. The Federal Communications Commission (FCC) uses the term "Tribal Lands" to address these lands as well as other communities in Hawaii and Alaska, such as the Hawaiian homelands, tribal statistical areas, and Alaska Native Villages. Currently there are 574 federally-recognised indigenous or native tribes in the U.S., and more than 60 state-recognised tribes. In pursuit of high-speed internet connectivity, several tribes and Native Nations have embraced a "digital sovereignty" movement based on the idea of spectrum sovereignty, where Native Nations have the right to access and use radio frequencies under a federal trust responsibility where resources are managed by the federal government on behalf of Native Nations .

Native Nations demonstrate the capacity of community driven networks in the many ways they have innovated to build their own networks and act as their own Internet Service Providers (ISPs) for the purpose of addressing the digital divide, and encouraging economic development. By owning and operating their own infrastructure, Native Nations see new opportunities to enact sovereignty by keeping power and data within their communities, rather than relying on external providers.

For example, in 2004 the MidWestern Coeur d'Alene Tribe leveraged a federal Community Connect Grant to develop a pilot broadband network using unlicensed spectrum bands. Doing so readied the tribe to capture future resources based on the success of an initial pilot and expand their network using additional federal resources. In Idaho, the Nez Perce Tribe leveraged federal funding assistance to establish a tribal utility, Nez Perce Networks. The utility supported by the Nation was able to sell internet connectivity service directly to homes and businesses, in addition to leasing tower space to cellular companies. In the absence of federal assistance, the Fond du Lac Band in Minnesota worked with private philanthropic donors to build a network that could reach some of its most rural inhabitants. While undergoing construction, the Fond du Lac Band leveraged their existing institutional network to install wireless hotspots on government-owned buildings. Finally, the St Regis Mohawk Tribe focused on delivering devices to youth and community members who could not afford them under a Broadband Technology Opportunity Program grant that brought 60 public computers to key places throughout their region, including the Boys & Girls Club, a cultural center, and senior centers.

All of these cases highlight how Native Nations have been able to overcome the digital divide, even when circumstances and structural systems make it challenging to access funds or establish partnerships.

BOX 11.7

Supporting community networks development in Africa

Community networks are telecommunications infrastructure developed and deployed primarily by a community rather than a local government or private company. In Africa there are several examples of community networks, as affordable internet connectivity infrastructure is broadly recognised as an enabler of access to knowledge and job opportunities. Because locals own and operate these networks, profit and technical knowledge are kept within the community. The development of community networks in Africa has set in motion a local movement focused on leveraging internet connectivity to improve social, education and economic conditions for all residents.

Community networks are established by engaging various stakeholders, and establishing collaboration with local institutions, to ensure that the project meets the needs of the local people. The study, "Understanding Community Networks in Africa," conducted by the Internet Society in 2017, emphasizes the role of social cohesion in community network development, as they often start with an individual who champions the network and articulates its value for the community thereby attracting seed funding to ignite the project. Barriers to the creation and scaling of community networks are primarily social, economic, technical and legal.

The study highlights several recommendations for governments to support the development of community networks includes:

- Actively promote and communicate with residents about Community Network models
- Include curricula for the roll-out and maintenance of community networks in existing skills development programs
- Leverage Universal Service and Access Funds or other new funding mechanisms available for the deployment, operation, and maintenance of community networks
- Create a friendly regulatory environment by making more unlicensed spectrum available, and implementing measures to reduce backhaul costs, and reduce fees and taxes to import and use telecommunications equipment
- Allow experimental licenses on a fast-track basis to ensure efficient start up for community networks

Local governments can facilitate P3s in four main ways: 1) by facilitating access to key infrastructure assets such as fiber, conduit, utility poles and real estate; 2) by facilitating access to customers; 3) by making data about internet infrastructure available to network deployers; and 4) by streamlining and publicising essential local processes such as permitting or inspections[18].

Broadly, there are three types of P3s for internet infrastructure deployment[19]:

- **Model 1: Public facilitation, private investment** - Where the private sector finances and operates internet infrastructure deployment and the public sector publicly supports the effort through community outreach and supportive regulation.
- **Model 2: Public funding, private execution -** Where a public authority negotiates a formal partnership with a private actor with public funding and private execution, similar to toll-road construction projects.
- **Model 3: Public infrastructure, private service -** Where a public authority and private partner share capital, operating and maintenance costs in dynamic, customised ways.

Typically, the more rights granted by the public authority to the private sector to design, finance, build or operate digital infrastructure, the less control the public authority maintains over the infrastructure. This can become challenging for public authorities faced with upgrading infrastructure in the future and can limit their options should a new competitor enter the market with a superior product. Additionally, the risk of inequitable user charges is high (i.e. high cost for internet subscriptions), when the costs of the tendering process are passed on to the consumer.

Sustainable P3 models are those that appropriately balance the tradeoffs between cost, risk, control and benefit. For example, a sustainable P3 model might involve a public authority building, owning and maintaining dark fiber, while a private partner lights the fiber, delivers services and handles customer support. An alternative example is one where a public authority procures a private provider to lay the infrastructure groundwork (conduit and fiber in the case of broadband), but requires that service delivery remain open to public and private third party providers. Local governments and public authorities can create incentives in P3s for private actors to guarantee successful phasing of the project. For instance, a private contractor may be more likely

to consider life-cycle costing during the construction phase of a project when it is also responsible for ongoing maintenance of the asset.

Ultimately, the burden falls on the public authority to design sustainable levers of cost, control and risk in a P3 that provides the private sector with the right incentives to invest, innovate, and build optimised solutions while maximising benefit to the community in the long term.

Legal issues in P3s

Before forming a P3, it's important to be aware of the types of legal issues often encountered by public and private partners entering such agreements. These issues should be addressed in negotiations occurring before the project begins and typically cover topics including infrastructure access or regulations compliance. Below is a list of common legal issues for P3s seeking to deliver internet connectivity:

- **Administrative authority** - Ensure that a P3 has authority to participate in such a venture and identify any limitations on its authority to do so, including regulatory caps on the size of the P3 investment.
- **Financing** - Identify resources that are accessible to the parties of a P3, and whether there are limits on types of expenditures or procurements for participants.
- **Access to public right of way** - Ensure the public authority can grant access to RoW, and identify timelines and expectations for doing so. Typically, any fiber installations underground or using street poles will require access to RoW. Occasionally, new towers may need to be constructed where there is no previously existing infrastructure.
- **Access to infrastructure** - Ensure the public authority can grant access to other types of facilities/ infrastructure relevant to internet connectivity that may require granted access including fiber, poles, ducts, conduits, sewers, streetlights, towers and rooftops.
- **Regulatory compliance** - Review any requirements at higher levels of government (regional, state or national) and ensure that the project is in compliance with these regulations.

D. Choosing a supply-side model

It's important to assess the feasibility and appropriateness of a supply-side solution. When choosing a supply-side model, there are several questions you can consider to guide your decision making[20]:

- What financial resources are available to me currently? Do I have enough revenue to finance an infrastructure project, or do I need to find a way to attract additional external finance?
- What is the best approach to creating a sustainable investment in infrastructure beyond the immediate project and funding available?
- What kind of variables might impact the long term sustainability of this solution (i.e., interest rates)? Conduct a sensitivity analysis.
- What are the benefits to maintaining control and ownership over internet infrastructure and in defining the deployment priorities?
- What is the tradeoff between control and cost?
- What is the likelihood that underserved or unserved communities will acquire internet access under my chosen model?
- Would we rather be better off keeping the ownership of the infrastructure but let an operator define and execute the deployment?
- Is it possible to support local bottom-up resident initiatives? Do they exist in my community?
- Given the socio-economic conditions on the ground, which level of competition is required to facilitate penetration of high quality and affordable services?

Demand-side solutions

Demand-side solutions address the barriers to internet use which include socioeconomic and cultural barriers. Demand side solutions can work to increase digital literacy through targeted programming, incentivise private connectivity providers to create affordability programs or create information campaigns to target cultural biases about using the internet, to name a few examples. Ultimately, demand-side solutions don't involve development of infrastructure but instead leverage programs and policies to address the socioeconomic, demographic, cultural and literacy divides.

A. Increase affordability of connectivity, skills and devices

Income inequality is one of the greatest barriers to connectivity. However, it is important to note that the economics of internet connectivity are complex[21] and achieving broad strides in affordability is typically the responsibility of national governments. Still, there are several solutions local governments and nonprofit organizations have attempted locally that provide critical support to low income populations. Here are some examples:

- Build an affordable internet option into municipal broadband and franchise agreements
- Provide free internet service in public buildings such as libraries and schools
- Incentivise private companies to offer free public Wi-Fi in exchange for advertising
- Leverage existing infrastructure to offset the cost of building new internet infrastructure and pass those savings along to customers
- Create digital device recycling/refurbishing programs where digital devices used by city staff are refurbished and provided at low-cost or no-cost to residents
- Partner with and support local nonprofits who offer low cost or no cost access to devices and digital literacy courses. For example, FreeGeek in Portland, Oregon is a nonprofit that offers free devices to people in exchange for completing digital literacy programs.

B. Build digital literacy

The Broadband Commission's Advocacy Target #4 says that by 2025, 60% of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills[22]. A 2017 study by GSMA showed that the top reported barrier to internet use in Africa, East Asia, South Asia and Latin America was digital skills[23]. Inadequate skills and digital literacy are increasingly emerging as a leading barrier to internet use in many vulnerable countries, especially LDCs.

There are several causes for lack of digital literacy and solutions pursued depend largely on the target population. For example, digital literacy is generally cited as the greatest barrier for participation among the elderly, but in many developing countries, digital literacy is a common barrier to school-age children in low income areas. An approach to provide digital literacy skills for elderly populations will differ greatly in terms of delivery methods and content from an approach for school-age children. There is no "one-size fits all" approach to increasing digital literacy, but some common approaches to increasing digital literacy Include:

- **Supporting or partnering with local nonprofits to create after-school programmes for school-age children:** For example, the City of San Antonio partnered with local nonprofit Youth Code Jam to co-design a digital literacy curriculum. The programming emphasises accessibility to all students, regardless of income, race, gender or disability.
- **Funding and supporting digital literacy coursework in existing public school programs:** Take the necessary steps to create digital skills curriculum in public school programmes at all age levels.
- **Building digital skills ambassador programmes:** Empower youth in unserved or underserved communities to teach digital literacy skills to other groups, with various rewards and incentives for goals met. For example, Rwanda's national Digital Ambassador Program (DAP) recruited 50 young Rwandans and trained them to become Digital Ambassadors (DAs). DAs were deployed to five districts (Nyagatare, Nyarugenge, Rulindo, Gisagara and Huye) where they delivered DAP programming to over 17,000 residents.

- **Offering adult and older adult digital literacy classes through public libraries or in partnership with external nonprofit partners**: Public libraries are often trusted sites for information in a community and can be leveraged for digital inclusion programming targeting adults and seniors. For example, Singapore's SDO@NLB program sets up pilot "Digital Offices," at select libraries to bring digital literacy services directly to seniors. Each Digital Office is equipped with a Digital Ambassador who provides assistance to seniors, and teaches regular digital literacy courses. Seniors can also interact with digital kiosks for additional support at each Digital Office location.

C. Enhance the accessibility of digital services

Accessibility of digital services can be a barrier for marginalised groups particularly women and persons with disabilities. These groups often struggle to access digital services because those services and their allocation are not designed to accommodate their unique condition. Accessibility of digital services also varies by geographical location, especially for marginalised groups.

Persons with disabilities

There is a wide spectrum of disabilities and alternative learning styles that should be accommodated when planning digital services, digital literacy solutions or internet connectivity infrastructure. The World Blind Union's "Accessibility GO!" report, and G3ICT's "Smart Cities for All Toolkit" makes several recommendations for action to support organizations to create a more inclusive ICT environment for persons with disabilities. Broadly some recommendations pertaining to internet connectivity and ICTs include:

- Engage persons with disabilities about planned digital services as experts in their own right
- Follow international, regional or local standards for universal design, and accessibility of ICTs in your procurement process
- Monitor updates to accessibility standards and maintain quality and compliance of ICTs under your influence
- Determine your digital services' compatibility with the latest Assistive Technology
- Provide digital literacy courses through the appropriate vehicle for persons with disabilities and accommodate a diversity of learning styles

Women

Worldwide, about 327 million fewer women than men have a smartphone and can access mobile internet. Barriers to access, affordability, education and digital literacy in addition to deeply embedded gender biases and socio-cultural norms, are some of the reasons for gender-based digital exclusion[24]. Therefore it's critical that policy interventions challenge such structural biases by creating and enhancing safe and affordable access to digital connectivity, skills and devices for women. The issue is so pervasive that organizations like G20, ITU, UNESCO and the OECD all address the gender divide in access to ICTs.

Concerns about safety and harassment are significant barriers for some women that prohibit them from benefiting from or desiring to access the internet. Women can face concerns of physical violence as a result of devices they own or borrow, and are often more vulnerable to theft. Social or cultural norms may further constrain women's freedom of movement, access to education and access to financial independence, all of which influence the likelihood of acquiring digital literacy skills. Some women may even struggle to access public access facilities due to a lack of access to transportation, an unsafe route or because public facilities are considered unsuitable for women. Some recommendations for increasing the accessibility of digital services for women include:

- Provide safe access to public facilities for women
- Embark on information campaigns to change cultural narratives about women's use of technology
- Provide women-only digital literacy classes that include child care accommodations
- Support efforts to make internet connectivity and devices more affordable
- Offer "leapfrog" opportunities like access to refurbished technology devices that can help bridge the divide by giving women the possibility to earn (additional) income, increase employment opportunities and access knowledge and general information.
- Create programmes that remove barriers to adult education for women
- Systematically collect data about programmes and outcomes for women to best identify what works and doesn't for this targeted group

D. Choosing a demand-side model

It's important to assess the feasibility and appropriateness of a demand-side solution. When choosing a demand-side model, there are several questions you can consider to guide your decision making:

- What are the demographics of my community's digital divide? Do I have a greater population of seniors, for example?
- What are the greatest challenges faced by my community when it comes to uptake of digital services? Affordability? Accessibility?
- What organizations in my community are already providing solutions for the community that I can support or build from?
- Is the main problem in my community access to the internet or access to devices that allow for internet connectivity?
- Do I have the resources to build and sustain my own digital literacy curriculum, or do I require a partnership with an external organization to do so?

Step five

Choose a financing model

Substantial investment in digital inclusion programming and infrastructure can often be out of reach for local governments. Additionally, private sector investment in digital infrastructure is selective, as return on investment is low in hard to reach areas, low income areas and rural areas. How digital infrastructure is financed shapes who controls digital assets and the data they produce.

Different financing models are appropriate for different contexts. For example, in small developing economies there are more technical and financial constraints calling for regional or national coordination of resources[25]. In general, P3s can bridge resource gaps and provide efficiency gains, but there are several other tools that should be considered as well when financing digital inclusion projects. Some of the most common vehicles for financing digital inclusion projects are public funds, government-backed bank loans and bonds, revenue-based financing, private capital and financial markets and participatory budgeting and community based financing.

Savings & revenue

Public investment in digital divide infrastructure is critical for the equitable provision of internet, and public oversight over digital infrastructure. Public authorities need to prioritise internet connectivity and budget for it as they would for other critical infrastructure such as water, energy or solid waste management. Sometimes local and national governments simply have sufficient savings or revenues to include this type of infrastructure investment in their annual capital expenditure plans. Incurred savings can be directed as a budget priority for the purpose of building internet connectivity infrastructure or digital inclusion initiatives. Doing so may require significant political support from leadership.

Public investment in the infrastructure for universal broadband can mobilise the corresponding private investment that lays the foundation for further development of infrastructure. When local governments "seed" an initial investment, they establish the municipality's role in shaping broadband infrastructure, develop conditions for baseline market responses, and create impact for targeted areas. With greater investment comes greater control for municipalities over the provision of infrastructure. From there, local governments can partner with the private sector to address prominent gaps in infrastructure[26].

A public authority can also receive revenue from the wholesale lease of internet infrastructure like fiber or broadband, as well as connectivity fees. This model is most appropriate for public authorities that choose the "Government Owned and Operated" framework discussed in Section X.X. This type of financing requires that a network be constructed and is already connecting users, and would not be an appropriate funding strategy for starting a digital infrastructure project.

Community based financing and participatory budgeting

Community-based financing refers to grassroots financing and funding that is generated or controlled by the community. One vehicle for community-based financing is participatory budgeting where citizens are invited by public authorities to directly decide on how to spend part of the government's budget[27]. Communities can also self-organize to raise and allocate funding for digital infrastructure projects which is particularly successful for last-mile communities that are rural, hard-to-reach or located in informal settlements. Finally, Universal Service and Access Funds (USAFs), which are public funds financed through contributions made by telecommunications companies, provide funding for grassroots projects that expand communications services to underserved areas and populations[28].

One notably successful model of a network built using community-based financing is Rhizomatica. Rhizomatica is a nonprofit that has been granted rights by the Mexican government to broadband spectrum across the country. In Rhizomatica's model, equipment is provided by nonprofit partners and the technology that powers the network is free and open source. The nonprofit focuses on capacity building by training community members in network installation and maintenance. As a result, participating communities pay less for equipment and installation (about one-sixth of the cost of a private connectivity provider for rural installation in the region). The installation cost covers Rhizomatica's staff and labour costs. To maintain the network, subscribers pay a small fee of about 30 pesos ($2) per month and the community may keep any remaining profit.

Below are a handful of existing finance resources for community-driven network development and financing:

- UN Participatory Habitat Initiative
- Alter-Mundi: Planning a Free Community Network
- Rhizomatica: Resources
- Universal Service Access Funds

Concessional finance
Concessional finance or "soft loans" refers to loans that have more generous terms than market loans. These generally include below-market interest rates, grace periods in which the loan recipient is not required to make debt payments for several years, or a combination of low interest rates/grace periods. Concessional finance can be offered by national governments, development banks or other agencies. Some private foundations, charities and NGOs can also offer concessional financing.

Federal governments will make funds available for infrastructure projects that can include building fiber or broadband infrastructure in the form of federal grants, or stimulus funds. These funds are often established through the development of national broadband plans. For example EU member states have access to the Connecting Europe Broadband Fund, which raised €500 million for broadband investment by 2020. International organizations such as the United Nations or World Bank occasionally provide funding for digital inclusion efforts as well.

Commercial credit and bonds
Another type of financing is through a government-backed bank loan, bonds or municipal bonds, also known as guarantees. To qualify for this type of funding, a proposal must show that the long term revenue will exceed the cost of the loan including principal and interest. Local governments in some countries can borrow money for capital projects in a number of different ways typically through long-term or short-term borrowing which is usually repaid through tax revenues or user fees.

Long-term debt is often used to finance large capital assets such as infrastructure. Issuing debt increases the total cost of the asset through the payment of interest, but it also allows local governments to acquire or build capital assets sooner by borrowing up front for assets that they could not otherwise fund from existing cash resources. By spreading out the debt payments over many years, local governments can minimise the financial impact of the investment.

Short-term debt is used for smaller scale projects of shorter duration, typically to provide an interim method of financing until long-term borrowing has been secured.

Private capital
In this model, investment funds provide equity or debt financing to the local government. For example, banks, investment funds and private equity investors may be interested in providing seed financing at higher interest rates for the first 3-5 years of project development. To qualify for this financing, local governments need a positive credit rating score, which is sometimes not feasible in developing countries. Alternatively, a Special Purpose Vehicle (SPV) can be established which allows user fees to repay the loan.

Alternatively, institutional investors operating on behalf of pension funds or other types of institutional finance instruments have interest in investing in more established infrastructure over the long term, at lower interest rates. Venture capital is not typically used for internet infrastructure investment as these investors value short-term investments at much higher levels of risk. Below are a handful of existing finance resources for Broadband investment.

- Federal Broadband Resource Database (United States)
- The Connecting Europe Broadband Fund
- European Fund for Strategic Investment
- European Investment Bank
- LACNIC
- Digital Moonshot for Africa
- UNCTAD
- EU Africa Infrastructure Trust Fund

Step six

Execute your plan -

examples from around the world

BOX 13.1

Using renewable energy to reduce cost of mobile internet in Cambodia

Around four billion people worldwide are not connected to the internet, and a billion people live in areas with no internet or mobile coverage, the majority of which are concentrated in remote areas. Poor rural infrastructure poses a major economic obstacle for mobile and internet providers looking to invest in rural networks. In Cambodia, 79% of the population live in rural areas, but only 50% are connected to the electricity grid (37% in rural areas). The lack of appropriate energy infrastructure makes it impossible to adequately maintain internet equipment, whether in the form of cable networks or receiver towers. Finally, road infrastructure further complicates the installation of necessary equipment.

In response to these challenges, local mobile operator Cellcard (a private company, and the third-largest mobile provider in Cambodia) began looking into an alternative power supply for its mobile telecommunication towers: solar power and diesel generators. These two power sources bypass the need for grid connection, yet pose their own challenges: large diesel storage tanks are targets for thieves, and solar panels have variable site performance and break easily. As a result, Cellcard went for a hybrid solution, installing solar-powered towers that run on diesel 2-6 hours per day. As a result, 92% of Cellcard's rural sites (2,362 units) were connected to the hybrid energy supply.

Cellcard invited GSMA, a global mobile operators consultant, to evaluate its strategy. According to GSMA's report, using hybrid diesel-solar sites allowed for 32% savings on fuel cost, which is the equivalent of 38.4 metric tonnes of CO2 per year. Cellcard saved $9.8 million through the use of these hybrid sites. Though the hybrid solution offset the high costs of fully solar-powered sites, a full shift to renewable energy sources would further reduce maintenance costs in the long term of this endeavor. GSMA estimated that even though diesel or hybrid sites have lower upfront costs, their maintenance costs are larger compared to solar-powered sites. Within 3-5 years after deployment, the total cost associated with solar-powered sites became lower than the total cost associated with a diesel-powered or a hybrid site. According to the model, by shifting its hybrid stations to fully solar-powered sites, Cellcard could reach an additional 4% of the population.

Figure from the report, page 14-15: cost comparison between solar, hybrid, and diesel-powered sites

Lessons learned:

- The challenge of installing and maintaining telecommunication towers is tied to other infrastructural challenges, such as transportation opportunities and the electricity grid.
- Rural telecommunication towers can be effectively powered with renewable energy. Installing hybrid solar and diesel powered stations upfront cost savings, but switching to fully solar is more profitable after 5 years of operation.

BOX 13.2

Digitalization of rural areas in Viet Nam: Yen Hoa Commune

The rural commune of Yen Hoa, with the population of 7,500+ people is home to a pilot project by the Department of Information Technology within the National Digital Transformation Programme. Within the Programme, the government established 12 “smart communes” to advance digital innovation in the agriculture sector. Today, Yen Hoa is a well-connected place, with 90 percent of households using the internet.

The digital transformation project in Yen Hoa began with a set of policies aimed at supporting and facilitating the transition, resulting in a Master plan for technology and digital government services, as well as cybersecurity . The pilot project, developed together with the people of Yen Hoa commune, includes several pragmatic upgrades to digital infrastructure, including revising network security procedures, regularly updating the local authorities' website, developing telemedicine and telehealth infrastructure, and the use of electronic medical records. Other results from the pilot include the expansion of online payment methods and trading platforms in the agricultural sector. This was achieved with the help of private companies including Vietcombank, VnPost and DIC that established online trading facilities.

Savings incurred were passed on as affordable mobile internet prices. The scenario proposed by GSMA led to saving $51,200 (USD) per site.

BOX 13.3`

Mawingu : Leveraging TV white space to build affordable digital inclusion in rural Kenya

Broadband access in Kenya is considerably low, with 72% of the population lacking affordable internet access, and even basic infrastructure such as electricity. Low connectivity for Kenyans represent challenges to access services and market opportunities.

A partnership between USAID Global Broadband and Innovations (GBI) Program and Microsoft's 4Afrika initiative supported the implementation of a ubiquitous, affordable and widespread technology: TV white spaces (TVWS). TVWS takes advantage of unused spectrum bands previously used for television broadcasting at a rate of just a few dollars per month, supported by solar power stations.

TV White Spaces is a technology that provides broadband access and has been piloted across Africa for its cost efficiency and wide reach. The TVWS is derived from analog TV radio signal broadcast, which can be converted into digital terrestrial signal when unused, thus the name "white spaces". It leverages Dynamic Spectrum Access (DSA), a technology that enables radio communications devices to transmit available and unused TV band frequencies. For TVWS to be implemented, it is necessary to create a network that identifies the unused radio frequencies and those which are protected, in order to allocate the unlicensed and available frequencies. While LTE works well for mobile devices, the TVWS is better adapted to stationary devices, and is often deployed in a "license-exempt" model.

The project connected thousands of Kenyans through 17 WiFi hotspots, and currently more than 50 additional hotspots are planned. Increase in access by the community has contributed to the development of additional internet-based initiatives, including a telemedicine and diagnosis service. For the public, the project has provided the capability of accessing online courses, more employment opportunities and economic inclusion, while also improving disaster mitigation capacity.

The Mawingu pilot project showcases the possibility of extending connectivity to areas without energy infrastructure, relying solely on solar powered stations, and is able to connect the local population to streaming services, emails, video conferencing, and high speed VPN services.

Regulations are an important factor to guarantee affordability in TVWS, as there is a need to allow unlicensed or license-exempt access to unused TV band spectrum. The United States and Canada were the first countries to implement such regulatory models, followed by Singapore and the United Kingdom. Other countries considering similar approaches are Japan, South Korea, South Africa, Malawi, the Philippines and New Zealand. Microsoft, with the support of multiple partners, has deployed TVWS technology for broadband connectivity in other African countries of Tanzania, Ghana, Namibia and South Africa.

In February 2020, the Kenyan government published an 'Authorization of the Use of TV White Spaces as part of a Dynamic Spectrum Access Framework", to support the use of "white spaces" for the provision of ICT and connectivity .

BOX 13.4

Empowering farmers through digital and financial inclusion in the Punjab Province, Pakistan

In 2016, the Government of the Punjab Province initiated a digital and financial inclusion program to assist small Pakistani farmers in accessing formal credit. The "Kissan" initiative provided under-banked and non-banked farmers with interest-free crop finance. It enabled eligible farmers to easily access the e-credit scheme through mobile wallets, with subsidised mobile phones provided by the local government.

In cooperation with two commercial banks and three microfinance institutions, the government set up a revolving fund of Rs, 2 billion. The Punjab Land Revenue Authority registered farmers, and between 2010-2019, Rs 600 million were allocated to the program. To enable easier access to e-wallets, program partners such as Telenor and Tameer Microfinance Bank also distributed free smart phones for those approved for the program. These phones have pre-installed digital wallets and other useful agriculture-related applications.

As of 2021, 471,000 eligible farmers in Punjab have registered for the program. A total of 917,000 loans have been distributed between the participants, amounting to Rs 61.99 billion. 125,000 smart phones with pre-installed apps have been disbursed to farmers. The program is currently under an assessment to determine its impact on the region.

BOX 13.5

Bridging the digital divide in Toronto

All of Toronto has access to some form of internet coverage, yet not everyone is able to afford quality internet access due to high prices. As of 2020, 39% of Toronto residents do not have internet speeds that meet standards of the Canadian Radio-television and Telecommunications Commission (CRTC). This was due to either poor infrastructure or inability to afford quality service. 34% of Toronto households indicated that they are able to afford high-quality internet only if they sacrifice other purchases like food or clothing. In the year the study was conducted, Canada had fifth-highest internet prices globally: even high-income households tend to spend at least 9.1% of their income on expenses related to internet connectivity. 51% of people surveyed by the Toronto Public Library said that the public library was the only source of internet access. Finally, most people unable to afford the internet are low-income, immigrant populations, and minority groups.

To address the digital divide and internet affordability issue, the City of Toronto undertook a number of pilot projects:

- Digital Canopy in low-income neighbourhoods. 25 residential tower apartments were planned to be connected to free internet for a year. The project was expected to cover as much as 13 000 Torontians.
- Public Wi-Fi in shelter sites.
- 400 connectivity kits that included a laptop and an internet receiver were distributed. 500 Smartphones were donated to the City and distributed among Indigenous populations, each with 6 month sof free data and calls.
- Free wi-fi access expanded in parks and recreational areas.
- 500 smart phones donated and distributed in low-income neighborhoods.

In early 2021, the government concluded that the measures taken had effect yet were hardly scalable and not economically sustainable. A more ambitious program, called ConnectTO, aims to connect broadband internet directly to low-income communities in need. The City's long-term considerations included citywide high-speed networks created in collaboration with a private partner and charged at a fair price. The city hopes to make use of some of the existing infrastructure (buildings, cables) as a foundation for new community networks. Furthermore, the City is working on a Digital Equity Policy that would help steer and guide the efforts towards affordable internet. Furthermore, this municipal digital infrastructure will be expanded to at least six major cities in Canada.

An important takeaway from the study is that small-scale, "band aid" solutions such as laptop donations or wi-fi access points, are hard to scale or connect to a broader, comprehensive vision of digital equity. Despite their high specificity, these projects do not allow to measure success in addressing the digital divide at large. In order to address the digital divide, a more long-term, systemic approach is required, as well as cooperation between public and private sectors.

BOX 13.6

Policy interventions: Indonesia's subsidised internet quotas

The COVID-19 pandemic forced schools across the globe to transition from in-person to distance learning. Some common issues associated with the transition included the lack of phones or laptops in students' households, poor connectivity, and parents' low digital literacy rate. Students were not the only groups impacted by this radical change, teachers who needed to work remotely suffered similar issues.

To address these problems, the Indonesian government issued 4-month subsidies in the form of an internet "data quota". The quota was issued in two forms: a quota for general use, and a quota for studies. Subsidy recipients included students and teachers in early childhood, primary, and secondary education as well as students and lecturers in colleges and universities. The quota volume was within the range of 20-50 GB/Month, depending on eligibility. Twenty-seven million recipients received the quota out of the target group that included 44 million students, 8.2 million university students and 200,000 teachers .

According to research by Gadjah University, around 70% of the target group was aware of the initiative, and 85% of surveyed participants agreed that the subsidy eased the economic burden. The subsidy policy was generally received well and provided substantial assistance to a large group in a relatively short period of time. However, the program was most effective for specific target groups rather than the entire population. While students who had access to cellphones and laptops benefitted from the policy, students in remote rural areas had to either travel to areas with good coverage, or did not make use of the subsidy at all. The total cost of the subsidy was around $128.4 million

The internet subsidy policy proved to be a cost-effective way to reach a large population in a short amount of time. However, it was reliant on pre-existing internet infrastructure and access to digital devices. As a result, it primarily benefited only a fraction of the population. The program is credited with alleviating many economic challenges for specific populations, but did not fundamentally transform the digital divide in Indonesia. Instead, it served to expose the significant extent of an existing digital divide. Additionally, the program demonstrated that alleviating the digital divide is tied to mitigating other forms of economic disparity. The government recognised the challenge and introduced another program that aims to supply 9,113 villages with 4G coverage by 2022.

BOX 13.7

Protecting digital inclusion rights for Indonesia's youth and persons with disabilities

According to the Indonesian Ministry of Health, six million people in Indonesia are known to have a disability, representing 2.45% of the country's population. In an attempt to narrow the digital divide of people with disabilities and ensure digital and social inclusion, the Indonesian government ratified many international programs related to disabilities . For example, regulation such as "Law 14/2008" serve to protect the right persons with disabilities have to obtain information without discrimination.

Two primary challenges impact improving ICT access for persons with disabilities in Indonesia: 1) improving the accessibility of digital content and websites, and 2) identifying the number of disabled households. In response to the former, the Indonesian government adopted the World Content Accessibility Guidelines (WCAG 2.0) to guide and ensure the accessibility of government websites, and implemented the use of ScreenReader, an assistive technology that helps the blind and dyslexic read websites and digital content. Additionally, the government developed digital literacy programs specifically for persons with disabilities. The "ICT Literacy Guidance for People with Disabilities" program specifically engages persons with disabilities and blind youth. The program involves local stakeholders from organizations working alongside local governments to deliver programming.

Despite these efforts, the government faces continued challenges to ensure the connectivity of persons with disabilities. Often, programming and policies isn't enough, as a great deal of stigmatization must be overcome to view disabilities as not necessarily limiting, but instead as alternative lived experiences that must be accommodated by service providers and technology developers alike. Additionally, to effect widespread change, governments must take a coordinated approach to procurement standardization, policy and accessibility guidelines adoption across multiple sectors and levels of government.

BOX 13.8

Women teaching women: India's Saathi program

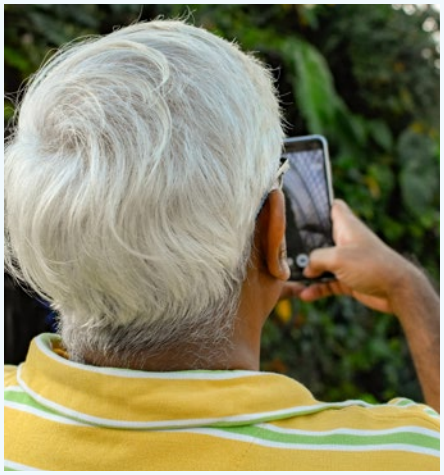
The gender-digital divide remains prominent, with women continuing to be at a disadvantage. This was particularly acute in rural India, where women accounted for only 10% of internet users in 2014. In addition to limited connectivity and literacy barriers, social norms also frequently underscore the divide, where internet access is often seen as a negative influence for women.

In collaboration with Tata Trusts, Google established the "Saathi" (friends) program. The program encourages women in rural India to develop and teach digital literacy skills in their communities. It provides training to women in accordance with local customs and practices. The trained Internet Saathis are sent to various villages with two tablets or smartphones for twenty days a month over a period of six months. These digitally literate Internet Saathis then inform others of the benefits of the internet, ways of accessing important information with mobile devices, and other learning objectives. As of 2020, there are more than 81,500 Internet Saathis who have assisted over 30 million women in improving their digital literacy skills. The program has covered 290,000 villages across 20 states in India.

As a direct result of the program, three in ten Internet Saathis and two in ten beneficiaries have established different forms of businesses, with earnings often between 3,000-5,000 rupees per month. A report by Google notes that businesses set up by Internet Saathis account for 60% of their total household monthly income, while those established by beneficiaries account for 52% of income.

The program and others like it, reveal three key gender-based digital divides: 1) access to connectivity and ICT, 2) the usage of digital technologies, and 3) active participation in the digital landscape. With local customs and practices in mind, targeted digital literacy learning programs are crucial in bridging the divide from all three dimensions for women and girls. Undoubtedly, access to ICT for women is pivotal. Not only does it allow women to access public and private services, it also facilitates women's contribution to the knowledge society.

BOX 13.9



Plan Ibirapitá - Connecting the elderly uruguayan population

The Ibirapitá programme in Uruguay seeks to bridge the digital divide for the elderly population by distributing tablets customised to provide a friendly user experience for the elderly people. It has been established by the government through the creation of a decree in 2015, and aims to promote digital inclusion for the elderly to improve social inclusion, participation and equality. In 2020, the programme was established under the Social Security Bank , with the objective to expand the access and resources needed to serve more users in the elderly community.

The tablets include 1GB of internet data per month, can be recharged and are ordered through local Ibirapitá spaces across Uruguay. These spaces are also where courses and support are offered for participants to learn how to use the tablets, their applications, and discover available content. Support for technical issues and usage information is provided via the program's website or through the local centers, including the return or dispatch of the tablets for maintenance.

According to the programme, the most accessed applications are for social media, video streaming, and communication, along with the public library portal. Users have the option to register for courses online or at the closest Ibirapitá center.

BOX 13.10

Adoption of digital technologies in low-income neighborhoods in Nairobi

Since the 2010s, Kenya has experienced a positive trend in the adoption of ICT, reaching 37 million mobile internet subscribers, and seeing an increase in the number of internet-based businesses. However, the digital divide persists and is primarily tied to socioeconomic disparities.

A 2017 study by the United States International University studied how the adoption of internet use differed between socioeconomic groups, and the cultural differences in attitude towards the use of ICT. The researchers examined internet adoption using a "Domestication" approach. Domestication refers to the process by which a technology becomes an integral part of a user's habits and daily activities. For example, Domestication of ICT occurs when members of a household take proactive steps to learn how to use ICT, and strive to benefit from it for work, study, or leisure. Researchers conducted a comparative study between two different neighborhoods of Nairobi: Umoja, an upper-middle class suburb, and Mathare, a city slum. A select number of households in both neighborhoods that lacked internet connectivity and mobile phones were provided with a laptop, an internet access dongle, a logbook to record their activities, and a 5-week training course. One person in the household was selected as a trainee and once receiving training, passed their knowledge on to other members of their household.

All participant households showed significant progress in adopting internet technology by the end of the study. Household members expanded their use of the internet from seeking work opportunities and local news to leisure, entertainment, and connecting with friends. Moreover, study participants invited friends and neighbors to share their digital knowledge. The participants also indicated that the digital skills training enhanced their employment potential and made them eligible for jobs they had to turn down previously.

The study highlights how addressing the digital divide requires more than the development and allocation of infrastructure. Internet literacy training is important for technology adopters to successfully navigate the digital economy, and make use of available services. Additionally, the study showed the relative success of internet adoption in a community or family-setting where digital skills training can be shared.

BOX 13.11

Bogotá's 'Território Inteligente' (Smart Territory) and 'Agendas de Transformación Digital' (Digital Transformation Agenda)

Bogota's Smart Territory program and the Digital Transformation Agenda are examples of the city's efforts to empower and promote digital capacity building with the local population. Through the program, one hundred projects were included in a portfolio of initiatives addressing quality of life, capacity building for residents, access to opportunity, and the redevelopment of green areas. Among those, the agenda for Education and Digital Adoption (Appropriación Digital) highlighted strategies to expand digital competencies, strengthen the autonomy of citizens, enhance the use of ICT technologies, and promote access to digital services.

To accommodate the Appropriación Digital, Bogota established the "Journeys of Collective Intelligence" program, which included participation from 683 people in vulnerable groups, including conflict victims, persons with disabilities, ethnic groups, women, youth, and rural residents. Day-long "Creative Marathons" were held, in which the local government worked with these stakeholders using open innovation techniques and rapid prototyping to identify solutions to problems identified by the community. This approach integrating community participation aimed to understand needs and gaps in digital capacities, as well as how they could be used to benefit and enhance standards of living for all of Bogotá.

Other initiatives within the broader strategy include "Aprende en Casa", a program that provides more than 1,500 educational courses that can be accessed online from home and the "Reto a la U" scholarship programme, which offers access to graduate programs related to technology and ICT. Additionally, in partnership with SENA - Secretaría Districtal de Educación, the municipality offered capacity courses in order to expand employment opportunities in technology fields.

BOX 13.12

Centros Comunitarios de Aprendizaje (CCA): Mexico's community centres for learning

In 2013, Mexico became the first country in the world to make internet access a constitutional right, and hold the government responsible as a provider, as it is with water provision and education in the country.

Following this mandate, the Mexican government established "Community Centers for Learning (CCA) ." These centers are the result of a multi-level partnership between national, regional and local governments, private sector and non-governmental organizations. CCA's are spaces for access to computers and the internet and the development of digital literacy skills. They also offer an opportunity for marginalised communities to access ICT infrastructure and information. The Centers are strategically located in areas where the populations lack connectivity, and aim to provide online formal education opportunities that can increase employment rates in such areas. The centers are expected to provide an entry point to the global landscape of information and knowledge sharing, and seek to impact the development of the community in need of it the most.

The structure of the partnership is such that Its implementation involves the center's manager, responsible for the coordination of the unit, the educational institution that provides the courses and capacity program, the civil society which is responsible for connecting the community and supporting improvements in the standards of living and work conditions, and the city government which coordinates the procedures needed to implement the center.


Curing Alzheimer's starts by believing we can.
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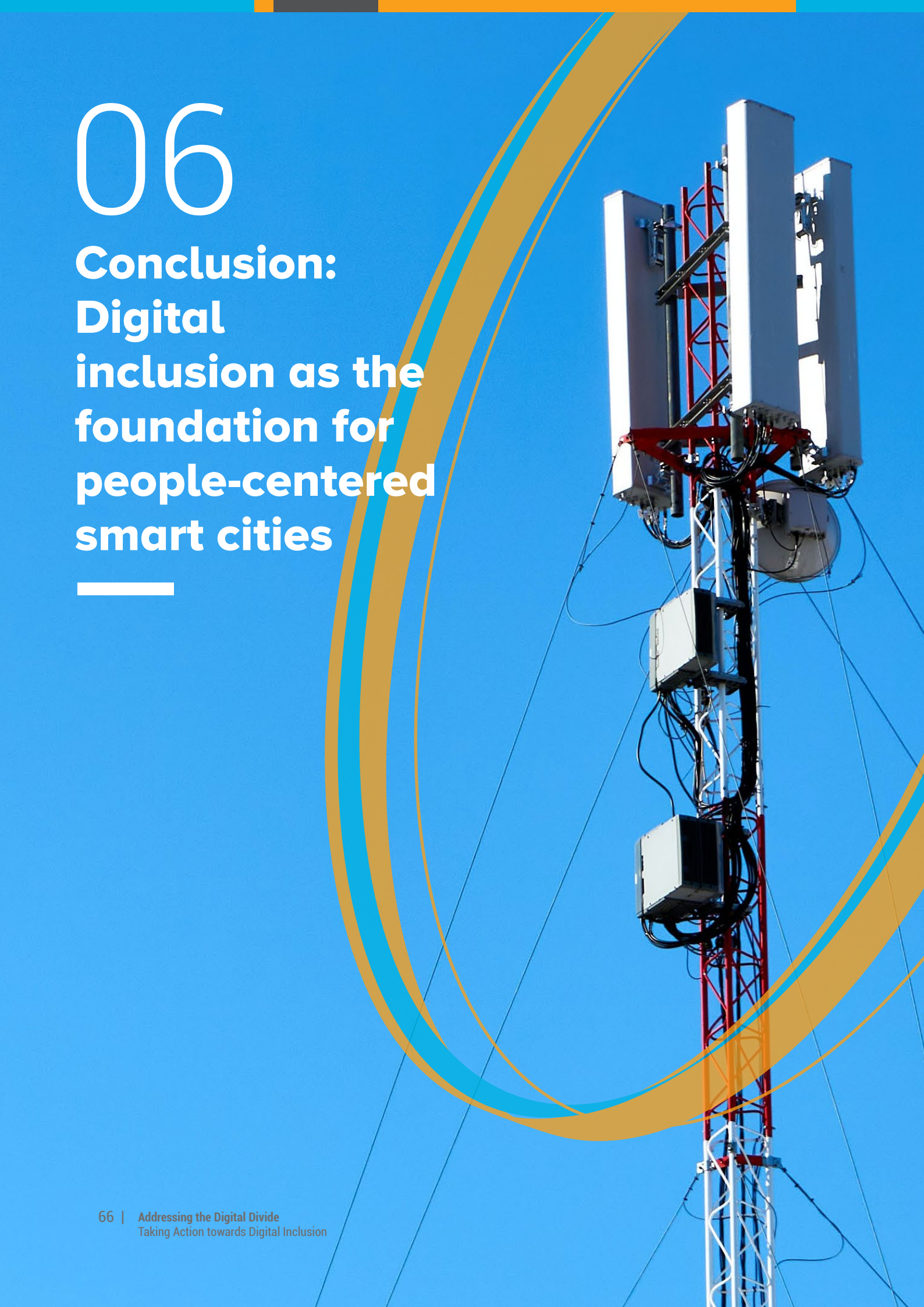
Conclusion: Digital inclusion as the foundation for people-centered smart cities



At the heart of people-centered smart cities is digital inclusion. Without affordable, equitable internet access all communities cannot participate to the fullest extent in society or reap the benefit of digital services provided by local government and society at large. Therefore, bridging the digital divide is the foundation of developing smart city strategies that place people at the centre of digital transformation.

The digital divide is both a symptom and perpetuator of income inequality where the disconnected largely belong to historically disadvantaged communities such as women, persons with disabilities, low-income communities and ethnic minorities. As a result, access to the internet has increasingly been understood as not just a technology problem, but as a confluence of several socio-economic conditions that influence access and use of ICT. **Taking action to bridge the digital divide today means reducing social and digital inequality simultaneously through multidimensional approaches that solve for a combination of technological, geographic, economic, educational, social and cultural reasons for the divide.**

Throughout this playbook, readers learned how to take action by creating customised digital inclusion solutions using cost-reducing strategies that leverage frameworks for community participation and multi-stakeholder financing. Readers were guided through a six step process starting with developing a Digital Divide Assessment (the subject of the first playbook in the series), identifying a Digital Divide Taxonomy, co-creating a digital inclusion plan, identifying a framework for taking action, choosing a finance model and finally, executing the plan.

Collectively, these elements form the first step towards a **people-centered smart city framework**, which encompasses digital transformation to realise sustainability, inclusivity, prosperity and human rights--thereby making urban digital transformation work for the benefit of all. **At the root of a smart city strategy that prioritises people is a digital inclusion plan that ensures equitable, convenient and affordable internet access.** Unlocking opportunities for this access pays dividends not just in terms of helping communities reap the benefits of digital services, but also in terms of elevating innovation, education and economic outcomes needed for inclusive participation in smart cities. The people-centered smart city framework and its components are articulated in *Centering People in Smart Cities: A Guidance Note for local and regional governments.*

Terms

Data divide
The gap among those who have the resources and ability to access and use open government data and those who have not.

Data sharing agreement
A formal contract that specifies the requirements for sharing data between two parties. The contract clearly documents what data is being shared and sets parameters for the use of data, data transmission, security, storage and destruction between any two parties that collect and/or manage data.

Data storytelling
Using data to tell a story visually, often through the use of informational graphics or mapping.

Digital divide
The gap between those who have access to and use Internet connectivity, digital literacy skills and internet-enabled devices and those who do not. While every community is different, the digital divide consistently reflects and amplifies existing social, economic and cultural inequalities such as gender, age, race, income, and ability. Access is multidimensional and includes the physical, spatial, cultural, demographic and socioeconomic conditions of accessibility.

Digital divide taxonomy
A classification of different types of the digital divide varying by the gaps exhibited, the location, and the root cause.

Digital human rights
Digital human rights are human rights as they exist in online and digital spaces. Digital technologies have the potential to advocate, defend and exercise human rights, but they can also be used to suppress, limit and violate human rights. Existing human rights treaties were signed in a pre-digital era, but online violations can today lead to offline abuses and, as highlighted by the UN Secretary-General, human rights exist online as they do offline and have to be respected in full. Of particular concern to the UN are data protection and privacy, digital identity, surveillance technologies including facial recognition and online harassment. In these areas, technlogies are increasingly being used to violate and erode human rights, deepen inequalities and exacerbate existing discrimination, especially of people who are already vulnerable or left behind.

Digital inclusion
The gap between those who have access to, and use Information Communication Technologies (ICTs) including Internet connectivity, digital literacy skills, and Internet-enabled devices, and those who do not. While every community is different, the digital divide consistently reflects and amplifies existing social, economic and cultural inequalities such as gender, age, race, income, and ability. Access is multidimensional and includes the physical, spatial, cultural, demographic and socioeconomic conditions of accessibility.

Digital literacy
The ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills.

Digital public goods
Open source software, open data, open AI models, open standards and open content that adhere to privacy and other applicable laws and best practices, do no harm, and help attain the SDGs.

Digital services
The electronic delivery of information including data and content across multiple platforms and devices like web or mobile. Digital services can be provided by any sector, public or private, that uses the internet to deliver information.

Digital sovereignty
The authority to independently control, protect, and manage digital data.

Digital twin
A digital representation of a real-world entity or system. The implementation of a digital twin is an encapsulated software object or model that mirrors a unique physical object, process, organization, person or other abstraction. Data from multiple digital twins can be aggregated for a composite view across a number of real-world entities, such as a power plant or a city, and their related processes.

E-government
The use of ICTs for improving the efficiency of government agencies and delivering better public services - including by providing government services online.

Gaps
The indicators or symptoms of the digital divide. Gaps are created in areas that have experienced a lack of investment in internet infrastructure or digital literacy resources as a result of geographic location, demographics, or socioeconomic class. Public and private sector entities alike can create gaps through systemic disinvestment in such communities. Authorities internationally recognise three manifestations of the digital divide where gaps are felt: connectivity (access to physical infrastructure), digital literacy, and devices (access to digital devices that use the Internet).

Homework gap
The gap between students with internet connectivity and those without.

Hyperlocal
Granular information or data related to a specific local community

Information and communication technology
All communication technologies, including the internet, wireless networks, cell phones, computers, software, middleware such as video-conferencing, social networking, and other media applications and services enabling users to access, retrieve, store, transmit, and manipulate information in a digital form.

Locations
Refers to where residents are experiencing the effects of the digital divide. This includes where residents experience a lack of connectivity; where residents live that suffer from low rates of digital literacy, or where residents live who lack convenient access to digital devices as determined by the residents themselves.

Least developed countries (LDCs)
Least developed countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets. There are currently 46 countries on the list of LDCs which are reviewed every three years by the UN Committee for Development (CDP).

Open data
Data that is freely available online for anyone to use and republish for any purpose.

Roots
The root causes of the digital divide are the reasons why people experience the effects of the digital divide. Root causes can be complex and include geospatial conditions, infrastructure accessibility and availability, socioeconomic conditions, demographic experiences, cultural practices, and education.

Smart sustainable cities
A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects.

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IMPLEMENTING THE NEW URBAN AGENDA

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