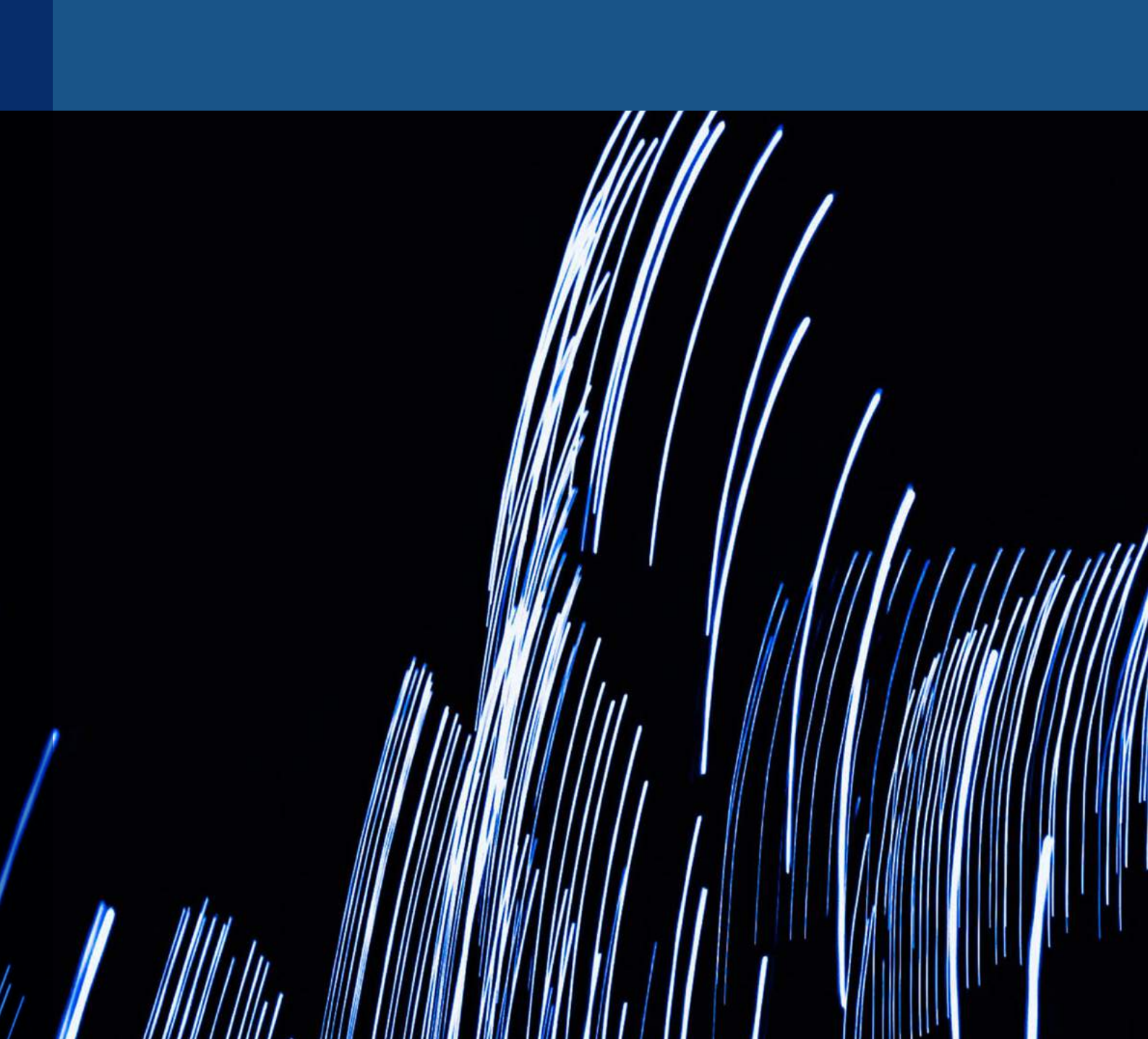




Connecting Africa Through Broadband

A strategy for doubling
connectivity by 2021 and
reaching universal access by 2030



BROADBAND COMMISSION
FOR SUSTAINABLE DEVELOPMENT



The views contained in this report do not necessarily reflect the position of the
Broadband Commission, or the views of all Members of the Broadband
Commission or their organizations.

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Broadband Commission
Working Group on Broadband for All:
A “Digital Infrastructure Moonshot” for Africa

October 2019



Table of Contents

Foreword.....	8
Acknowledgements.....	12
Executive Summary	14
Abbreviations.....	22
1. Introduction.....	24
2. Snapshot of Africa’s Digital Infrastructure.....	34
3. Mission, Vision, and Principles for Digital Transformation in Africa.....	46
4. Investment Requirements for 2021 and 2030 Digital Infrastructure Targets	56
5. Policy and Regulatory Frameworks to Enable Digital Transformation.....	68
6. Digital Skills and Local Content Development.....	78
7. Targeted Approach for Device Affordability.....	84
8. Roadmap and Action Plan to Achieve Universal, Affordable, and Good Quality Broadband Access Across Africa.....	92
9. Financing Mechanisms for the Digital Infrastructure Moonshot for Africa.....	108
10. Monitoring Progress towards Broadband for All	112
Appendixes	116

Figures

Figure 0.1.	The World Bank's Digital Economy for Africa (DE4A) Framework.....	15
Figure 0.2.	Investment Needed to Achieve Universal Access to Broadband Connectivity by 2030	16
Figure 0.3.	Relative Size of Investment Needed by Country for Universal Access by 2030	17
Figure 0.4.	MFD Indicative Distribution of Cost Sharing	18
Figure 0.5.	Roadmap for Universal Access to Affordable and Good Quality Broadband	20
Figure 2.1.	Broadband Penetration in African Countries by Technology, 2010-2018....	35
Figure 2.2.	Broadband Infrastructure Value Chains.....	36
Figure 2.3.	Proportion of Population with Access to Electricity, 2017	43
Figure 4.1.	Mobile Penetration in Africa by Country, 2018.....	60
Figure 4.2.	4G Mobile Broadband Penetration in Africa by Country, 2018.....	61
Figure 4.3.	Investment Needed to Double Broadband Penetration in Africa by 2021	63
Figure 4.4.	Relative Size of Investment Needed by Country to Double Broadband Connectivity by 2021.....	64
Figure 4.5.	Investment Needed to Achieve Universal Access to Broadband Connectivity	65
Figure 4.6.	Relative Size of Investment Needed by Country for Universal Access by 2030.....	66
Figure 4.7.	Expected Broadband Penetration Growth (2018, 2021, 2030)	67
Figure 4.8.	Investment Needed to Achieve Universal Access to Connectivity by Region.....	67
Figure 7.1.	Affordability of Entry-Level Device in Low- and Middle-Income Countries by Region.....	86
Figure 8.1.	Roadmap for Universal Access to Affordable and Good Quality Broadband	94
Figure 8.2.	Ghana Investment Fund for Electronic Communications - Smart Community Architecture	100
Figure 9.1.	MFD Indicative Distribution of Cost Sharing	111
Figure A.1.	Estimating Requirements for the 2021 Target: Model Structure (Indicative).....	120
Figure A.2.	Estimating Requirements for the 2030 Target: Model Structure (Indicative).....	121

Tables

Table 1.1.	Examples of Digital Infrastructure Initiatives and Programs	30
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Boxes

Box 1.1.	The African Union's Digital Transformation Strategy for Africa	26
Box 1.2.	The World Bank's Digital Economy for Africa (DE4A) Framework.....	27
Box 1.3.	European Union-African Union Digital Economy Task Force (EU-AU DETF) ..	29
Box 2.1.	ITU Interactive Transmission Map.....	37
Box 2.2.	African Undersea and Terrestrial Fiber Optic Cables	39
Box 2.3.	GSMA Mobile Coverage Map.....	41
Box 2.4.	Sustainable Development Goal on Energy (SDG7) and the World Bank Group.....	43
Box 3.1.	Mobilizing Finance for Development (MFD).....	48
Box 3.2.	GSR19 Best Practice Guidelines to Fast-Forward Digital Connectivity for All.....	49
Box 3.3.	Principles for Natural Disasters and Climate Change in the Telecom Sector.....	51
Box 3.4.	The World Bank 's Core Principles for Digital Infrastructure	53
Box 3.5.	Five Principles for the Digital Transformation Strategy for Africa	54
Box 3.6.	Mission, Vision, and Values for ITU's Strategic Plan 2020-2023.....	55
Box 4.1.	A Multistakeholder Process	58
Box 5.1.	Digital Public Platforms.....	76
Box 5.2.	The Impact of Taxation on Affordability	77
Box 6.1.	Addressing Digital Skills and Local Content	80
Box 6.2.	Closing the Digital Skills Gap for Nigerian Women and Girls	81
Box 6.3.	Technology Bootcamp Empowers Young Tanzanian Women.....	82
Box 7.1.	KaiOS: Affordable Smart-Feature Phones.....	88
Box 8.1.	Facebook's Shared Backhaul Projects	96
Box 8.2.	Reverse Subsidy Auctions as a Mechanism for Widening Rural Access	98
Box 8.3.	Huawei: Innovative Infrastructure Solution to Expand Access to Rural Areas.....	102
Box 8.4.	Microsoft's Airband Initiative.....	102
Box 8.5.	Nokia's Smart City Playbook	103
Box 8.6.	Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps	105
Box 8.7.	Intelsat's Partnership with UNHCR to Bring Internet Access to Refugees.....	106
Box B.1.	ITU's Smart Village Platform.....	123
Box B.2.	The Digital Transformation Platform and Broadband Investment Program in the Maghreb Region.....	123
Box B.3.	Developing a Public-Private Partnership for International Fiber Optic Connectivity – São Tomé and Príncipe	124
Box B.4.	OneWeb – Strategy to Connect Remote, Rural Villages and Roadways	126
Box B.5.	KT's Copper Wire-Based Gigabit Internet Technology Solution.....	128
Box B.6.	Talia's Quika Brings HTS Ka Band Services to Remote Locations.....	129
Box B.7.	The Smart Africa Broadband Strategy Document.....	129
Box B.8.	GSMA's Mobile Internet Skills Training Toolkit.....	131
Box B.9.	KT's GiGA Island Initiative	132
Box B.10.	ISTIC's Double Hundred Universities Cooperation Project	133
Box B.11.	WomEng South Africa with One Million STEM Girls Project.....	134
Box B.12.	Shared-Value Partnership for Equitable Access to Digital Literacy in Kenya	135

Foreword

HIS EXCELLENCY PAUL KAGAME,
President, Rwanda Co-Chair,
United Nations Broadband Commission for
Sustainable Development

THE HONORABLE CARLOS SLIM HELÚ,
President, Carlos Slim Foundation Co-Chair,
United Nations Broadband Commission for
Sustainable Development

Dear friends,

Since my appointment as UN Broadband Commissioner in September 2018, the World Bank Group (WBG) has actively engaged with the Working Group Commissioners and Focal Points, African Union, governments, the private sector, and the donor community to promote an ambitious vision to harness digital technology and innovation to transform the African continent's economies, societies, and governments. This is urgent. Africa is the key to reaching our goals of ending extreme poverty by 2030 and boosting shared prosperity. Our latest *Poverty and Shared Prosperity 2018* report found that in 2015, the most recent year with robust data, global extreme poverty reached 10 percent – the lowest level in recorded history. But the report also showed that extreme poverty is becoming more concentrated in Sub-Saharan Africa because of the region's slower rates of growth, problems caused by conflict and weak institutions, income inequality and a lack of success in channeling growth into poverty reduction.¹ Sub-Saharan Africa now accounts for most of the world's poor, and— unlike most of the rest of the world—the total number of extremely poor people in Sub-Saharan Africa is increasing – from 278 million in 1990 to 413 million in 2015. In 2015, the continent was home to 27 of the world's 28 poorest countries, all with poverty rates above 30 percent, and the region had more extremely poor people than the rest of the world combined. Whereas the average poverty rate for other regions was below 13 percent as of 2015, it stood at about 41 percent in Sub-Saharan Africa. The working-age population in Africa is expected to increase by some 450 million people between 2015 and 2035. If current trends continue, less than one quarter will find stable jobs. Over 300 million people will be unemployed.

The digital agenda fosters economic growth and creation of jobs. Accelerating broadband connectivity so that every individual, business, and government in Africa is digitally enabled is a once in a generation chance to disrupt the growth trajectory and open up new opportunities for economic and social development. According to econometric studies prepared by the International Telecommunication Union (ITU), expanding mobile broadband penetration by 10 percent in Africa would yield an increase of 2.5 percent in GDP per capita. In addition, it suggests that a 10 per cent

1. 1. The World Bank. *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*. Despite faster growth in some Sub-Saharan African economies, such as Burkina Faso and Rwanda, the region has also struggled to improve shared prosperity. The bottom 40 in the dozen Sub-Saharan African countries saw their consumption (or income) rise by an average of 1.8 percent per year in 2010–15 (slightly below the global average of 1.9 percent per year). Furthermore, the consumption (or income) level of the bottom 40 shrank in a third of those 12 countries.

drop in mobile broadband prices will boost adoption of mobile broadband technology by more than 3.1 per cent.² Broadband connectivity also creates new jobs through many avenues – directly through the demand for labor from technology-based companies and indirectly through demand from the wider ecosystem that support technology-based enterprises. And innovation has always created jobs in new sectors that did not exist before (for example, jobs in innovation hubs and jobs in professions that require access to data). Universal, affordable and good quality broadband underpins the digital economy and its rapidly expanding businesses, creating millions of jobs in these new sectors. The global impact of an increase in internet penetration on employment have been analyzed by the ITU, Deloitte as well as other institutions and academic institutions. Expanding internet growth to a much higher level (75 percent penetration) could lead to a nine percent increase of job creation compared with what might have existed with current levels of penetration.

We must ensure that the promise of digital transformation leaves no one behind.

Digitization is expanding access to basic needs and services. Several of the Sustainable Development Goals (SDG), such as universal identification, efficient government services, and financial inclusion and job creation require the intensive use of information and communication technologies (ICT). Digital ID projects in Côte d'Ivoire and Guinea kickstarted the West Africa regional identification program with more than \$300 million from the West Africa Unique Identification for Regional Integration and Inclusion (WURI) program. A new generation of projects is helping transform selected sectors through e-health, e-agriculture, digital transport, and more, promoting effective, transparent, tech-enabled public service delivery, evidence-based policy and public management, harnessing the data revolution. Underlying these goals is SDG target 9c: to significantly increase access to ICTs and strive to provide universal and affordable access to the internet in least developed countries (LDCs) by 2020. To achieve this, we must take a global approach to digital transformation, and at the same time step up our commitment to connect the 49 percent of the population in the region that are still excluded from ICT services and are most at risk of being left behind. Significant progress has been made and much more can be done toward making services more affordable and increasing adoption.

We call for a coalition to rally around the African Union for an ambitious digital transformation agenda. I am very pleased that the World Bank is a member of the UN Broadband Commission, and is working closely with the African Union, regional economic communities and African governments to support a new level of ambition for digital transformation. Under the digital economy for Africa initiative (DE4A), which has sometimes been called a “digital moonshot for Africa,” the WBG is supporting the African Union Digital Transformation Strategy. Prepared under the leadership of the African Union Commission (AUC), the Digital Transformation Strategy for Africa sets out a bold vision to ensure that every African individual, business, and government is digitally enabled by 2030. The goal is to drive the digital transformation of Africa and ensure its full participation in the global digital economy.

For dynamic, inclusive, and safe digital economies to emerge, African countries will

2. ITU, Economic contribution of broadband, digitization and ICT regulation: Econometric modelling for Africa, https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.BDT_AFR-2019-PDF-E.pdf.

need to follow a holistic approach to building a dynamic digital economy on top of strong analog foundations of good governance, enabling regulations, accountable institutions, and relevant skills. Based on global experience and learning, World Bank and IFC have launched a joint development framework to support continued efforts towards inclusive and sustainable digital economies. This comprehensive agenda focuses on strengthening the five foundations needed for the digital economy to function. In this regard, the digital economy will further require broadband networks to be universally available, affordable, of good quality and accessible alongside data centers/cloud services (Digital Infrastructure Pillar); digital platforms that allow governments, firms, and individuals to access a wide range of products and services and conduct secure online transactions, underpinned by unique, authenticated digital identification for an inclusive digital economy (Digital Platforms pillar); the ability for people, businesses, and governments to pay, transact, and manage their financial wellbeing—all digitally—and for people and businesses to access affordable/tailored digital financial services including credit, insurance, deposit, and pensions (Digital Financial Services Pillar). When new or existing businesses are able to transact online, secure digital data on markets and consumers, and expand through digitized value chains and e-commerce, then digital economies energize growth, offer innovative products and solutions, and create new forms of work (Digital Entrepreneurship Pillar). Finally, ensuring the widespread availability of digital skills allows individuals and business to harness the opportunities and guard against the risks of the digital economy (Digital Skills Pillar). These five pillars are critical foundations of the digital economy.

In addition to the five foundational pillars, there are several crosscutting elements that are also key to achieve a vibrant, inclusive and safe digital transformation. The digital economy can provide a new growth model to create economic growth, jobs, new products and services, poverty reduction, and enhance the region's competitiveness. A digital economy brings digital transformation to the traditional, or "analog," sectors of an economy, such as healthcare, education, agriculture, trade and banking, among others. However, it can also bring risks and vulnerabilities which are being exploited by cybercriminals. Misinformation, harassment of vulnerable groups, and closing the gap between connected and unconnected are real challenges for policy makers. Therefore, governments must be able to maximize benefits, while actively minimizing the risks of the digital economy, and this will require an appropriate regulatory and policy environment. In relation to cybersecurity and data protection, relevant legislation and cybersecurity measures have to be addressed to ensure a safe digital economy. Competition is also an essential component to ensure an efficient digital transformation strategy - governments should encourage healthy competition, increase productivity, and achieve scale. Furthermore, women are a critical component of any digital transformation in Africa. However, restrictive gender norms exist in different regions, as is the case in Sub-Saharan Africa, that limit women's access to and usage of digital technologies, further excluding them from opportunity.³ In order to address this, a rigorous research approach must be carried out to inform policy, implementation strategy and evaluation metrics, ensuring that African women form a key part of the digital economy.

The digital revolution is well underway in Africa and offers a leapfrogging opportunity in many foundational areas of the digital economy to leverage global and regional initiatives. A digital transformation promises to be a positive multiplier for other socioeconomic trends, bringing them to scale to achieve a deeper and faster transformation. Rising mobile phone penetration, improving broadband connectivity and accelerating internet speeds, and the widespread adoption of mobile money

3. Gender norms differ greatly between regions, countries and even subregions, however, gender gaps in mobile ownership and mobile internet use are often wider where mobile penetration is lower, as is the case in Sub-Saharan African.

across Africa are all changing the way the continent communicates, collaborates, and transacts. In turn, this will unleash new opportunities for people, businesses, and governments in a virtuous circle.

In particular, there are significant opportunities to be gained for the region in the agriculture sector, where the target for 2030 is for every African farmer, agribusiness, and ministry of agriculture to be digitally enabled. E-agriculture will be critical to promote efficiency and sustainable production, where land and soil information could be readily available in public databases and irrigation systems could be monitored digitally, to optimize water use. Many other sectors of the economy will also benefit. As an example, universal access to affordable high-speed broadband communications technology will assist health systems to provide higher quality and more patient-focused care, especially in rural and remote areas, by giving health workers access to tools that allow them to do more and draw on resources previously only available in major urban centers.

I applaud the efforts of the African continent to take this agenda to the next level, with the support of Heads of States. I also count on all of us, the friends of digital transformation, to work together in a coordinated manner. It will be critical that we work closely with the African Union Commission (AUC), with regional economic communities, and governments, with development partners, and with representatives of the private sector to create a single coordination platform to support the efforts the continent is making. You can count on the World Bank Group's full participation in this effort. You can also count on our full commitment to the digital transformation agenda in Africa, leveraging all our instruments, our knowledge, and our convening power.

In this Working Group report under the Broadband Commission's auspices, we propose a roadmap and action plan for universal, affordable and good quality broadband connectivity in Africa, combining investment needs, sector reforms, and demand stimulation required to advance to a single digital market on the continent. Underpinning the successful implementation of the roadmap is the World Bank Group's Mobilizing Finance for Development (MFD) approach to systematically leverage all sources of finance, expertise, and solutions to support developing countries' sustainable growth. In this roadmap and action plan. I am calling for a global coalition to achieve Africa's digital transformation so that by 2030 every individual, business, and government in Africa is digitally enabled and ready to thrive in the digital economy. The roadmap may be found in chapter 8.

The present report has been created collaboratively, over several meetings, drawing on contributions and insights from the participants of the Broadband Commission for Sustainable Development's Working Group on Broadband for All: A Digital Infrastructure Moonshot for Africa. I would like to give special thanks to the members of the Working Group and other active participants who agreed to share so much of their time, wisdom, and experiences. You will find a description of the multistakeholder consultation process in appendix C and a list of those members of the Working Group under the Acknowledgments section of the report.

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**More information about the
Working Group on Broadband for All:**

A Digital Infrastructure Moonshot for Africa is available at:
<https://www.broadbandcommission.org/workinggroups/Pages/WG2-2018.aspx>

Executive Summary

Digital technologies and the digital economy will have a transformative impact on development. Today's economy is being driven by digital transformation across all sectors and digital technology is increasingly at the center of people's daily lives. Indeed, several Sustainable Development Goals (SDGs) require information and communication technologies (ICTs) as an enabler, notably to achieve universal identification, more efficient delivery of government services, financial inclusion, and job creation. Furthermore, digital transformation will impact key sectors of the economy, such as health, agriculture, education and trade, among others, and will support the needs of people, governments, and the private sector resulting in an essential tool for people's access to rights and services as well as better governance. Underlying these goals is SDG Target 9.c: *to significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries (LDCs) by 2020*. While some progress has been made in this regard, there is a danger that in Africa, where many of the LDCs are located, this target will be missed, both in terms of access and affordability. Home to some 1.2 billion inhabitants, the continent will need to act quickly and boldly, or risk being left behind as **the rise of digital technologies and the digital economy offers a once in a generation chance to take advantage of digital transformation to accelerate the achievements of the SDGs.**

Achieving universal affordable and good quality broadband access across the whole of Africa requires a sustained and committed effort from all stakeholders.

The African Union Commission (AUC) set up a taskforce and led a multistakeholder process to develop the *Digital Transformation Strategy for Africa*, a vision to harness digital technologies and innovation to transform Africa's economies, societies, and governments to generate new economic growth, job creation, and poverty reduction. As a complement to AUC's vision, the World Bank Group (WBG) has also initiated a regional program, the Digital Economy for Africa (DE4A) initiative, with five corresponding foundational pillars – digital infrastructure, digital financial services, digital platforms, digital entrepreneurship, and digital skills (see figure 0.1) – with the objective to digitally enable every African individual, business, and government by 2030, while targeting intermediate priority results by 2021.

While these initiatives set clear goals and address important issues toward universal affordable and good quality broadband access, there has been less discussion about the investment required and financing needs to meet the targets, modalities for financing the agenda, and how to operationalize the framework and principles. To this end the **Working Group on Broadband for All: A Digital Moonshot Infrastructure for Africa** was formed as a multistakeholder consultation group to engage key ICT industry partners, estimate the investment needs, and prepare a roadmap to help countries and development actors coordinate, accelerate and prioritize their efforts to help reach the SDGs by improving digital infrastructure in Africa. This report summarizes the findings and recommendations from the Working Group.

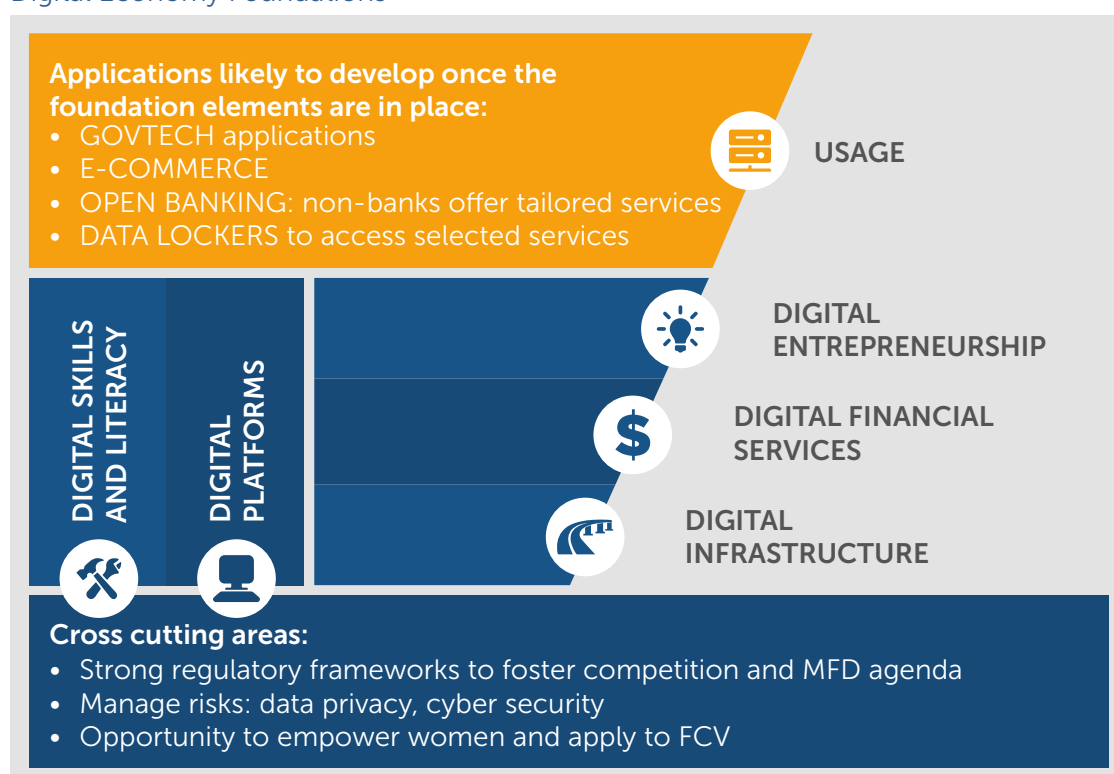
4. The AU process is codified in AU rules for consultations ahead of approval by Heads of States.

Figure 0.1. **The World Bank's Digital Economy for Africa (DE4A) Framework**

Principles

Comprehensive	Taking an ecosystem approach that looks at supply and demand and defies a narrow silo approach in defining the requisite elements and foundations for digital economy
Transformative	Aiming at a very different scale of ambition beyond incremental 'islands' of success
Inclusive	Creating equal access to opportunities and dealing with risks of exclusion
Homegrown	Promoting homegrown digital content and solutions while embracing what is good and relevant from outside the continent
Collaborative	Ensuring collaboration and coordination among countries, among sectors, and among public and private players

Digital Economy Foundations



Investment Requirements for 2021 and 2030 Digital Infrastructure Targets

The World Bank has developed two goals to ensure the initiative is fully realized and the strategy stays on track: a short-term progress milestone to be achieved by 2021 – to double broadband connectivity penetration in Africa by 2021 from 2016 penetration levels, and a long-term target to be achieved by 2030 – *to achieve universal affordable and good quality broadband access in Africa by 2030*.

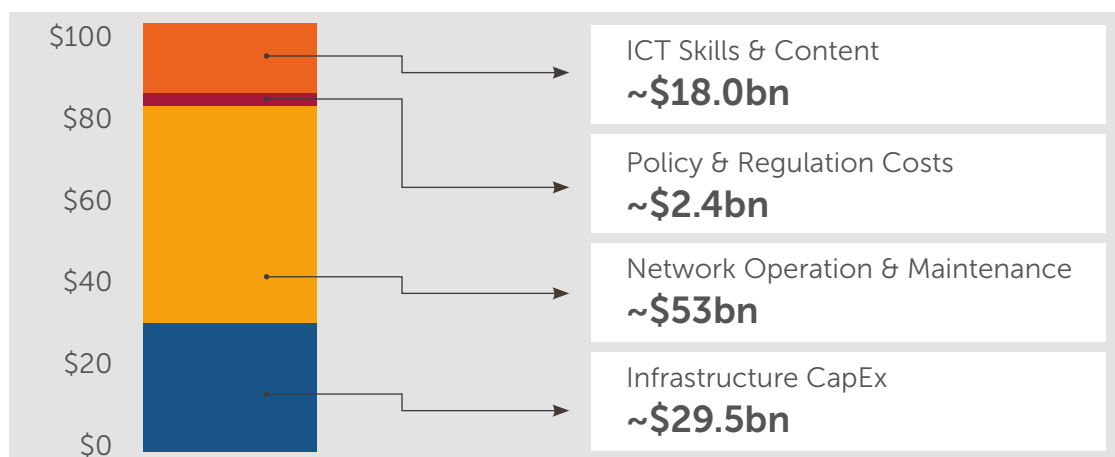
Using a variety of data sources, including consultations with key ICT industry stakeholders, the following key findings were concluded.

To double broadband connectivity by 2021, nearly 220 million new people must come online and an estimated \$9 billion in investment is required.

Doubling broadband penetration also implies a significant uptake of penetration in areas already covered by broadband networks, through legal and policy reforms aimed at increasing accessibility, awareness, affordability, relevance, safety, and security as well as the level of digital skills through capacity building programs. Specific attention should be devoted to countries showing low penetration level, of which many are in a fragile situation⁵.

Nearly 1.1 billion new unique users must be connected to achieve universal, affordable, and good quality broadband internet access by 2030, and an estimated additional \$100 billion would be needed to reach this goal over the next decade (see figure 0.2). This is unquestionably a **significant infrastructure undertaking**, requiring the deployment of nearly 250,000 new 4G base stations and at least 250,000 kilometers of fiber across the region. It also requires rolling out satellites, Wi-Fi based solutions, and other innovations to reach an estimated population of nearly 100 million that live in remote rural areas that are currently out of reach of traditional cellular mobile networks. Another required investment is building the **user skills and local content foundations** to ensure that the deployed infrastructure is used adequately, in a manner that would support its long-term viability. Investment in developing and implementing **adequate policy and regulation frameworks** will also be required to create market conditions that foster technology deployment, the development of a broader technology ecosystem, and overall broadband service affordability.

Figure 0.2. **Investment Needed to Achieve Universal Access to Broadband Connectivity by 2030**



5. <https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations>

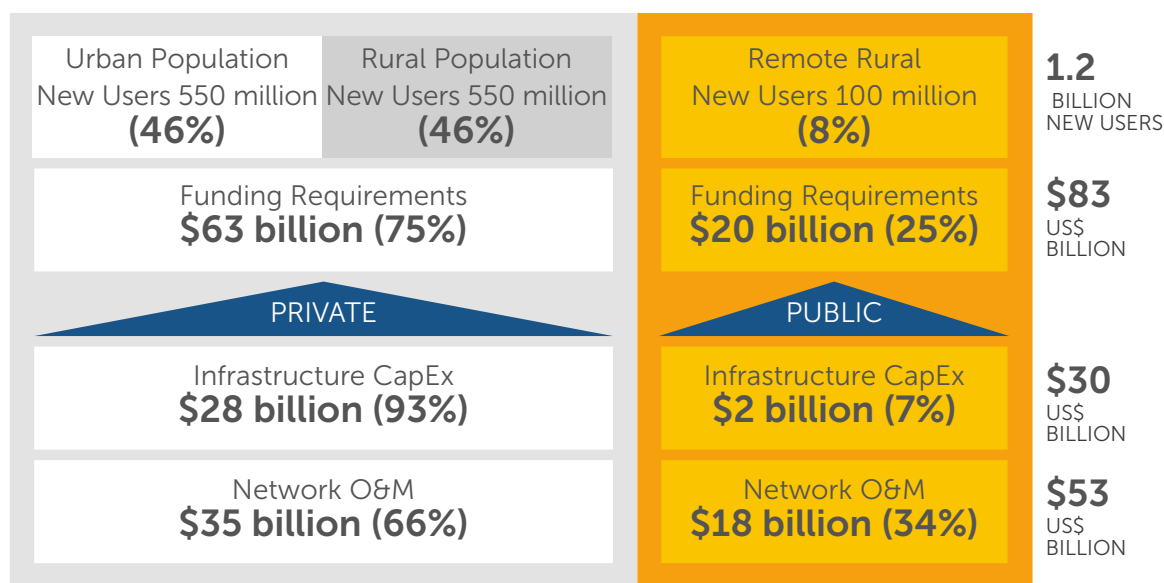
Figure 0.3. **Relative Size of Investment Needed by Country for Universal Access by 2030**



No single actor acting alone will be able to meet the 2030 target and carry the burden of a \$100 billion investment funding requirement. Mobilizing Finance for Development (MFD) is the World Bank Group's approach to systematically leverage all sources of finance, expertise, and solutions to support developing countries' sustainable growth. Focus of efforts are centered in three main areas: (i) strengthening investment capacity and policy frameworks at national and subnational levels; (ii) enhancing private sector involvement and prioritizing commercial sources of financing; and (iii) enhancing the catalytic role of Multilateral Development Banks (MDBs). By scaling up private-finance mobilization, it aims to support countries' development goals in ways that complement and reinforce public resources.

All participating organizations must collaborate to ensure that their resources are used in the most effective way. Partnership among the financing partners as well as other implementing partners is more likely to result in effective investments, and ultimately, greater impact. Table 0.4 below provides an indicative distribution of cost sharing between the public and the private for infrastructure capital expenditure (CapEx) and network operations and maintenance (O&M). Another significant aspect of the MFD approach demonstrates that public investment participants (e.g. MDBs, bilaterals and other development aid agencies) will channel investments in areas that the private sector sees as non-commercially viable.

Figure 0.4. **MFD Indicative Distribution of Cost Sharing**



Note: New users in remote rural area are estimated at ~100m (~15%-20% of the rural population). This represents the low-density areas out of reach of traditional mobile networks.

Policy and Regulatory Frameworks to Enable Digital Transformation

Public policies and government practices can influence the development and impact of universal, affordable and good quality broadband connectivity in different ways. While the best policy option for any given country will depend on its unique context, certain core principles and established good practices have proven effective in accelerating broadband growth and adoption across different countries. The following are key features of broadband policy options:

- **National ICT Policies and Digital Strategies:** The basic foundation for establishment and promotion of broadband, including national digital strategies (holistic approaches to digital development and planning) and policy principles, directives and targets for sector-specific national ICT strategy as well as general principles for competition policy.
- **Laws, Legislation, and Regulation:** Regulatory agencies, instruments, rules, decisions, and oversight, which

implement and enforce legal and policy mandates, and govern overall broadband/ICT sector performance.

- **Public Funding, Investment:** Direct public funding of broadband projects through various vehicles, including government subsidies and public financing through public-private partnerships (PPP) arrangements.
- **Programs, Initiatives:** Government sponsored or supported programs to promote broadband awareness, adoption, and use, including education and training.
- **Government Adoption, Procurement:** The role of government as a user of broadband in its operations at all levels, including network connectivity, procurement of equipment and services, and aggregation of government demand and adoption across agencies.
- **Taxation, Fiscal Policy:** Tax, tariffs, fees, and other fiscal policies that affect costs and incentives for broadband service and equipment suppliers, investors, entrepreneurs, and customers.

Each of the above forms of policy intervention can influence one or more aspects of the overall broadband ecosystem. Furthermore, governments should design coordinated national broadband strategies for digital transformation that cover technological advancements and increased demands to leapfrog towards more integrated information systems and services.

Digital Skills and Local Content Development

Bringing over a billion new users online on the continent requires the global community to invest in digital skills and local content development – in particular, in local language – as part of the effort to increase connectivity and prepare people as active digital citizens. Given that most of the population still offline are from marginalized groups, including women, the poor, and rural communities, there is a need to invest in developing basic digital skills and support a local digital ecosystem to increase relevant local content and knowledge that support development opportunities, including for women and girls.

Investment must come from all stakeholders to prioritize the necessary policies and programs to develop digitally ready populations, for example, national governments sponsoring ICT educational development programs for worker retraining, multilateral development organizations investing in education programs for vocational schools, civil society organizations implementing digital skills education initiatives, and the private sector investing in local content development. Digital skills and content development programs should incorporate public- and private-led interventions, as well as those targeted at women and girls, and rural communities.

Device Affordability

Affordability remains one of the main challenges in addressing the global digital divide. The relatively high costs of getting online also include the costs of purchasing a mobile device. Sub-Saharan Africa faces the greatest challenge in terms of the affordability of an entry-level mobile device. The combination of expensive entry-level mobile data plans and entry-level devices keep the majority of people in the region offline.

As such, to achieve universal, affordable and good quality broadband access on the continent, improving device affordability must be a priority. To lower device costs, public and private stakeholders should explore the following strategies:

- **Increase device affordability and adoption through targeted public policies and market measures:** governments should explore programs that subsidize mobile devices, such as through its universal service and access funds (USAF). Governments should also work with the private sector and financial institutions to facilitate access to finance and payment plans for mobile devices, as well as assess the impact of taxation on devices. Governments should also work with the private sector and financial institutions to facilitate access to finance and payment plans for mobile devices, as well as assess the impact of taxation on devices. Continent-wide adoption of the ITA is critical to achieve this.⁶
- **Support business models offering low-cost devices on the market:** governments can support policies that promote local innovation and research and development for internet-enabled devices such as handsets, as well as prioritize support through government investment agencies for ventures (between local and foreign firms or PPPs) that seek to offer low-cost devices to the market.

6. 20 years of the Information and Technology Agreement. Boosting trade, innovation and digital connectivity. https://www.wto.org/english/res_e/publications_e/ita20years2017_e.htm

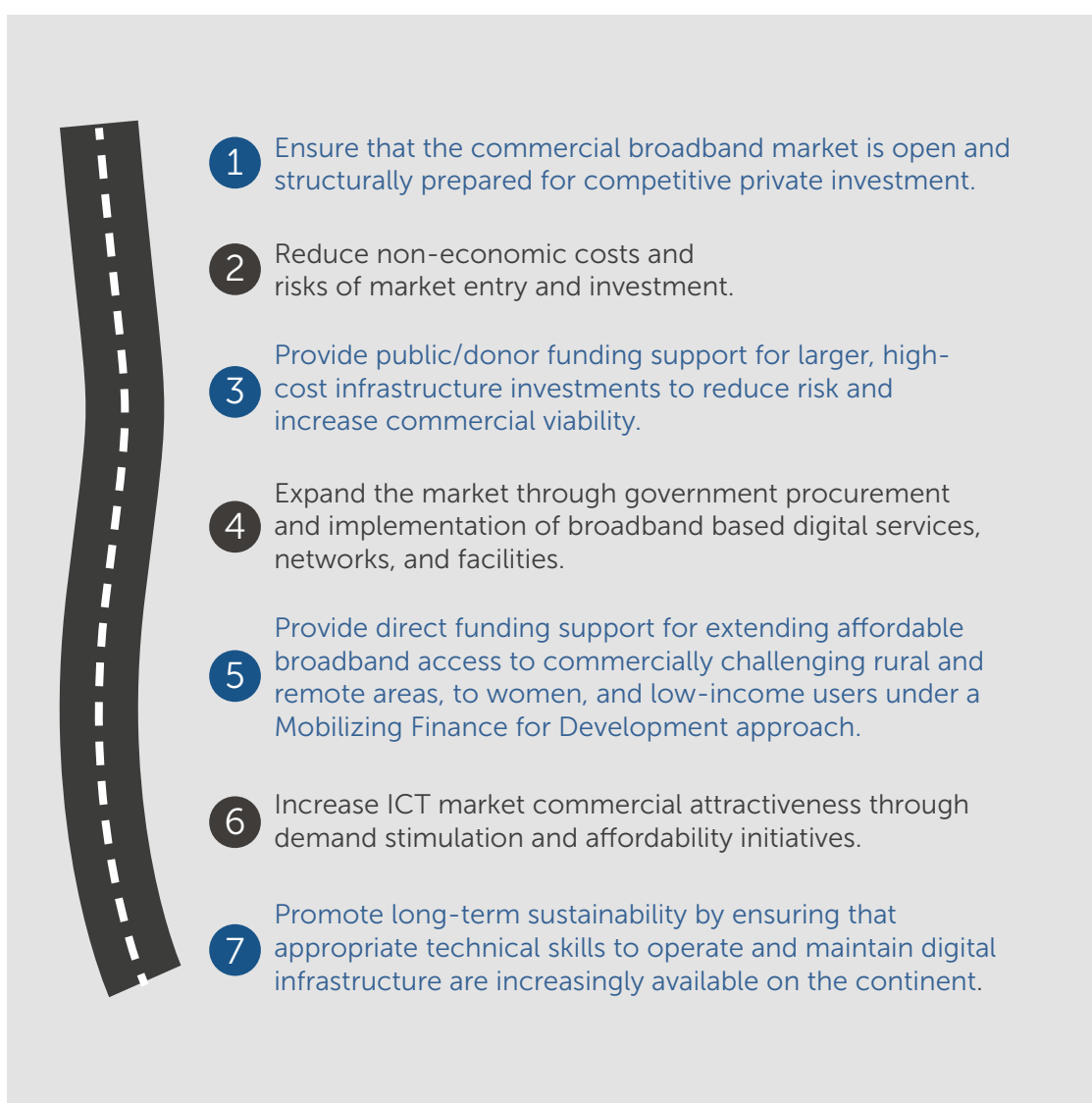
- **Engage with the private sector and other partners to lower manufacturing and distribution costs for devices:** The private sector, government, and academia should

examine the challenges posed by, and effects of, royalty stacking in the smartphone industry since royalties largely contribute to the high price of devices.

Roadmap and Action Plan

The main features of the broadband development roadmap by 2030 for any country include the following sequence of key objectives.

Figure 0.5. **Roadmap for Universal Access to Affordable and Good Quality Broadband**



In establishing its own policy, funding, and project priorities, each government should review the extent to which it has addressed each of these elements, and what its next actions should be to achieve

the relevant objectives. Specific short- and long-term action plans for each of the objectives are explained thoroughly in chapter 8.

Financing and Conclusion

With **an overall estimate of \$109 billion needed** to achieve the universal access to affordable and good quality broadband, drawing private investment in broadband infrastructure will be key, together with other funding sources. In this regard, countries should enable the MFD approach by opening up the markets to attract new participants, innovative business models and technologies, drawing much needed investment capital.

Stakeholders must also undertake investments for systemic changes needed to reach the 2030 goal, including in basic digital skills to use broadband, policy and regulatory reform, device financing mechanisms as well as in appropriate technical skills to operate and maintain digital infrastructure.

No single actor acting alone will be able to meet the 2030 target and help achieve the SDGs. All stakeholders must come together and collaborate to realize universally affordable access to the internet for all Africans. This includes: the African Union and regional economic communities; African governments and respective public investment agencies; sector regulators; multilateral development banks and regional development banks; the United Nations and other development agencies; the private sector (both national and foreign); and civil society groups and nongovernmental organizations.

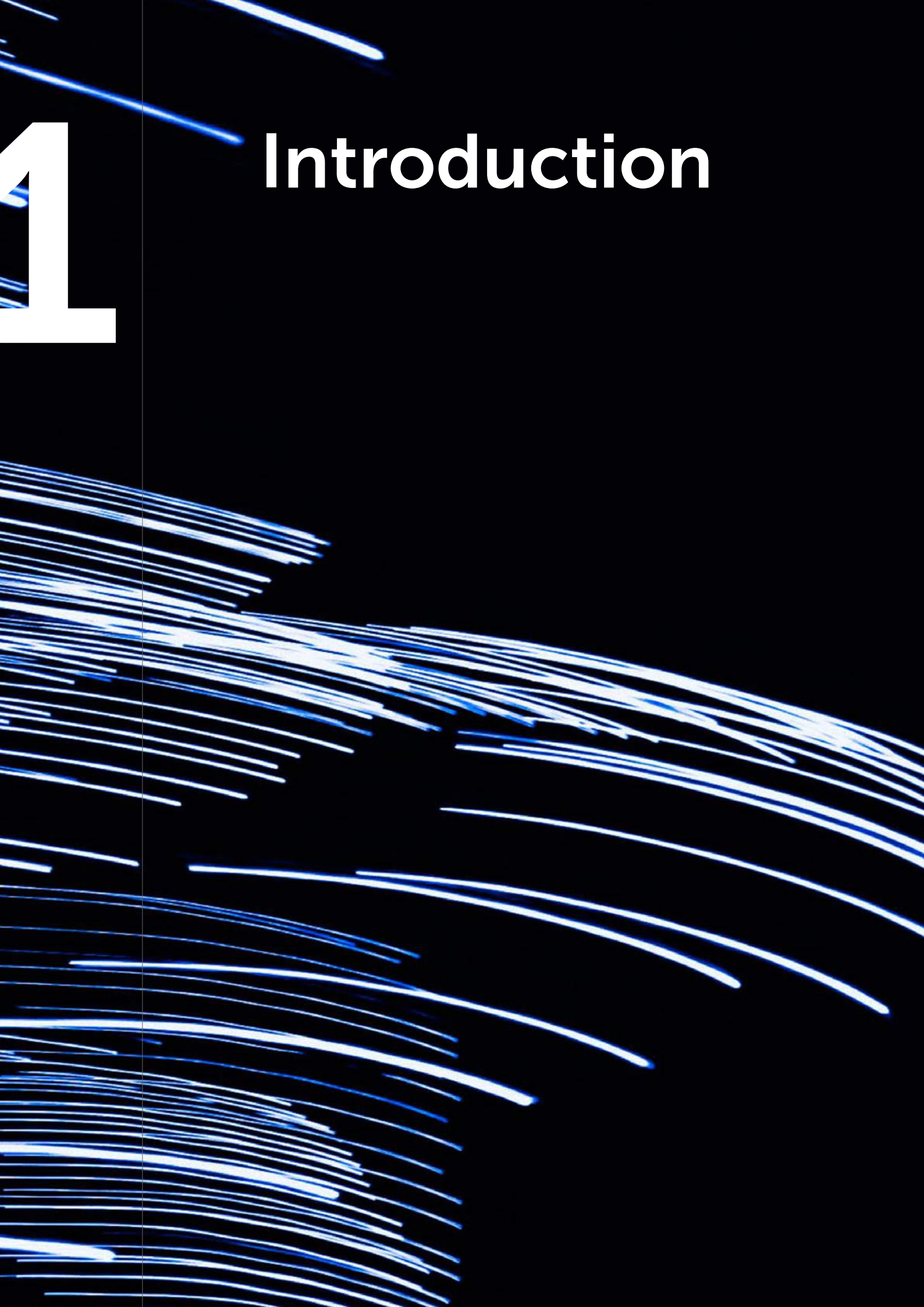


Abbreviations

A4AI	Alliance for Affordable Internet
ADI	Affordability Driver Index
APC	Association of Progressive Communications
ARPU	Average revenue per user
AU	African Union
AUC	African Union Commission
BTS	Base transceiver station
CapEx	Capital expenditure
CIPESA	Collaboration on International ICT Policy in East and Southern Africa
DE4A	Digital Economy for Africa
EDGE	Enhanced Data rates for GSM Evolution
EU	European Union
FCV	Fragility, Conflict and Violence
GB	Gigabyte
GDP	Gross domestic product
GPRS	General Packet Radio Service
GSMA	GSM Association
IBRD	International Bank for Reconstruction and Development
ICTs	Information and communication technologies
IDA	International Development Association
IFC	International Finance Corporation
ISP	Internet service provider
ITA	Information and Technology Agreement
ITU	International Telecommunication Union

LDCs	Least developed countries
Mbps	Megabits per second
MDB	Multilateral development bank
MFD	Mobilizing Finance for Development
MIGA	Multilateral Investment Guarantee Agency
OECD	Organisation for Economic Co-operation and Development
OpEx	Operational expenditure
OS	Operating system
PPP	Public-private partnership
QoS	Quality of service
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees
USAF	Universal Service and Access Fund
USAID	United States Agency for International Development
VAT	Value added tax
WBG	World Bank Group
WEF	World Economic Forum
3G	Third-generation mobile telecommunications technology
4G	Fourth-generation mobile telecommunications technology
5G	Fifth-generation mobile telecommunications technology

All dollar amounts are U.S. dollars unless otherwise indicated

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1

Introduction

The transformative impacts of digital technologies and the digital economy on development has been widely agreed. Today's economies are being driven by digital transformation across all sectors and digital technology is increasingly at the center of people's daily lives. As such, technology is redefining how economic activities occur across countries, paving the way towards digital economies, at national, regional, and global levels. Therefore, a well-functioning digital economy can help achieve faster economic growth, offer innovative products and services, create jobs and export revenue, and achieve greater international competitiveness.

In this regard, the 2030 Agenda for Sustainable Development highlights the significance of ICTs in the achievement of SDGs and recognizes that, "The spread of information and communication technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies." All three pillars of sustainable development – economic development, social inclusion, and environmental protection – need ICTs as catalysts and several SDG targets require the intensive use of ICTs, notably in achieving universal identification, more efficient delivery of government services, financial inclusion, and job creation. Underlying these goals is target 9.c, to *"significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in the least developed countries (LDCs) by 2020."*

While significant progress has been made in this regard, there is a danger that in Africa, where many of the LDCs are located, this target will be missed, in terms of both access and affordability. In Africa, mobile cellular subscriber penetration is only 76 percent, households with internet access at home 22 percent, individuals using the internet 24.4 percent – as opposed to 107 percent, 57.8 percent, and 51.2 percent, respectively, globally.⁷ Moreover, according to the State of Broadband 2018 report, African countries on average spend about 1.1 percent of GDP on investment in digital transformation (including internet infrastructure and networks), while developed countries spend 3.2 percent of GDP. This means that, not only have some countries and regions already accelerated ahead, but also the gap in internet availability between developed and developing countries may effectively grow larger every year. Nevertheless, Africa cannot afford to think small nor act slowly. Home to some 1.2 billion inhabitants, the continent will need to act quickly and boldly, or risk being left behind as ***the rise of digital technologies and the digital economy offers a once in a generation chance to disrupt this trajectory.***

Recognizing the significance of the continent's leadership to prioritize and accelerate digital transformation, several continent-wide initiatives have been initiated to support the digital transformation of the continent. The African Union Commission (AUC) set up a taskforce and led a multistakeholder process to develop the *Digital Transformation Strategy for Africa* which sets out a vision to harness

7. ITU. https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2018/ITU_Key_2005-2018_ICT_data_with%20LDCs_rev27Nov2018.xls

digital technologies and innovation to transform Africa's economies, societies, and governments to generate new economic growth, job creation, and poverty reduction (see box 1.1). The World Bank Group (WBG) has also initiated a regional program, the Digital Economy for Africa (DE4A) initiative, in support of the AUC's vision with five corresponding foundational pillars – digital infrastructure, digital financial services, digital platforms, digital entrepreneurship, and digital skills

(see box 1.2). In addition, the European Union-African Union Digital Economy Task Force (EU-AU DETF) was formed to guide the EU and AU when prioritizing actions for cooperation towards African digital transformation and provides recommendations around four pillars (see box 1.3): access to affordable broadband connectivity and digital infrastructure; digital skills; digital entrepreneurship; e-services (fintech, e-government, e-commerce, and e-health).

Box 1.1. The African Union's Digital Transformation Strategy for Africa

The African Union (AU) is taking the digital transformation agenda seriously at the highest level. The African Union Commission (AUC), under the auspices of Commissioner Dr. Amani Abou-Zeid, who is also a Commissioner for the Broadband Commission for Sustainable Development, is preparing a *Digital Transformation Strategy for Africa*. The strategy document brings together various pillars of the digital economy, including digital infrastructure, enabling environment, policy and regulation, digital platforms, digital financial services, digital skills, human capacity, digital innovation and entrepreneurship, as well as initiatives in **key vertical sectors such as government, education, health, agriculture, industry, trade, and financial services**. The strategy, which includes a roadmap and action plan for implementation, is expected to be adopted by the AU at its summit in 2020.

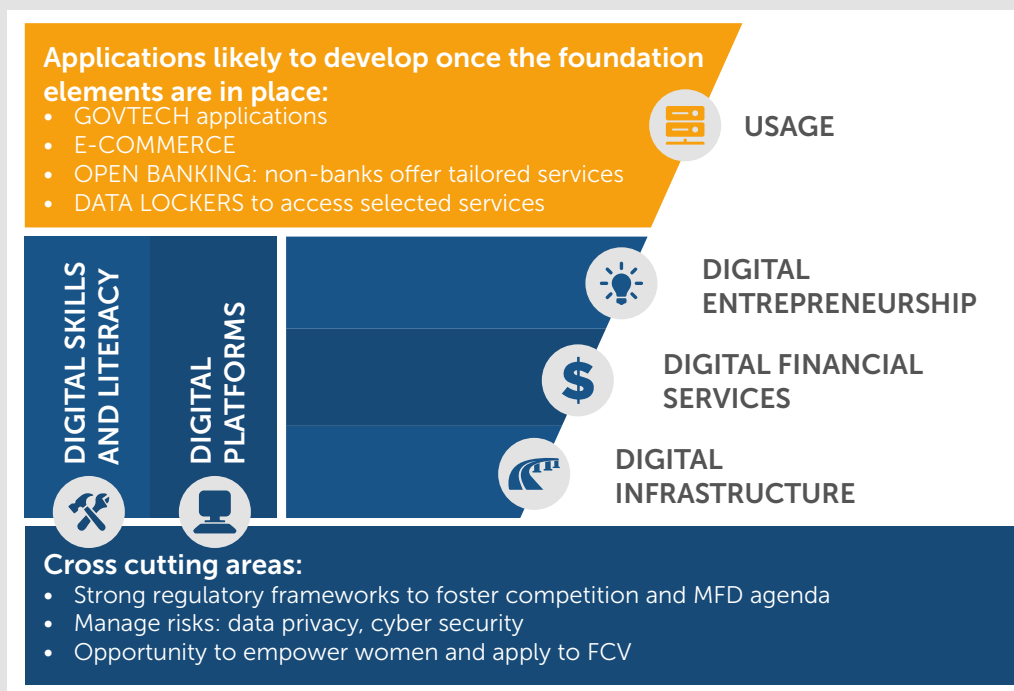
Once adopted, *the Digital Transformation Strategy for Africa* will be implemented at national, subregional, regional, and global levels, with key institutions playing specific and complementary roles in the institutional framework for implementation. While AUC will provide a coordination mechanism to facilitate the implementation of the strategy at the regional level, to provide strategic guidance, to seek support from development partners and to ensure coherence with the operationalization of the Africa Vision 2030, each member state will operationalize the strategy by establishing national strategies and programs to promote the digital economy. Regional economic communities (RECs), which make up the building blocks of the African Union, will be called upon to establish subregional strategies and programs to promote the digital economy. International organizations (IOs) and development partners (DPs), including the World Bank Group, the African Development Bank, the International Telecommunication Union (ITU), the European Union and other regional development banks and financial institutions, would support this process by providing technical and financial resources to implement this strategy. This also requires all African Union member states to mobilize financial and technical resources to support the effective implementation of this strategy.

Box 1.2. The World Bank's Digital Economy for Africa (DE4A) Framework

Principles

Comprehensive	Taking an ecosystem approach that looks at supply and demand and defies a narrow silo approach in defining the requisite elements and foundations for digital economy
Transformative	Aiming at a very different scale of ambition beyond incremental 'islands' of success
Inclusive	Creating equal access to opportunities and dealing with risks of exclusion
Homegrown	Promoting homegrown digital content and solutions while embracing what is good and relevant from outside the continent
Collaborative	Ensuring collaboration and coordination among countries, among sectors, and among public and private players

DIGITAL ECONOMY FOUNDATIONS





The Digital Economy for Africa (DE4A) initiative is an integrated regional program, aligned with the five corporate priorities, that also engages external partnerships. The objective is to digitally enable every African individual, business, and government by 2030, while targeting intermediate priority results by 2021. The DE4A initiative supports the operationalization of the initiative of the AU to create a momentum for digital transformation in Africa, drawing in commitments from member states, development partners, and other stakeholders to the high-level objectives and encouraging leadership at the national and subregional levels to champion the agenda.

For dynamic, inclusive, and safe digital economies to emerge, African countries will need to follow a holistic approach to building a dynamic digital economy on top of strong analog foundations of good governance, enabling regulations, accountable institutions, and relevant skills. Based on the experiences of successful digital economies, the five foundations identified as critical and priorities for the DE4A initiative are: 1. Digital Infrastructure (broadband networks, data centers); 2. Digital Platforms (digital ID systems and trust services, govtech, private sector platforms, for example, e-commerce); 3. Digital Financial Services (including digital payments); 4. Digital Entrepreneurship (digital startups, and existing firms harnessing digital technologies); and 5. Digital Skills. The five foundations of the digital economy would need to be supported by a flexible legal and regulatory framework that fosters competition, protects individuals and data, promotes inclusion, and mitigates risks.

The digital transformation of Africa would foster economic growth and reduce poverty. It has the potential to create more jobs, encourage entrepreneurship among the youth, increase farmers' productivity, bring more women into the labor force, and create markets. Reaching the Digital Economy for Africa Initiative targets would raise growth per capita by 1.5 percentage points per year and reduce the poverty headcount by 0.7 percentage points per year. The potential growth benefits and poverty reduction effects are larger in Sub-Saharan Africa, and especially among fragile countries. When complemented with appropriate human capital investments, these effects could more than double.⁸

8. <https://www.worldbank.org/en/region/afr/publication/taking-the-pulse-of-africas-economy>

Box 1.3. European Union-African Union Digital Economy Task Force (EU-AU DETF)

The African and European Unions decided in December 2018 to establish a Digital Economy Task Force, engaging a number of African and European representatives of the public, private, and international sectors. The European Commission set out its ambitions for a comprehensive and innovative partnership between Africa and the EU, and a renewed determination to boost investment for job creation with a stronger role for the private sector.

The goal of the task force is to draw policy recommendations and propose concrete actions to address the principal barriers faced by the African continent as it seeks to further develop the digital economy and society. Over the past six months, the EU-AU Task Force has worked in developing a shared vision and a set of common agreed principles, and its efforts resulted in the final report presented at the Digital Assembly 2019 in Bucharest. The report sets out a number of policy recommendations focused on four main goals, namely:

1. **Accelerating universal access to affordable broadband**, requiring developing the right financial instruments, regulatory environment, business models, and synergies through properly designed partnerships;
2. **Guaranteeing essential skills for all to enable citizens to thrive in the digital age**, understood in a wide and comprehensive way across lifelong education pathways that needs to be addressed by all public or private institutions;
3. **Improving the business environment and facilitating access to finance and business support services** to boost digitally enabled entrepreneurship and partnerships between African and European industry;
4. **Accelerating the adoption of e-services** and the further development of the digital economy for achieving the Sustainable Development Goals.

The DETF report will guide the EU and AU to prioritize actions for cooperation. It will continue to serve as a platform of partnership for the private sector, donors, international organizations, financial institutions, and civil society based on a shared understanding of how an already fast evolving African digital transformation can achieve crossborder integration and bring benefits to all citizens.

Amongst the proposed priorities for digital transformation, digital infrastructure is a critical foundational element that provides the way for people, businesses, and governments to get online, and link with local and global digital services – thus connecting them to the wider digital economy. The 2018 Global Connectivity Index (GCI) also witnessed greater GDP returns among countries with concentrated adoption of ICT infrastructure. Countries

with less proactive investment have seen less stellar results.⁹ Therefore, a number of regional and international organizations, and private and public sector ICT stakeholders are presenting and advocating initiatives, strategies, and programs around expanding access to broadband infrastructure and services, and set overlapping and mutually reinforcing targets. Some examples of such initiatives and targets are shown in table 1.1.

Table 1.1. **Examples of Digital Infrastructure Initiatives and Programs**

Initiative	UN Sustainable Development Goal Target 9.c	Broadband Commission for Sustainable Development's 2025 Targets
Adopted	Adopted in 2015 (New York)	Adopted in 2018 (Davos)
Goals/ Targets	Significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020	BY 2025: 1. All countries should have a funded national broadband plan or strategy or include broadband in their universal access and service (UAS) definition 2. Entry-level broadband services should be made affordable in developing countries at less than 2% of monthly Gross National Income (GNI) per capita 3. Broadband internet user penetration should reach: a) 75% worldwide b) 65% in developing countries c) 35% in Least Developed Countries 4. 60% of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills 5. 40% of the world's population should be using digital financial services 6. Overcome unconnectedness of micro-, small- and medium-sized enterprises (MSMEs) by 50%, by sector 7. Gender equality should be achieved across all targets

9. Huawei. 2018. Tap into New Growth with Intelligent Connectivity: Mapping your Transformation into a Digital Economy with GCI 2018. <http://huawei-dialog.de/wp-content/uploads/2018/05/Huawei-Global-Connectivity-Index-2018-EN.pdf>.

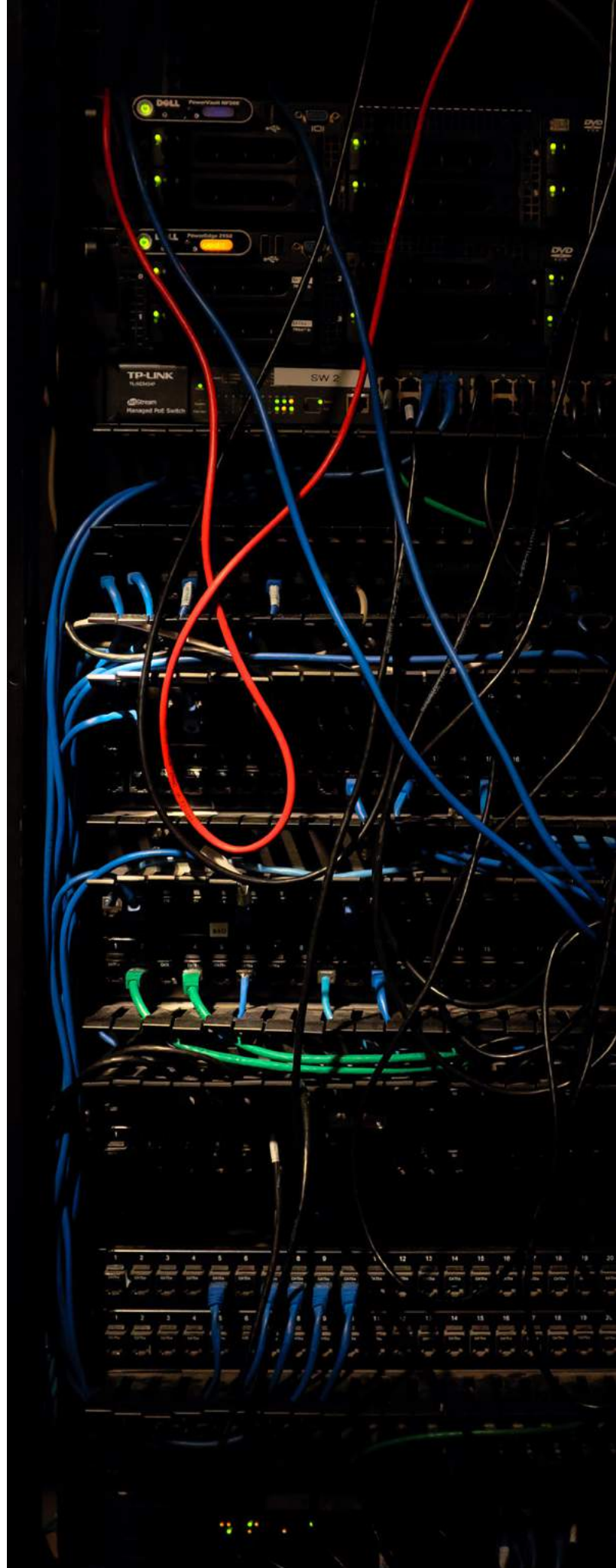
Initiative	ITU's Connect 2030 Agenda for Sustainable Development
Adopted	Initially adopted in 2014 (Busan); revised in 2018 (Dubai) (Resolution 200)
Goals/ Targets	BY 2023: Goal 1: Growth – Enable and foster access to and increased use of telecommunications/ICTs: - Worldwide, 65% of households should have access to the internet - Worldwide, 70% of individuals should be using the internet - Worldwide, telecommunications/ICTs should be 25% more affordable (baseline year 2017) - All countries adopt a digital agenda/strategy - Worldwide, 50% increase in the number of broadband subscriptions 40% of countries to have more than half of broadband subscription more than 10 Mbps 40 per cent of the population interact with government services online
Goals/ Targets	Goal 2: Inclusiveness – Bridge the digital divide and provide broadband for all: - In the developing world, 60% of households should have access to the internet - In the least developed countries (LDCs), 30% of households should have access to the internet - In the developing world, 60% of individuals should be using the internet - In the least developed countries (LDCs), 30% of individuals should be using the internet - The affordability gap between developed and developing countries should be reduced by 25% (baseline year 2017) - Broadband services should cost no more than 3% of average monthly income in developing countries - Worldwide, 96% of the rural population should be covered by broadband services - Gender equality among internet users should be reached - Enabling environments ensuring accessible telecommunications/ ICTs for persons with disabilities should be established in all countries

Initiative	ITU's Connect 2030 Agenda for Sustainable Development
Goals/ Targets	Goal 3: Sustainability – Manage challenges resulting from telecommunication/ICT development: • Improve cybersecurity preparedness of countries, with key capabilities, presence of strategy, national computer incident/emergency response teams and legislation • Increase the global e-waste recycling rate to 30% • The percentage of countries with an e-waste legislation raised to 50% • Greenhouse gas emissions generated by the telecommunication/ICT sector to be decreased per device by 30% (baseline year 2015) • All countries to have a National Emergency Telecommunication Plan as a part of their national and local disaster risk reduction strategies Goal 4: Innovation and partnership – Lead, improve and adapt to the changing telecommunication/ICT environment: • All countries to have policies/strategies fostering telecommunication/ICT-centric innovation • Increased effective partnerships with stakeholders and cooperation with other organization and entities in the telecommunication/ICT environment

Initiative	World Economic Forum (WEF)'s Internet for All Initiative ¹⁰	Digital Infrastructure Pillar of AU's Digital Transformation Strategy for Africa and WBG's Digital Economy for Africa
Adopted	2016	2019
Goals/ Targets	Bring internet access to the next 3-4 billion people and ensure the creation of local content and infrastructure	Achieving universal, affordable, and good quality broadband connectivity by 2030 (interim milestone of doubling broadband connectivity by 2021 – baseline year 2016)

10. http://www3.weforum.org/docs/WEF_internet_for_All_4_pager.pdf

While these initiatives set clear goals and address important issues toward universal broadband access, notably in Africa, there has been less discussion about the investment required and financing needs to meet the targets, modalities for financing the agenda, and how to operationalize the framework and principles. In this regard, the World Bank has led the UN Broadband Commission Working Group on Broadband for All: A Digital Infrastructure Moonshot for Africa to engage key ICT industry partners, estimate the investment needs, and prepare a roadmap to help countries and development actors accelerate and prioritize their efforts to increasing connectivity and reaching full coverage in Africa. As such, the Working Group aims to propose a new catalyst for the moonshot approach – rather than an incremental approach – to connect the unconnected, accelerating and scaling exceptional and coordinated efforts to achieve a seemingly impossible goal.



The background is a solid black field. It is decorated with numerous bright blue, glowing streaks of varying lengths and thicknesses. These streaks are mostly horizontal or slightly curved, creating a sense of motion or data flow. In the upper left corner, a large, bold, white number '2' is partially visible, cut off by the left edge of the frame.

2

Snapshot of Africa's Digital Infrastructure

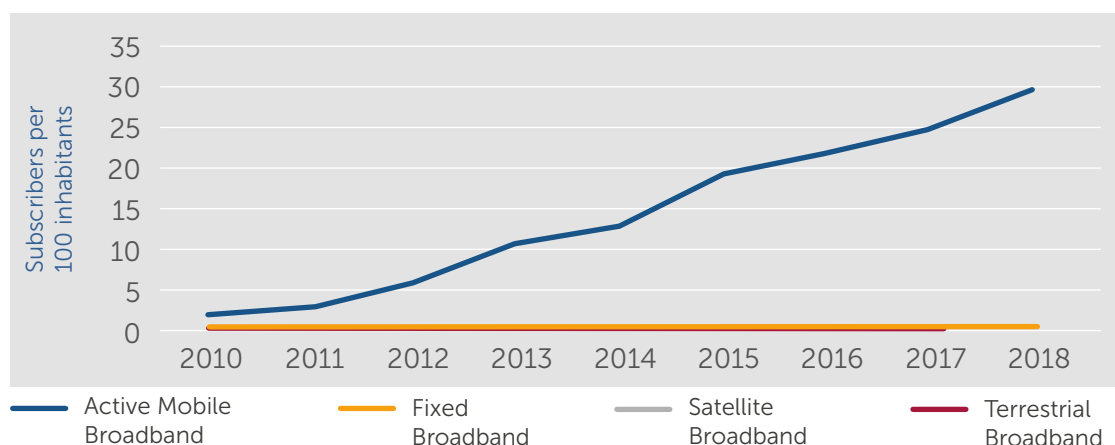
In broad terms, digital infrastructure comprises connectivity (for example, high-speed broadband networks and internet exchange points),¹¹ the Internet of Things (IoT) (for example, mobile devices, computers, sensors, voice-activated devices, geospatial instruments, machine-to-machine communications, vehicle-to-vehicle communications), and data repositories (for example, data centers and clouds).¹² For the digital economy, high-speed broadband connectivity to access the internet is a critical foundation.¹³

Fixed broadband, that is, dedicated, physical links of high-speed internet, connected to homes, offices, and governments, has had very limited reach in Africa (see figure 2.1). Although fixed broadband penetration has continuously increased in recent years in urban areas largely because of a sharp drop in subscription charges, mainly in Sub-Saharan Africa, Africa still has the

lowest penetration of fixed broadband worldwide. Subscription charges in Africa are still higher than that in middle-income countries. Monthly subscriptions in Sub-Saharan Africa are more than twice as costly as those in North Africa.

Today, mobile broadband, that is, the use of high-speed internet via mobile or smart device, is the principal way by which people accross Africa access the internet (see figure 2.1). Nevertheless, despite the major advances in mobile connectivity and internet access, Africa's mobile broadband penetration rate (about 25 percent) is still the lowest worldwide. While coverage and quality of mobile networks used for the internet varies extensively amongst countries, substantial gaps also remain between urban and rural access within countries. In terms of affordability, the African region has the highest price relative to income for mobile broadband services.¹⁴

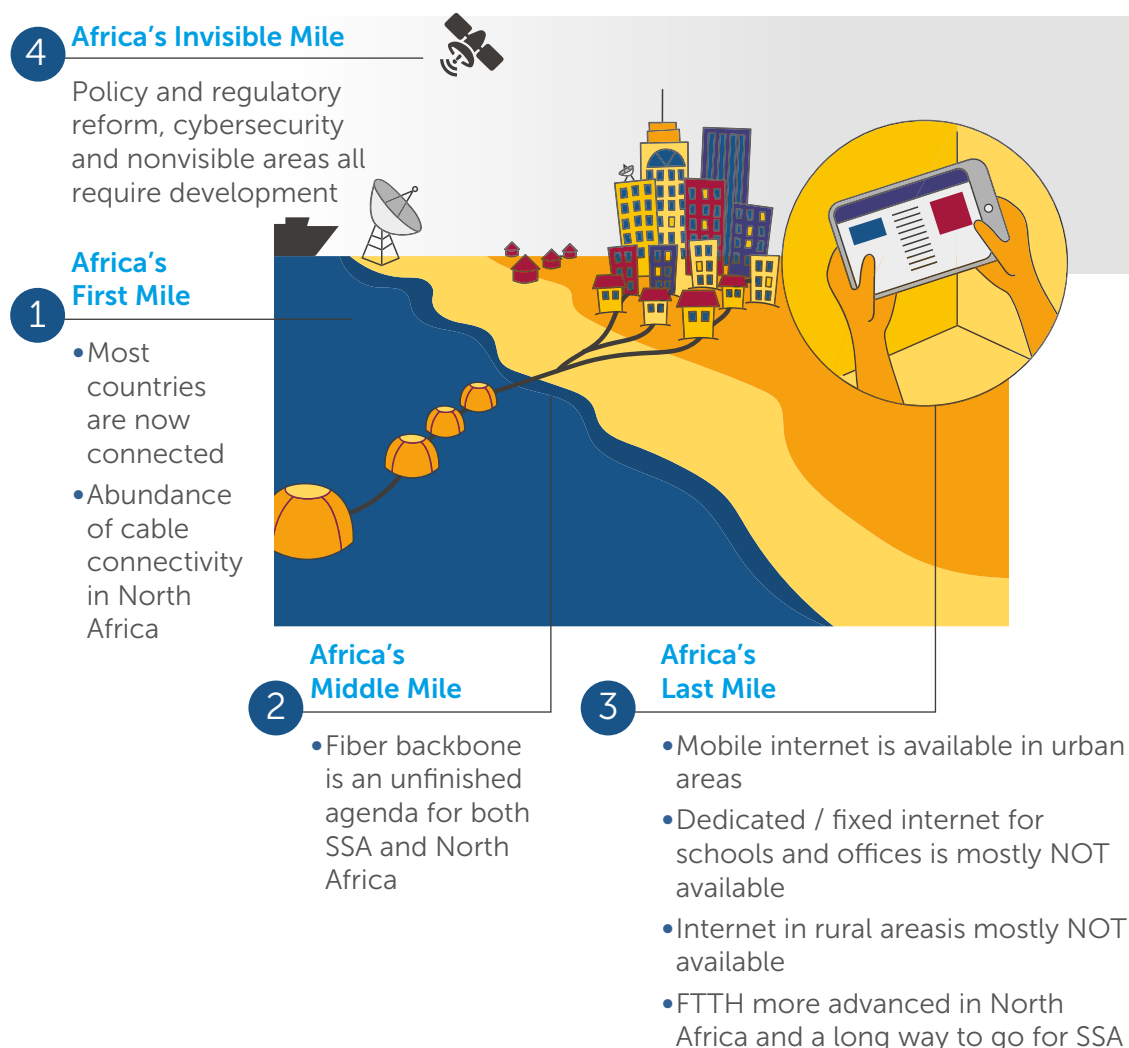
Figure 2.1. **Broadband Penetration in African Countries by Technology, 2010-2018**¹⁵



Source: ITU.

11. Connectivity includes mobile and fixed access networks, metro and backhaul networks, national backbone networks, and international connections.
12. Service enabling infrastructure include private or independent data centers, and, increasingly, Infrastructure-as-a-Service and Software-as-a-Service cloud platforms.
13. Cesar Calderon, Kambou, Gerard, Korman, Vijdan, Kubota, Megumi, Cantu Canales, Catalina. 2019. "An Analysis of Issues Shaping Africa's Economic Future." Africa's Pulse, No. 19, April. <https://openknowledge.worldbank.org/handle/10986/31499>.
14. A4AI. <https://a4ai.org/new-mobile-broadband-pricing-data-2018>; ITU. <https://www.itu.int/en/ITU-D/Statistics/Pages/ICTPrices/default.aspx>
15. Fixed-broadband subscriptions refers to fixed subscriptions to high-speed access to the public internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fibre-to-the-home/building, other fixed (wired)-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband.

Figure 2.2. **Broadband Infrastructure Value Chains**



1 FIRST MILE WHERE THE INTERNET ENTERS A COUNTRY International internet access, including submarine cables, landing stations, satellite dishes, crossborder microwave, etc.	2 MIDDLE MILE WHERE THE INTERNET PASSES THROUGH THAT COUNTRY National backbone and intercity network, including fiber backbone, microwave, internet exchange points (IXPs), local hosting of content, etc.	3 LAST MILE WHERE THE INTERNET REACHES THE END USER Local access network, including local loop, central office, exchanges, wireless masts.	4 INVISIBLE MILE HIDDEN ELEMENTS THAT ARE VITAL TO ENSURING THE INTEGRITY OF THE VALUE CHAIN Nonvisible network components include the spectrum, network databases, cybersecurity, etc, but can also include potential bottlenecks, like international frontiers.
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Source: World Bank, 2016.

The broadband network value chain, to develop universal, affordable and good quality broadband internet, comprises four broad segments: first mile, middle mile, last mile, and invisible mile (see figure 2.2). All parts of the value chain

need to be built incrementally. Equally important are supporting infrastructure (for example, data centers and a reliable electricity supply) and devices that are used to access the internet.

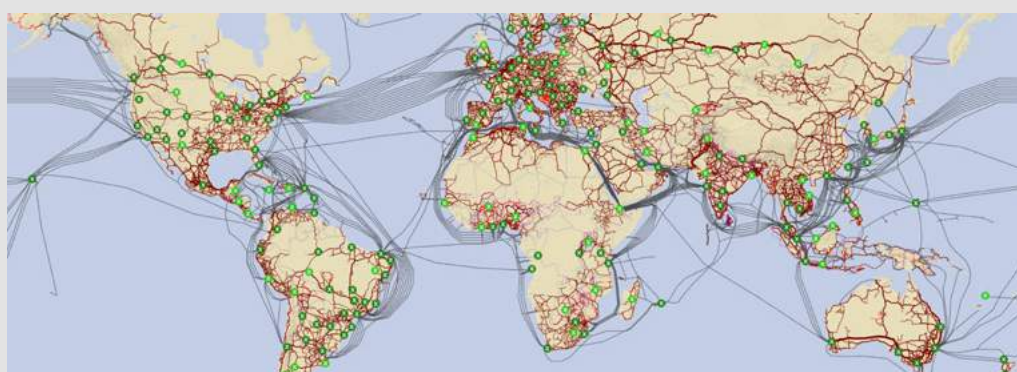
The first mile is where the internet enters a country. The network components are international internet access and include submarine cables, landing stations, satellite dishes, crossborder microwave, domain name registration, and so on.

Countries in Africa need to be connected to undersea cables or via crossborder terrestrial links (particularly for landlocked countries). Many countries in Africa have access to submarine cable systems, either directly through local landing points or through terrestrial connections, particularly for smaller and landlocked countries (see box 2.1 and box 2.2). In September 2018 only three countries were not connected by fiber to submarine cables: the Central African Republic, Eritrea, and South Sudan. Every seaboard country except Eritrea and Guinea-Bissau had at least one submarine cable

landing. The rapid expansion of the submarine cable network circumventing the continent in the past decade has increased Africa's international submarine fiber capacity nearly tenfold since 2010,¹⁶ crossing the 100 Tbps mark in 2018, with new direct connections established with Asia and the Americas.

Although the first mile has improved thanks to the regional submarine network infrastructure, it could be further improved if policies focused on liberalizing the market for satellite dishes, having wholesale providers instead of mobile operators own submarine cables (as there may be an incentive for operators not to provide submarine connectivity to competitors in their markets), and promoting competition over the international gateway and cable landing stations.

Box 2.1. ITU Interactive Transmission Map



The Interactive Transmission Maps are a cutting-edge ICT-data mapping platform to take stock of national backbone connectivity (optical fibers, microwaves and satellite Earth stations) as well as of other key metrics of the ICT sector. The map is validated by network operators and administrations through the ITU Regional Offices and recorded in the Validation Framework. Underlying the map is a database, containing records of each individual link.

The following indicators are either compiled or calculated from this database: i) Transmission network length (route kilometers); ii) Node locations; iii) Equipment type of terrestrial transmission network; iv) Network capacity (bit rate); v) Number of optical fibers within the cable; vi) Operational status of the transmission network indicator; vii-a) Percentage of population within reach of transmission networks; vii-b) Percentage of area within reach of transmission networks.

Source: <https://www.itu.int/itu-d/tnd-map-public/>

16. Xalam Analytics. 2017. The Future of African Bandwidth Markets, May. <https://xalamanalytics.com/product/the-future-of-african-bandwidth-markets/>



The middle mile is where the internet passes through a country. The network components are the national backbone and intercity networks, including the fiber optic cables or copper wires, microwave, satellite links, internet exchange points (IXPs), local hosting of content, and so on.

Once connected to high-speed internet at the border, countries in Africa require fiber backbones to carry internet traffic from the border to urban and rural centers throughout the country and backhaul or metro networks to extend further. Africa's terrestrial fiber infrastructure has witnessed significant transformation. According to Hamilton Research, African countries have rolled out over 1,389,000 kilometers of terrestrial fiber links, of which about 936,000 kilometers were operational in 2018.¹⁷ According to Xalam Analytics, at least another 230,000 kilometers of fiber are needed to reach planned target of universal access by 2030, with another 25,000 kilometers to moderately densify

the largest metros – only in Sub-Saharan African markets.¹⁸

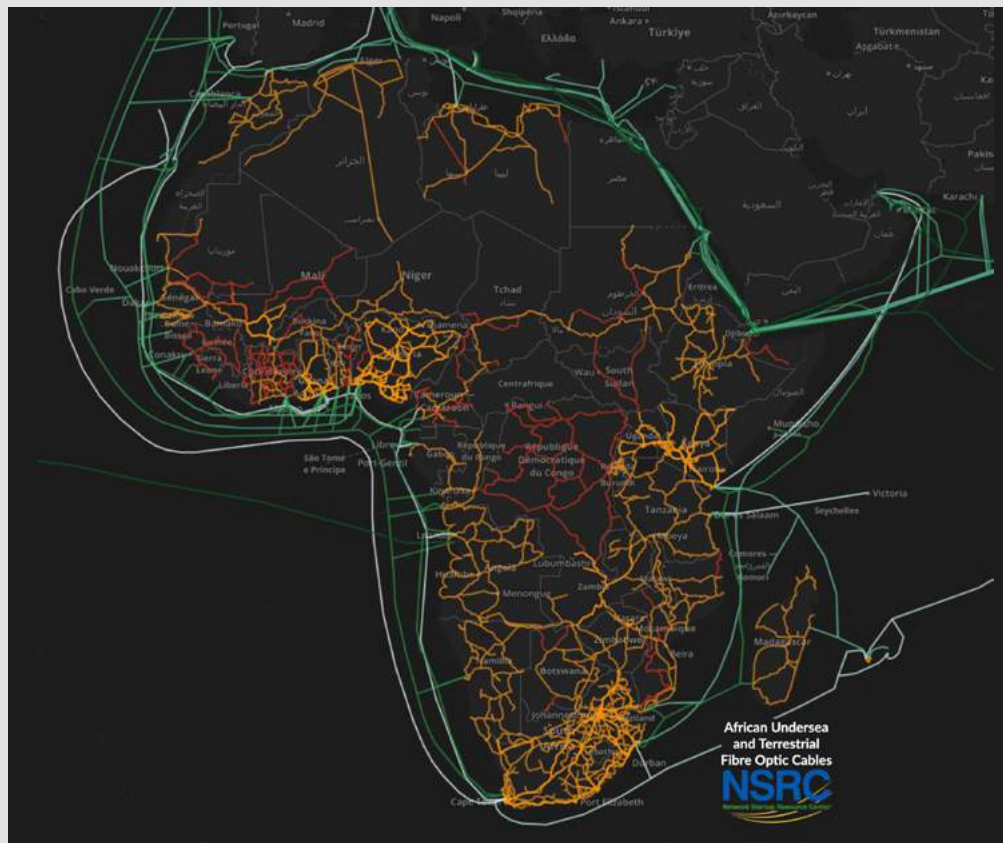
Satellite transmission remains extremely important for Africa, with satellite bandwidth covering every square kilometer of Africa and providing connectivity beyond the reach of terrestrial transmission networks. Africa Mobile Networks (AMN) plans to use capacity from geostationary (GEO) satellites to build and operate 5,000 mobile network base stations to serve rural communities in Sub-Saharan Africa that currently lack service.

Currently, 42 percent of countries in Africa lack IXPs. According to the Africa IXP Association (Af-IX), there are about 44 active IXPs located across 32 countries in Africa. This means that most of their domestic internet traffic is exchanged through points outside their respective country, usually through satellite or submarine fiber across multiple international hubs to reach their destination.¹⁹

18. Xalam Analytics. 2018. Please refer to appendix A.

19. Internet Society. <https://www.internetsociety.org/issues/ixps/facebook-ixp-partnership/>

Box 2.2. African Undersea and Terrestrial Fiber Optic Cables



Terrestrial Fibre Status

- Live
- Under Construction

Undersea Fibre Optic Cables

60GBPS 5TBPS

AfTerFibre or African Terrestrial Fibre is a map of African terrestrial (and now undersea) fiber optic infrastructure initiatives. It was developed with some initial support from Google and is now hosted and supported by the Network Startup Resource Center. AfTerFibre is an open data initiative with data sources available for public download.

Maps for AfTerFibre are typically sourced as raster images, sometimes from the corporate websites of operators, sometimes from studies or reports on regional infrastructure development, and sometimes through personal contacts. Maps that are not already available on the web are uploaded to a Flickr website. The raster images are then digitally traced and converted into GIS format and uploaded to the CartoDB, a cloud-based GIS platform.

Source: <https://afterfibre.nsrc.org/>

The last mile is where the internet reaches the end-user. Once high-speed internet arrives at a population center, via the first and middle miles, telecommunications operators provide internet services (such as mobile or fixed internet services) to people, businesses, and governments. The network components are the local access network, including the local loop, which has historically been comprised of copper cables but now fiber is increasingly used in urban areas, central office exchanges, and cellular wireless masts as well as satellite. There are also new developments, for example, last mile fiber could potentially be replaced with 5G fixed wireless access (FWA), and other innovative solutions (such as drones or balloons).

In Africa, because of gaps in the first and middle miles, telecommunications operators have historically relied upon satellite links to provide internet services. With undersea internet cables being built for the first mile in Africa, and fiber backbones slowly emerging for the middle mile, Africa's last mile connectivity also continues to expand as operators roll out mobile and fixed broadband infrastructure. According to Hamilton Research, in June 2018, 54.2 percent of the population in Sub-Saharan Africa lived within a 25-kilometer range of an operational fiber optic network node, which marks a significant expansion of the reach of the internet beyond urban centers to thousands of towns in the interior.

Despite the recent rapid expansion of network coverage around the world, mainly driven by the upgrading of 2G networks to 3G or 4G and network sharing, the mobile coverage gap is

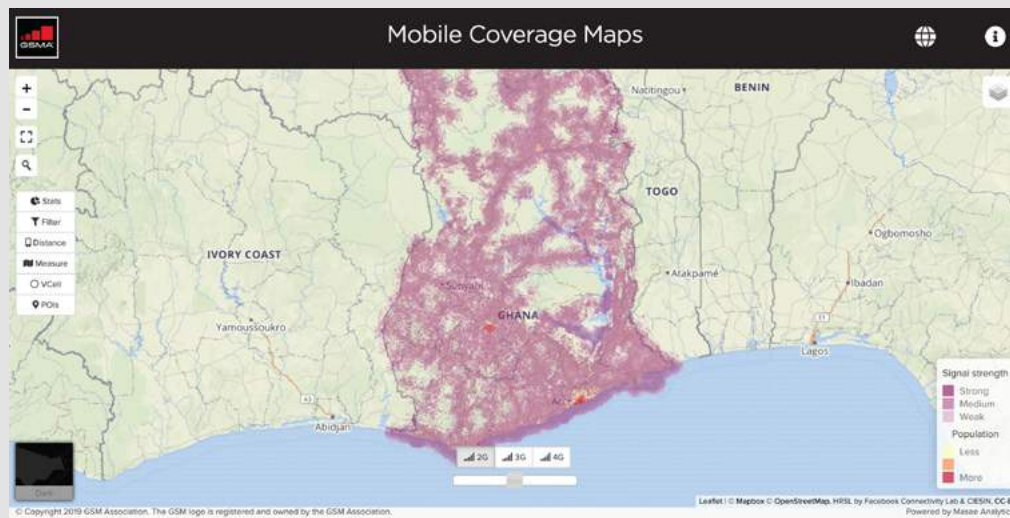
the most acute in Africa: 3G network coverage reached about 71 percent and 4G coverage about 40 percent in 2018. Further expansion is expected in the coming years (see box 2.3). According to the ITU, the number of broadband connections in Africa crossed the 400 million mark in 2018, nearly twenty times 2010 levels, boosted by a broad expansion in 3G, 4G, and last mile fiber network coverage.

Several transformative technologies, such as the Internet of Things (IoT) and artificial intelligence, depend on connectivity. As Africa cannot afford to miss the next technological wave, there is a need to connect the unconnected in rural Africa and ensure that rural areas will benefit from digitalization efforts particularly in agriculture, health, and education. In this regard, the "traditional" broadband plans must evolve towards fully fledged digitalization plans that consider all sectors of the economy and government that can benefit from digital transformation strategies.

Moreover, Africa is witnessing one of the highest rates of rural-urban migration at the present time. Africa's urban population is expected to triple by 2050.²⁰ Managing the urban transition will therefore be key for economic growth and the wellbeing of Africa's urban and rural populations. Connecting cities in Africa and making them smarter, safer, and more sustainable requires attention. Today, Smart City projects and initiatives in Africa remain fragmented, representing one or more standalone applications based on specific needs, resources, and priorities making them hard to integrate with other applications as part of a common framework.

20. UNECA. 2017. Economic Report on Africa 2017. *Urbanization and Industrialization for Africa's Transformation*. <https://uneca.org/publications/economic-report-africa-2017>.

Box 2.3. GSMA Mobile Coverage Map



GSMA's Mobile Coverage Maps platform is a tool that is intended to help operators and others estimate the precise location and size of uncovered populations. These maps allow users to:

- Gain an accurate and complete picture of the mobile coverage in a given country by each generation of mobile technology (2G, 3G, and 4G)
- Estimate the population living in uncovered or underserved settlements with a very high level of granularity (for example, small cities, villages or farms)
- Search for uncovered settlements based on population size

Data are directly collected from mobile operators and overlaid with the High Resolution Settlement Layer, a dataset developed by Facebook Connectivity Lab and the Center for International Earth Science Information Network (CIESIN) at Columbia University. This data estimates human population distribution at a hyperlocal level, based on census data and high-resolution satellite imagery. This data has been enriched by adding socioeconomic indicators and key buildings such as schools, hospitals, and medical centers.

The platform currently hosts eight maps: Ghana, Côte d'Ivoire, Liberia, Nigeria, Rwanda, Tanzania, Uganda, Zambia, with further countries to be added.

Source: <https://www.mobilecoveragemaps.com/>

The invisible mile consists of the hidden elements that are vital to ensuring the integrity of the value chain. This includes the network components that are not visible, including the radio spectrum, network databases (for example, for numbering), cybersecurity, and so on, but can also include potential bottlenecks such as market concentration, multilayered taxation of activities, lack of access to rights-of-way, and inefficient regulations including transborder regulatory issues. While mobile technology has a leading role in extending broadband access and the significance of satellite services in African continent, the availability of frequency spectrum is limited in most of the African countries. Africa has amongst the lowest allocation of spectrum to the mobile network operators (MNOs).



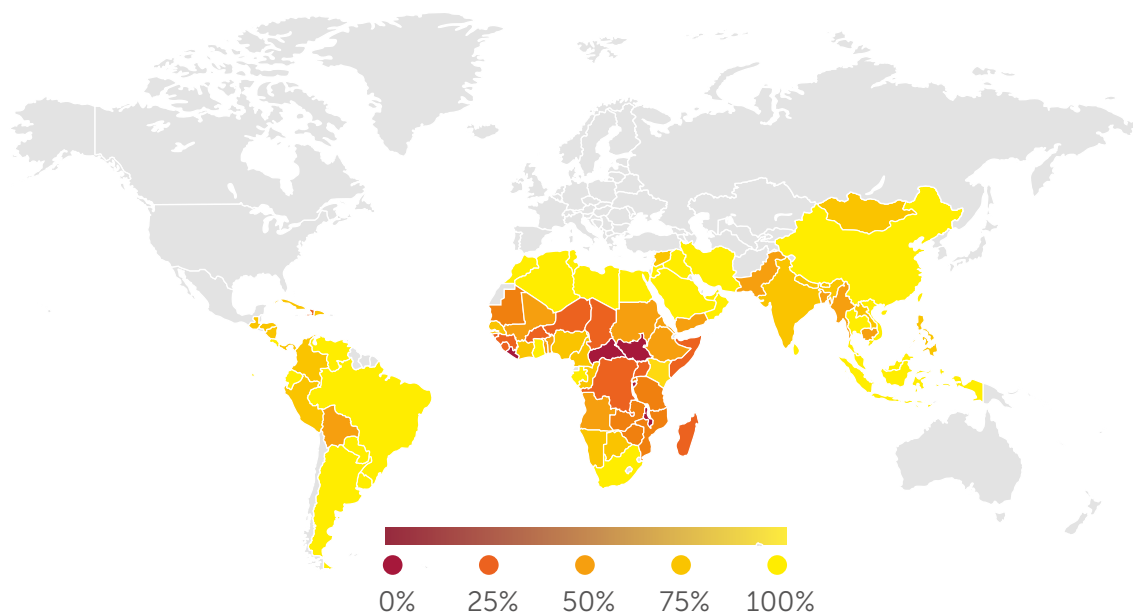
Supporting Infrastructure

Access to reliable electricity is also a major constraint to the expansion of digital infrastructure in Africa. Electricity is needed for a range of activities, from recharging devices to powering mobile base stations. Overall, the household electrification rate in Sub-Saharan Africa is the lowest in the world, averaging 44 percent of the population in 2017 – compared with 87 percent in North Africa and worldwide (see figure 2.3).²¹ There are also huge gaps in electricity access between rural and urban households in the region. Access rates among urban households are about 79 percent, compared with 23 percent among rural households in Sub-Saharan Africa. Even in grid-connected areas, electricity service quality is often low, with frequent and sometimes long-lasting outages, planned and unplanned. In addition, the cost of electricity is a major challenge in some countries, adding to the cost of broadband access. Meanwhile, increasing investment in rural electricity mini-grids, off-grid solar, and recent technological development has started to offer more cost-effective solutions other than grid extension to remote and rural areas.

While the Sustainable Development Goals (SDGs) include a target to ensure access to affordable, reliable, sustainable, and modern energy for all (SDG 7), notable initiatives to support the electrification in Africa include: the World Bank's Energy portfolio and the African Development Bank (AfDB)'s Sustainable Energy Fund for Africa program (see box 2.4).

21. IEA, IRENA, UNSD, WB, WHO. 2019. Tracking SDG 7: The Energy Progress Report 2019. Washington, DC: World Bank. <https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf>

Figure 2.3. **Proportion of Population with Access to Electricity, 2017**



Source: IEA <https://www.iea.org/sdg/>

Box 2.4. Sustainable Development Goal on Energy (SDG7) and the World Bank Group

Sustainable Development Goal 7 calls for achieving universal access to reliable, affordable, and modern energy services. This goal has also been one of the guiding principles for the World Bank's energy lending. Correspondingly, the World Bank has been scaling up its financing for electricity access, committing over \$1 billion a year (FY18 and FY19) of financing to directly expand access through grid expansion, mini-grids or off-grid solutions, not counting additional funding for upstream generation, transmission, and distribution investments. Recognizing the new opportunities created by technology advances, about half of the financing commitments are targeting decentralized renewable energy solutions, such as mini-grids and standalone solar home systems, leveraging also private sector investments into these technologies.

The vast majority (over 90 percent) of these energy access investments are targeting Sub-Saharan Africa. In order to assist governments to accelerate progress towards the universal electricity access, the World Bank is also supporting governments in improved planning, using geospatial least-cost electrification tools. For this purpose, the Energy Sector Management Assistance Program (ESMAP) is launching a new geospatial electrification tool: the Global Electrification Platform (GEP), which will support policy makers, development partners and private sector in better planning and targeting of electrification investments, allowing least-cost integration of grid, mini-grids, and off-grid technologies, based on geospatial data and multiple policy scenarios.

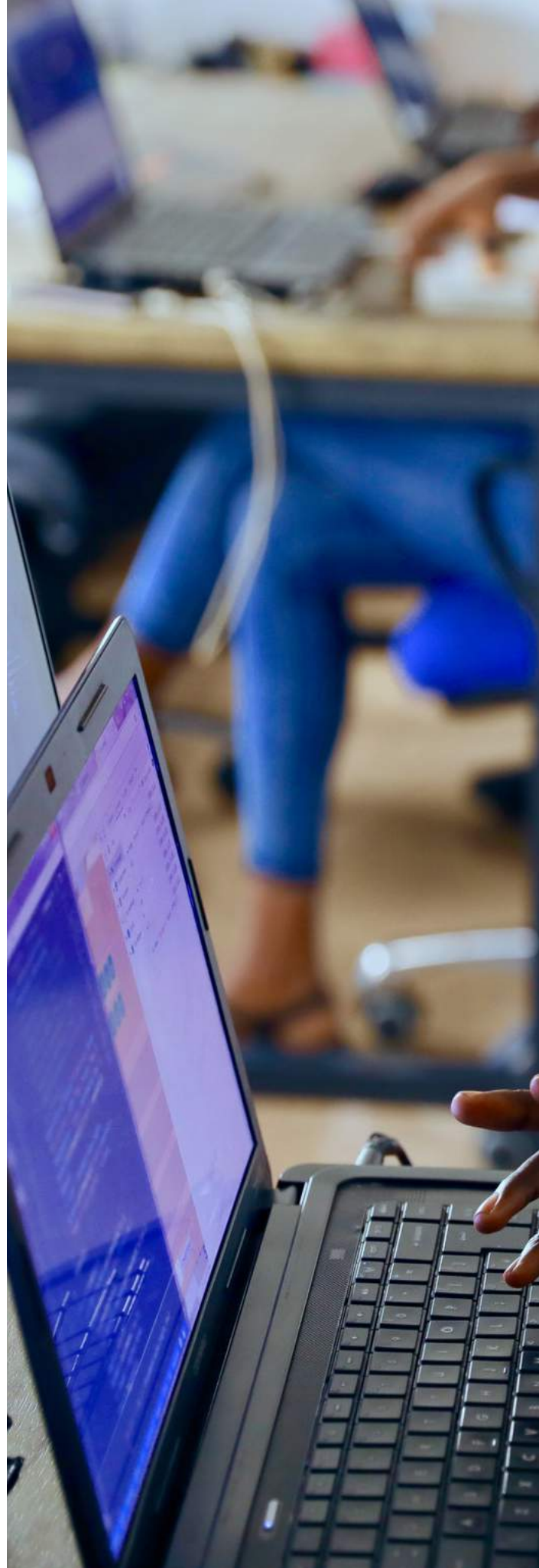
Africa's content hosting infrastructure is also becoming more robust, thanks to the buildout of dozens of dedicated data center facilities across the region. Africa's data center colocation space has nearly doubled in size since 2014.²² Data centers also consume vast amounts of electricity to power computer equipment and keep them cool. In 2011, Google reported that it used 260 megawatts of electric power for its data centers,²³ which is greater than the 2014 installed capacity in 19 Sub-Saharan African countries.²⁴ Moreover, data centers require high levels of reliability to ensure a seamless, nonstop flow of data. Owing to the region's challenging environment for reliable and inexpensive electricity, most businesses host their data outside the region. This results in a large volume of data transmitted to overseas data centers, requiring significant amounts of international bandwidth. Along with connectivity and storage costs, it takes a longer time to access overseas data centers, raising the issue of latency. Security also is an issue, as increasing amounts of government, business, and personal information are transmitted abroad, with uncertain data protection.²⁵

22. Xalam Analytics. 2018. *The African Data Center Colocation Boom*.

23. Glanz, James. 2011. "Google Details, and Defends, Its Use of Electricity." *The New York Times*, 8 September. <http://www.nytimes.com/2011/09/09/technology/google-details-and-defends-its-use-of-electricity.html>

24. Trimble, Christopher Philip, Kojima, Masami, Perez Arroyo, Ines, and Mohammadzadeh, Farah. 2016. *Financial Viability of Electricity Sectors in Sub-Saharan Africa: Quasi-Fiscal Deficits and Hidden Costs*. Policy Research Working Paper 7788. Washington, DC: World Bank Group. <http://documents.worldbank.org/curated/en/182071470748085038/Financial-viability-of-electricity-sectors-in-Sub-Saharan-Africa-quasi-fiscal-deficits-and-hidden-costs>

25. Blimpo, Moussa P., and Malcolm Cosgrove-Davies. 2019. *Electricity Access in Sub-Saharan Africa: Uptake, Reliability, and Complementary Factors for Economic Impact*. Africa Development Forum. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/31333>





The background is black with numerous bright blue, curved, and streaky light patterns that sweep across the lower half of the image. A large, bold, white number '3' is positioned on the left side, partially overlapping the text.

3

Mission, Vision, and Principles for Digital Transformation in Africa

The vision and objectives of the Broadband for All: A Digital Infrastructure Moonshot for Africa Working Group are fully aligned with other related initiatives, programs, policies, and funding mechanisms, such as the Broadband Commission's Target 2025, AU's Digital Transformation Strategy for Africa Initiative, and the World Bank Group's Digital Economy for Africa (DE4A) initiative. The Working Group is tasked with defining connectivity gaps, investment requirements, and defining a roadmap and action plan in support of achieving broadband for all in the African continent, which will help reach the UN Sustainable Development Goals (SDGs) through digital transformation.

In this regard, to make a meaningful contribution to the broader digital transformation agenda, the Working Group's vision of digital connectivity is that it should be:

- **Universal:** existing coverage gaps by fixed and mobile broadband networks should be addressed to ensure that broadband service is available for every individual, business, and government on the continent;
- **Affordable:** the price of broadband service should be sufficiently low so that it may be provided as a basic service.
- **Good quality:** the quality of broadband is often measured by median upload and download speeds (Mbps) and latency. The definition of broadband access should go beyond getting people online and ensure minimum service levels – in order to reap the benefits of broadband connections on innovation and productivity.

Successful achievement of these mission and visions is highly dependent on the following elements that cover both supply and demand sides for boosting broadband infrastructure:

- **Increased level of investment:** significant investment is required throughout the broadband infrastructure value chain, in particular in local access network infrastructure in rural and remote areas. Any financing gap to meet the goals will be bridged through the mobilization of public as well as private capital – mainly through the Mobilizing Finance for Development (MFD) approach (see box 3.1);
- **Enabling policy and regulatory framework:** Government policies and practices should promote investment and effective competition to drive down prices and ramp up usage, regulators should adopt open and participatory processes to reach decisions that take into account the interests of all involved stakeholders. It is also crucial that the regulatory framework must also evolve compliant with advances in technology (see box 3.2).
- **Digital skills for the digital citizen:** All citizens must have basic digital skills that prepare them as active digital citizens who understand the value of the internet and how to use it, as well as produce local content.
- **Device affordability:** A set of policy and market measures needs to be implemented to increase the affordability of internet-enabled handsets to provide a reliable means to get online.

Box 3.1. Mobilizing Finance for Development (MFD)

Mobilizing Finance for Development (MFD) is the World Bank Group's approach to systematically leverage all sources of finance, expertise, and solutions to support developing countries' sustainable growth. The Principles of MDB's Strategy for Crowding-in Private Sector Finance for Growth and Sustainable Development (the Hamburg Principles) provide a common framework for multilateral development banks (MDBs) to increase levels of private investment in support of development. Based on their experience to date in working with the private sector, the MDBs agreed to focus their efforts on three main areas:

- Strengthening investment capacity and policy frameworks at national and subnational levels;
- Enhancing private sector involvement and prioritizing commercial sources of financing; and
- Enhancing the catalytic role of MDBs themselves.

In scaling up private-finance mobilization, the aim is to support countries' development goals, in ways that complement and reinforce public resources. Given the demand-driven nature of the MDBs' work, client countries are ultimately responsible for engaging the MDBs in catalyzing private investment – each MDB will therefore tailor its approach to the specific opportunities in its member countries as well as its own remit and structure, within the framework established by the Hamburg Principles.

The WBG institutions – IBRD, IDA, IFC, and MIGA – work in concert to promote private investments that are economically viable and cost effective, fiscally and commercially sustainable, balanced from a risk-reward perspective, and transparent. Through this holistic approach, the WBG supports improving the enabling environment, developing regulatory conditions, building capacity, putting in place standards, financing a first mover or innovator, and reducing risks.

Source: <http://www.worldbank.org/en/about/partners/maximizing-finance-for-development#1>

Box 3.2. GSR19 Best Practice Guidelines to Fast-Forward Digital Connectivity for All

If we are set to achieve the UN Sustainable Development Goals (SDGs) in our societies by 2030, we need to be open to new regulatory tools and solutions and act now.

Digital connectivity can provide the canvas for achieving SDGs across the board and the transformative impact of digitalization will underpin progress on various development paths. The opportunities are within reach; however, they cannot be taken for granted.

1. Core design principles for collaborative regulation

Policy design principles are at hand for regulators to help develop an understanding of new technology paradigms and guide them towards appropriate regulation. Led by these principles, regulators can fine tune their regulatory response, ensuring optimal impact on the market.

We therefore identified seven design principles to respond to new technology paradigms and business models stemming from collaborative regulation:

- i. **To achieve digital transformation, policy and regulation should be more holistic.** Cross-sectoral collaboration along with revisited regulatory approaches such as coregulation and self-regulation, can lead to new forms of collaborative regulation based on common goals such as social and economic good, and innovation.
- ii. **Policy and regulation should be consultation and collaboration based.** In the same way digital cuts across economic sectors, markets and geographies, regulatory decision making should include the expectations, ideas and expertise of all market stakeholders, market players, academia, civil society, consumer associations, data scientists, end-users, and relevant government agencies from different sectors.
- iii. **Policy and regulation should be evidence-based:** Evidence matters for creating a sound understanding of the issues at stake and identifying the options going forward, as well as their impact. Appropriate authoritative benchmarks and metrics can guide regulators in rule-making and enforcement, enhancing the quality of regulatory decisions.
- iv. **Policy and regulation should be outcome-based:** Regulators need to address the most pressing issues, for example market barriers and enabling synergies. The rationale for any regulatory response to new technologies should be grounded in the impact on consumers, societies, market players and investment flows as well as on national development as a whole.
- v. **Policy and regulation should be incentive-based:** Collaborative regulation is driven by leadership, incentive and reward. Regulators should keep a wide array of investment incentives at hand to provide impetus for markets to innovate and transform while maximizing benefits to consumers.

vi. Policy and regulation should be adaptive, balanced, and fit for purpose:

Regulation-making is about flexibility – continually improving, refining, and adjusting regulatory practices. The balance in regulatory treatment of new services is more delicate than ever. A close, continuous link to markets and consumers is important to get digital on the right glide path to achieving social and economic goals.

vii. Policy and regulation should focus on building trust and engagement:

Collaborative regulation provides the space for cocreating win-win propositions, working towards regulatory objectives while increasing the engagement of industry. Trust becomes the foundation of the regulatory process, underpinning the growth of digital.

Source: www.itu.int/bestpractices

Note: Since 2000, the Global Symposium for Regulators (GSR) brings together heads of national telecom/ ICT regulatory authorities from around the world and serves as the global annual venue for regulators to share their views and experiences on the most pressing regulatory issues they have identified. GSR also fosters a dynamic global industry regulators dialogue, between regulators, policy makers, industry leaders, and other key ICT stakeholders. GSR's Global Dialogue provides a neutral platform for ITU-D Sector Members to share their views on major issues facing the ICT sector. GSR concludes with the adoption by regulators of a set of regulatory best practice guidelines.

Meanwhile, the following guiding principles should underpin the planning, funding, design, construction and operation of the digital infrastructure under this initiative:

- **Inclusive:** Targeted approaches are needed to address the increasing gender and digital divide to ensure the social and economic empowerment of disadvantaged groups and people with specific needs including rural communities, differently abled persons, young people and children, and women and girls.
- **Safe and Secure:** Safe and secure digital environment encompasses data protection provisions and security of critical information infrastructure. These principles ensure increased confidence in, and use of, the internet while facilitating the success and stability of broadband networks.
- **Resilient and Sustainable:** Infrastructure resilience is the ability of infrastructure systems to function and meet users' needs during and after a natural hazard. Making them more resilient is critical not only to avoid costly repairs but also to minimize the wide-ranging consequences of natural disasters for the livelihoods and wellbeing of people (see box 3.3).²⁶

26. Hallegatte, Stéphane, Jun Erik Maruyama Rentschler, and Julie Rozenberg. 2019. *Lifelines: The Resilient Infrastructure Opportunity* (French). Sustainable Infrastructure. Washington, DC: World Bank Group. <http://documents.worldbank.org/curated/en/821871561014920854/Lifelines-The-Resilient-Infrastructure-Opportunity>.

Box 3.3. Principles for Natural Disasters and Climate Change in the Telecom Sector

The distributed and largely private ownership of telecommunications infrastructure and its cross-sectoral dependencies make it challenging to implement nationwide turnkey efforts at building infrastructure resilience. However, a collaborative approach between stakeholders within ICT and across sectors can contribute towards shared resilience at lower cost and help reconcile the need for investment in resilience and in expansion of networks, while improving affordability.

Some general principles that can support building resilience of telecommunications infrastructure against climate and geophysical events through coordinated action between the public and private sectors are:

- **Include telecommunications infrastructure as critical national infrastructure:** Recognizing the importance of domestic and international connectivity to the economy, governments may choose to categorize these infrastructures as critical, and include them in national climate risk assessments. This would also enable necessary legal and regulatory reforms to facilitate increased resilience and disaster readiness of digital infrastructure, and provide a platform for engagement with the private sector, as owners of the infrastructure, on the subject.
- **Encourage development, acceptance, and adherence to standards:** The data center industry has grown globally by building trust through international standards, for all aspects of design, construction, operation, and demise of facilities. Such an approach to climate resilience of connectivity infrastructure can enable greater coordinated improvements in resilience.
- **Identify and rectify points of failure through redundancy or rapid restoration:** The private sector should periodically assess impact of acute and long-term climate and geophysical events across the value chain. Owners of nodes such as data centers, landing stations and IXPs may find it prudent to invest in redundancy while owners of last mile infrastructure may find restoration and replacement to be more viable investments. Similarly, the public sector can perform similar aggregated assessments at national and subnational levels to identify and rectify vulnerabilities.
- **Include resilience in new investment and upgrade decisions:** Leverage the relatively shorter lifecycles and rapid rate of technological obsolescence to include climate resilience in all elements of network design and, in turn, in investment decisions. This also applies to the enabling environment to support improved resilience through iterative reforms that facilitate rapid rollout of cost-saving and resilience-enhancing measures.

- **Leverage cross-sector dependencies:** Digital infrastructure is dependent on energy to operate, and data centers have the added requirement for water. Additionally, these utilities and transport are increasingly dependent on telecommunications for their routine operations. These interdependencies provide opportunities for shared investment in resilience, backup and restoration efforts. The public sector can play a critical role in coordinating these efforts as the only common point of contact between the various stakeholders.
- **Mobilize financing for increased investment in resilience:** While digital connectivity increasingly becomes a utility infrastructure, it does not benefit from the public support other traditional infrastructures have received over the years. However, there are opportunities for mobilizing public and private sector capital in strengthening the resilience of national digital infrastructure, as demonstrated in the past by the sector through successful implementation of universal service and access funds. Facilitating private-sector investment in, and contribution to, the resilience and protection of infrastructure assets is a key role the public sector and international organizations can play.



The initiative is also guided by core principles for other related initiatives and programs on digital transformation and digital infrastructure, including the World Bank Core Principles for Digital

Infrastructure (see box 3.4), five principles for the AU's Digital Transformation Strategy for Africa (see box 3.5), and the ITU's Strategic Plan for 2020-2023 (see box 3.6).

Box 3.4. The World Bank's Core Principles for Digital Infrastructure

- **Enabling a procompetitive, human-centric ICT policy and regulatory framework:** to eliminate barriers to entry, introduce competition in the ICT sector, reduce overall industry costs and prices, with a focus on expanding connectivity for all, including for the poor, marginalized, and rural populations.
- **Building strong institutional capacity:** to build independent regulatory institutions that enforce regulations in a transparent, participatory regulatory process.
- **Enabling investment climate:** to create policy and regulations on foreign investment and national fiscal policy in telecommunications and the ICT sector in general, that facilitate and incentivize capital expansion.
- **Supporting policy and regulatory approaches for broadband deployment and converged services:** to adapt necessary legal and regulatory frameworks to make them better suited to support broadband access and services; to adhere to open access principles; to secure a safe internet; to seek only the level of regulation necessary to promote the rapid growth of new services and applications and to minimize barriers to entry.
- **Addressing access gaps by going beyond the market:** to utilize public funding, development aid, or government initiatives to bring affordable broadband to underserved areas and population groups, where the private sector will not reach because of the lack of market incentives.
- **Supporting gender-responsive policy and regulatory approaches to affordable broadband deployment and services:** to contribute to the elimination of the digital gender gap.
- **Achieve digital inclusion by supporting digitally inclusive policies, strategies and targeted approaches to address the increasing gender and digital divide:** to ensure the social and economic empowerment of disadvantaged groups and persons with specific needs including rural communities, differently abled persons, youth and children and women and girls.

Source: Boutheina, Guermazi and David Satola. 2005. "Creating the 'Right' Enabling Environment for ICT." In *E-development: From Excitement to Effectiveness*, edited by Robert Schware, 23-46. Washington, DC: World Bank Group. <https://openknowledge.worldbank.org/bitstream/handle/10986/7274/341470EDevelopment.pdf?sequence=1&isAllowed=y>

Box 3.5. Five Principles for the Digital Transformation Strategy for Africa

The African Union and the World Bank's DE4A initiative agreed on the following five principles of the digital economy that are key to implementing the five main foundations of the strategy:

- **Comprehensive:** taking an ecosystem approach that looks at supply and demand and defies a narrow silo approach in defining the required elements and foundations for the digital economy.
- **Transformative:** aiming at a very different scale of ambition, beyond incremental "islands" of success.
- **Inclusive:** ensuring that the digital economy creates equal access to opportunities and dealing with the risks of exclusion.
- **Homegrown:** basing expansion of the digital economy on Africa's realities and unleashing the African spirit of enterprise to produce more homegrown digital content and solutions, while embracing what is good and relevant from outside the continent.
- **Collaborative:** dealing with the digital economy requires a flexible mindset, requiring different types of collaboration among countries, sectors, and public and private players, as well as facilitation, retooling, and encouraging risk taking.



Box 3.6. Mission, Vision, and Values for ITU's Strategic Plan 2020-2023

Vision: An information society, empowered by the interconnected world, where telecommunications/information and communication technologies enable and accelerate social, economic and environmentally sustainable growth and development for everyone.

Mission: To promote, facilitate, and foster affordable and universal access to telecommunication/information and communication technology networks, services and applications and their use for social, economic and environmentally sustainable growth and development.

Value: ITU recognizes that achieving its mission requires that it build and maintain trust among its membership and inspire the confidence of the public at-large. This applies to both what the Union does and how it is done. The Union is committed to continuously building and safeguarding that trust by ensuring that its actions are guided by the following values:

- **Efficiency:** Focusing on the purposes of the Union, making decisions on the basis of appropriate studies, evidence, and experience, taking effective action and monitoring outputs, avoiding internal ITU duplication.
- **Transparency and accountability:** By enhancing transparency and accountability processes for better decisions, actions, results and management of resources, ITU communicates and demonstrates progress towards the achievement of its goals.
- **Openness:** Being aware of and responsive to the needs of all its membership, as well as the activities and expectations of intergovernmental organizations, the private sector, civil society, the technical community, and academia.
- **Universality and neutrality:** As a United Nations specialized agency, ITU reaches, covers, and represents all parts of the world. Within the remit of the Basic Instruments of the Union, its operations and activities reflect the express will of its membership preferably by consensus. The Union also recognizes the overarching pre-eminence of human rights, including the right to freedom of opinion and expression, which includes the freedom to seek, receive and impart information and ideas through any media and regardless of frontiers, and the right to not be subjected to arbitrary interference in privacy.
- **People-centered, service-oriented and results-based:** Being people-centered, ITU is focused on people in order to deliver results that matter to each and every individual. Being service-oriented, ITU is committed to further delivering high-quality services and maximizing satisfaction of beneficiaries and stakeholders. Being results-based, ITU aims for tangible results and to maximize the impact of its work.

4

Investment Requirements for 2021 and 2030 Digital Infrastructure Targets

Achieving universal, affordable, and good quality access to broadband connectivity in Africa would be a significant undertaking considering that the continent still has so far to go to achieve universal coverage for basic services, such as electricity, clean water, housing, education, healthcare, and so on. Nevertheless, broadband access can provide a foundation and indeed support efforts for achieving universal coverage in other areas, such as in healthcare coverage and service provision.²⁷ The economic impact of broadband access, moreover, is notable. ITU's 2018 study on the economic impact of broadband penetration noted that, in middle income countries, an increase of ten percent in mobile broadband penetration yields an increase of 1.8 percent in GDP, and for low income countries, an increase of ten percent in mobile broadband penetration yields an increase of two percent in GDP.²⁸ In Sub-Saharan Africa, a ten

percent increase in mobile broadband penetration is likely to lead to a 2.5 percent increase in GDP.²⁹ However, there is limited quantitative analysis available for estimating precisely how much total investment will be required to realize this objective in the specific context of Africa. For the purposes of this assessment, and through a process of consultation with stakeholders, this report seeks to provide such quantitative support to inform government policies and private sector strategies.³⁰

The process for developing the investment requirements for the broadband networks' component of the DE4A initiative is outlined below, with the key assumptions underpinning these estimates and the findings of this analysis. In addition, appendix A provides a detailed review of definitions and methodology used to develop these estimates.

27. See Deloitte. 2014. *Value of Connectivity Economic and Social Benefits of Expanding Internet Access*.

28. ITU. 2018. *The Economic Contribution of Broadband, Digitalization and ICT Regulation*.
<https://www.itu.int/pub/D-PREF-EF.BDR-2018>

29. ITU. 2019. *Economic Contribution of Broadband, Digitization and ICT Regulation: Econometric Modelling for Africa*.
https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.BDT_AFR-2019-PDF-E.pdf

30. See the following reports for early analysis on this topic: https://www.un.org/esa/ffd/wp-content/uploads/2016/01/Financing-for-ICT-Infrastructure_ITU_IATF-Issue-Brief.pdf; and <http://www.eu-africa-infrastructure-tf.net/attachments/library/aicd-background-paper-3-ict-invst-summary-en.pdf>

Box 4.1. A Multistakeholder Process

The World Bank, with support from the Alliance for Affordable Internet (A4AI), has prepared a baseline assessment of current broadband connectivity in Africa and what would be required to achieve the 2021 milestone and the 2030 target. The analysis used a variety of data sources, principally from the World Bank Group (WBG), the United Nations (UN), the International Telecommunication Union (ITU), the Global System for Mobile communications Association (GSMA), the A4AI, the World Economic Forum (WEF), and Xalam Analytics.

To verify the quantitative analysis, the WB and A4AI convened several multistakeholder consultation groups – notably with the Commissioners from the Broadband Commission’s Working Group on Broadband for All, multiple stakeholders in the ecosystem, including WBG development partners – to engage key ICT industry partners and identify possible ways of increasing connectivity and reaching full coverage in Africa. This diverse group included representatives from over 35 private companies, international organizations, and civil society groups from around the globe (see appendix C for the full list of representatives and more information about the consultation process).

Key Assumptions

The assumptions for the investment estimates are anchored in several definitions that were consulted upon.

2021 Milestone versus 2030 Target for the DE4A Initiative

To ensure that its Digital Transformation Initiative is fully realized and to ensure the strategy is on track, the World Bank has developed two goals:

- a short-term progress milestone to be achieved by 2021 – *to double broadband connectivity penetration in Africa by 2021 from 2016 penetration levels*
- a long-term target to be achieved by 2030 – *to achieve universal, affordable and good quality broadband access in Africa by 2030*

For the 2021 milestone to double broadband connectivity in Africa by 2021 from 2016 penetration levels, the assumptions are:

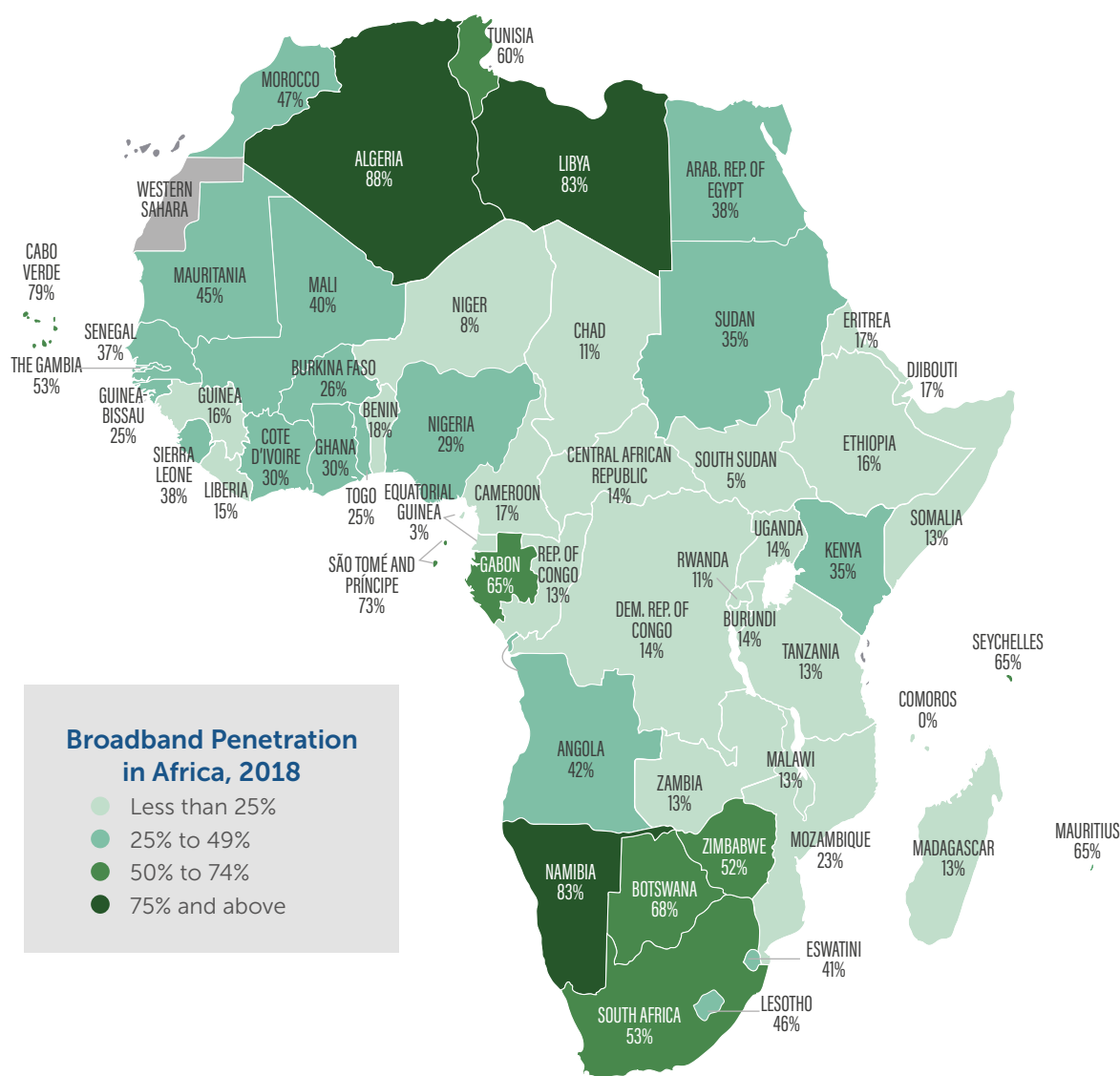
1. **Broadband internet is defined (during this period) as an average download speed of 3 Mbps** and is technology neutral (that is, data can be transmitted via cable, fiber, satellite, radio, or other technologies).
2. **Doubling broadband penetration is defined as doubling, between year-end 2016 and year-end 2021, the levels of broadband penetration among the population of 10 years of age and older.** 2016 is selected as the baseline year for this analysis to ensure alignment with the World Bank's World Development Report 2016 and to consider the lead time to plan and roll out broadband networks. The estimated level of the penetration is provided by GSMA Intelligence data and adjusted by SIM ownership ratio to determine unique subscribers. The target is set at 10 years of age and older, in recognition of data protection and privacy laws of various countries that seek to protect children when accessing the internet.

Doubling broadband penetration in Africa by 2021 is a milestone towards the 2030 target, *to achieve universal affordable and good quality broadband access in Africa by 2030*. For this 2030 target, the key assumptions are:

1. **Good quality broadband internet is defined as an average download speed of at least 10 Mbps** and is technology neutral (that is, data may be transmitted via cable, fiber, satellite, radio, or other technologies).
2. **Universal coverage is defined as 90 percent penetration of the population of 10 years of age and older.** The estimated level of the penetration rate is primarily based on GSMA Intelligence data, as it is the most accurate source of mobile broadband infrastructure data available. The target age is set at 10 years and older in recognition of data protection and privacy laws of various countries that seek to protect children when accessing the internet. The 90 percent penetration target is used to define universality to take account of that segment of the population which chooses not to use personal ICTs, those who are prevented from doing so (for example, prisoners) and those who use shared facilities, for instance, within a family, from a school or university, or from a community center.
3. **Affordable access is defined in terms of the Broadband Commission for Sustainable Development's target of entry-level mobile broadband data costing two percent or less of average monthly income.**³¹
4. **Connecting the last 15-20 percent of the population in rural and remote areas, depending on the population density level, requires innovative business models and alternative technologies, such as satellite and Wi-Fi based technical solutions.**

31. Broadband Commission for Sustainable Development. 2018. *2025 Targets: Connecting the Other Half*. <https://www.broadbandcommission.org/Documents/publications/wef2018.pdf>

Figure 4.1. **Mobile Broadband Penetration in Africa by Country, 2018**



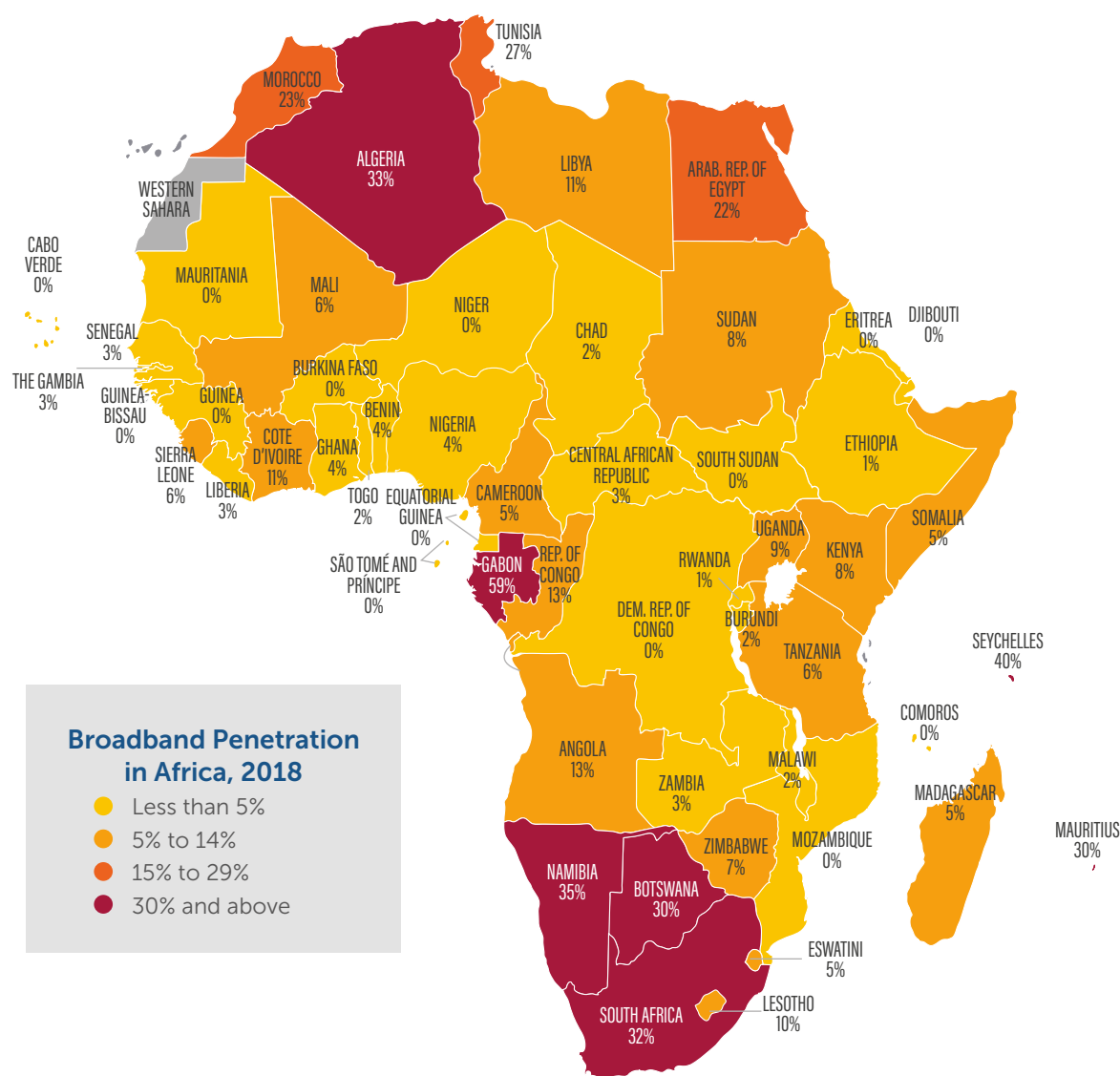
- Regional average: 31% (2018 estimate)
- Estimates based on GSMA, UN, Xalam Analytics data.
- Penetration based on unique users and target population aged 10 and above.
- Broadband is defined as average download speeds of 256 Kbps or greater while the target download speeds by 2021 is 3 Mbps.

* *Disclaimer:* Figures may differ from the actual level of penetration and information available on other sources. Note the key assumptions underpinning the 2021 target for details.

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This map was produced by the cartography unit of the World Bank Group. The boundaries, colors, denominations and any other information show on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Figure 4.2. **4G Mobile Broadband Penetration in Africa by Country, 2018**



- Regional average: 9% (2018 estimate)
- Estimates based on GSMA, UN, Xalam Analytics data.
- Penetration based on unique users and target population aged 10 and above.
- Broadband defined as average download speeds of 10 Mbps or greater.

* *Disclaimer:* Figures may differ from the actual level of penetration and information available on other sources. Note the key assumptions underpinning the 2030 target for details.

Key Findings

Investment Requirements to Achieve the 2021 Milestone

In order to double broadband connectivity by 2021, **the baseline broadband penetration of the target population in Africa would have to increase from about 18 percent in 2016 to about 36 percent by 2021.** This would mean bringing about 220 million new people online.

Considerable progress has already been made towards this target. It is estimated that about 120 million new users were connected between 2016 and 2018, bringing broadband user penetration in the region to about 31 percent in 2018. However, growth rates are slowing. To achieve the proposed 2021 target, a further 100 million new broadband users must be connected across the continent. Furthermore, there are still a significant number of countries in Africa below the 20 percent penetration target, with many in a fragile situation³², that will be at risk of lagging further behind in the context of accelerating digitization across the continent: there were 31 countries below the 20 percent broadband penetration mark in 2016, and 22 countries in 2018.

The country distribution of investment requirements to achieve the 2021 milestone is a function of several factors, including (though not limited to): current penetration levels, market size, literacy, income, expected costs, perceived investment risks and existing levels of broadband network coverage. It is estimated that the 49 countries in Sub-Saharan Africa (SSA) account for about 83 percent of the region's target population. However, on average, about a third of the SSA population remains out of reach of mobile broadband networks (compared to about two percent in North Africa). With average broadband penetration of about 26 percent in

2018, countries in SSA would need to add about 70 million new broadband-connected users by 2021, that is, about 70 percent of the overall regional target.

It is estimated that about \$9 billion in investment would be required to double broadband connectivity penetration in Africa by 2021 (see figure 4.3).³³

Access network infrastructure (using mobile infrastructure as a proxy) capital expenditure (CapEx) would account for about half of the required investment. Including recurring network maintenance costs, some 75 percent of the required investment is directly tied to the need to roll out and maintain broadband networks in areas not currently served by a mobile broadband signal, and to support the additional connected user base and related traffic.

Doubling broadband penetration also implies a significant uptake of penetration in areas already covered by broadband networks, through legal and policy reforms aiming at increasing accessibility, awareness, affordability, relevance, safety and security as well as the level of digital skills through capacity building programs. In this regard, countries should adopt the MFD approach by promoting market competition and leveraging all sources of finance, expertise, and solutions with the aim of removing entry barriers, demonopolizing industry segments and increasing competition while building institutions for long-term sustainability to enable private investment and eliminate existing constraints. About 20 percent of the required investment is tied to the need to build the user skills and local content foundations to ensure that the deployed infrastructure is effectively used. A further five percent would need

32. <https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations>

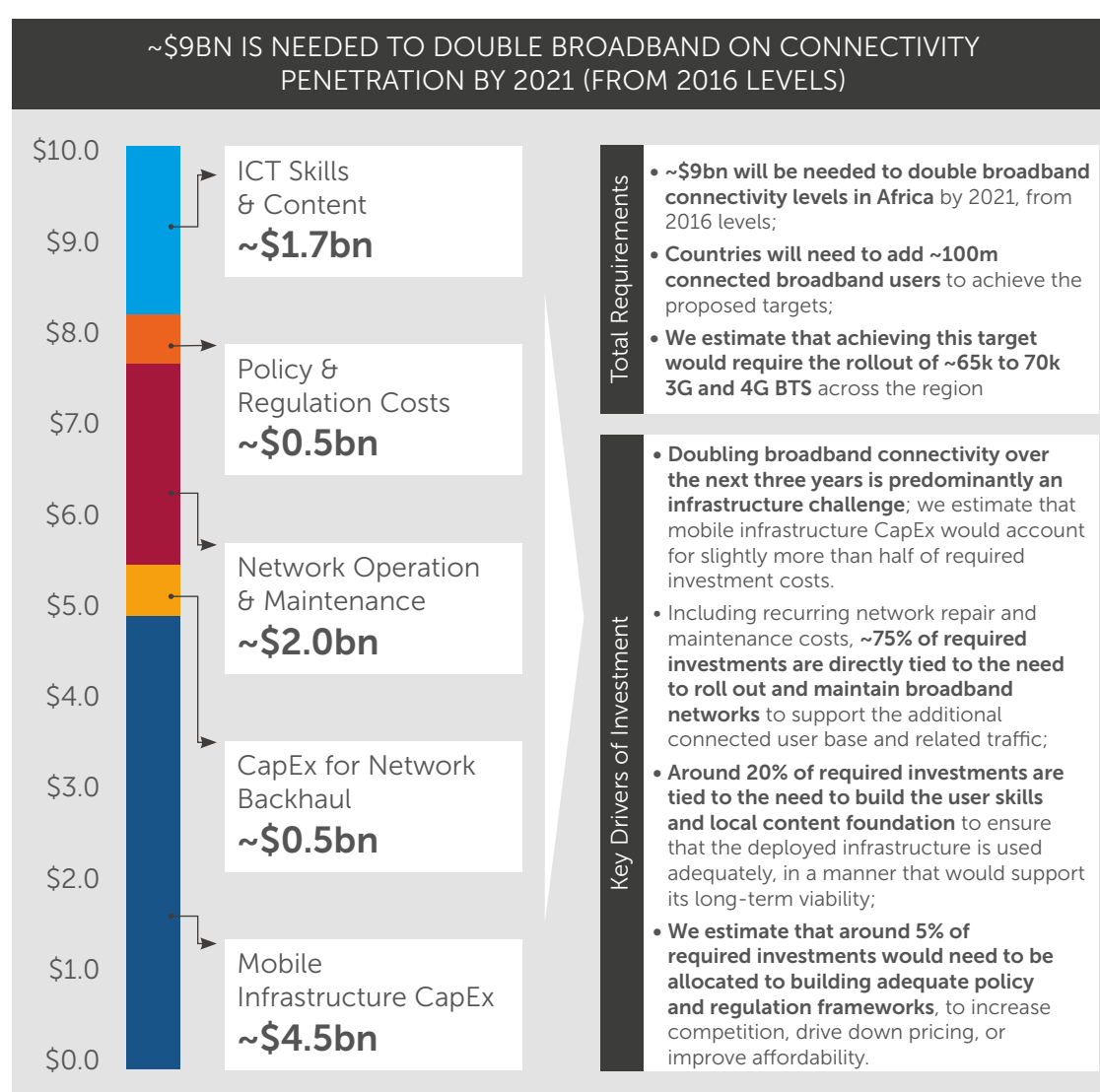
33. This figure excludes investments made between 2016 and 2018.

to be allocated to building adequate policy and regulation frameworks. Research has shown that investments in policy and regulatory frameworks reform has been extremely limited and urgently need to be increased to ensure required technical support and capacity building.³⁴

At the subregional level, SSA accounts for about 73 percent of estimated

investment requirements to double broadband connectivity penetration by 2021 from 2016 levels (see figure 4.4). With the foundational infrastructure largely in place in North Africa, requirements primarily concern the need to increase broadband network density, enhance digital skills, and build the market conditions for broad-based access.

Figure 4.3. **Investment Needed to Double Broadband Penetration in Africa by 2021**

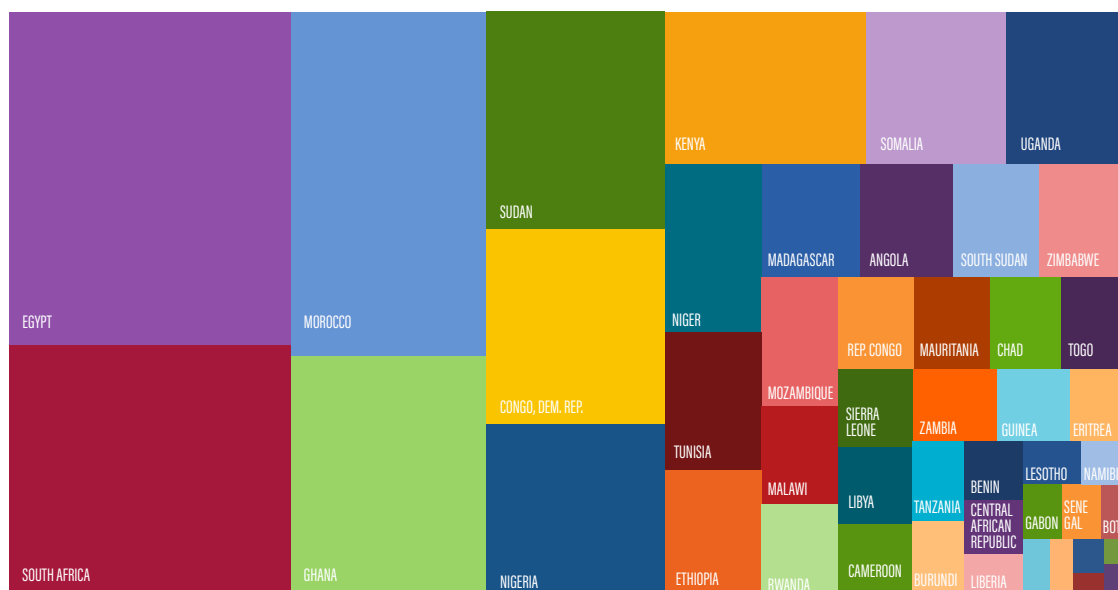


Source: Xalam Analytics estimates.

Note: Mobile infrastructure is used as a proxy for access network infrastructure.

34. A4AI: <https://a4ai.org/closing-the-investment-gap-the-critical-role-of-development-banks-to-advance-digital-inclusion/>

Figure 4.4. **Relative Size of Investment Needed by Country to Double Broadband Connectivity by 2021**



Investment Requirements to Achieve the 2030 Target

Achieving universal, affordable and good quality access to broadband connectivity is a considerable challenge. Using the 10 Mbps download speed definition for broadband, nearly 830 million people were still unconnected to high-speed broadband networks in Africa as of 2018. To achieve universal and affordable access to good quality broadband, African countries will need to connect nearly 1.1 billion new unique users by 2030. **It is estimated that additional investments of about \$100 billion would be needed to reach this goal over the next decade, or close to \$9 billion a year** (see figure 4.5).

Connecting 1.1 billion new users by 2030 is unquestionably a significant infrastructure undertaking. It would require the deployment of nearly 250,000 new 4G base stations and at least 250,000 kilometers of fiber across the region. Between 2019-2025, mobile operators in Africa are expected to invest approximately \$45 billion in network CapEx.³⁵ If similar levels were maintained to 2030, then total network investment

in the period 2019-2030 would be almost \$80 billion.³⁶ This investment amount also includes costs to roll out the next generation networks such as 5G and to enhance QoS, that is, not all the \$80 billion CapEx is being planned to be dedicated to extend the broadband access. It would also require rolling out innovative satellite, Wi-Fi based solutions, or other innovative solutions to reach an estimated population of nearly 100 million that live in remote rural areas that are currently out of reach of traditional cellular mobile networks.

Therefore, infrastructure investment requirements are substantial. It is estimated that nearly 80 percent of all required investments are directly related to the need to roll out and maintain broadband networks to support the additional connected base and associated traffic. Further, within this amount, at least 15- 20 percent of infrastructure investment is associated with the cost of connecting users in remote rural locations.

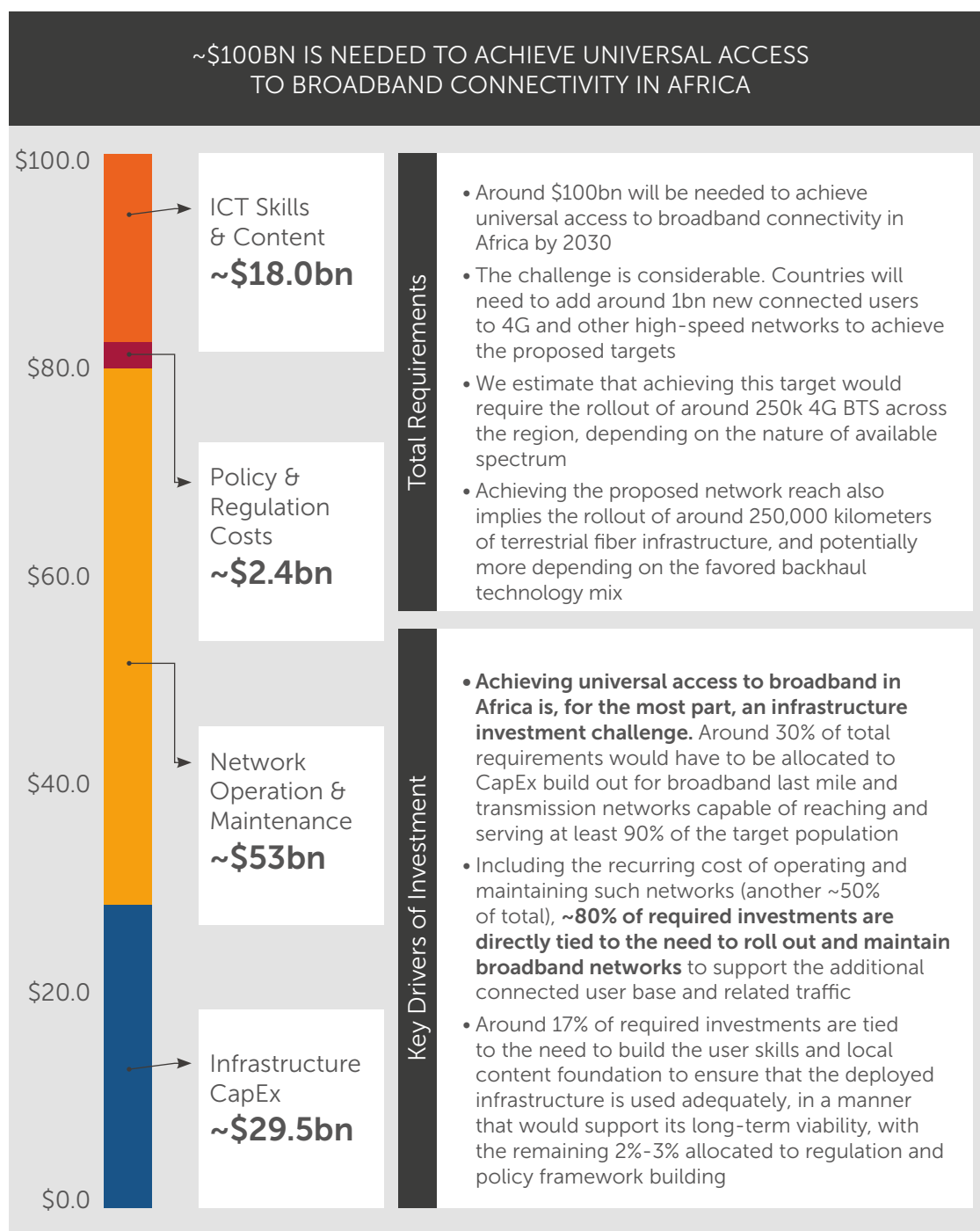
35. Source: GSMA Intelligence. Annual CapEx is based on exchange rates as of Q1 2019 to avoid exchange rate fluctuations and forecasting. Total mobile operator CapEx in Africa in 2019-2025 is estimated to be about \$70 billion. In order to estimate the proportion of this that is spent on networks, a network proportion of 65 percent is assumed.

36. This investment does not include spectrum acquisition and renewal costs, which in many countries can be significant.

In addition, the analysis points to the considerable weight of recurring costs on overall investment requirements. More than half of the projected cumulative infrastructure costs to achieve universal access relate to

recurring network operation and maintenance or operational expenditure (OpEx), underscoring the importance of developing viable standalone or subsidized economic models.

Figure 4.5. **Investment Needed to Achieve Universal Access to Broadband Connectivity**



Source: Xalam Analytics estimates.

Note: Operation and maintenance costs are assessed on a cumulative basis over a 12-year period (2018-30).

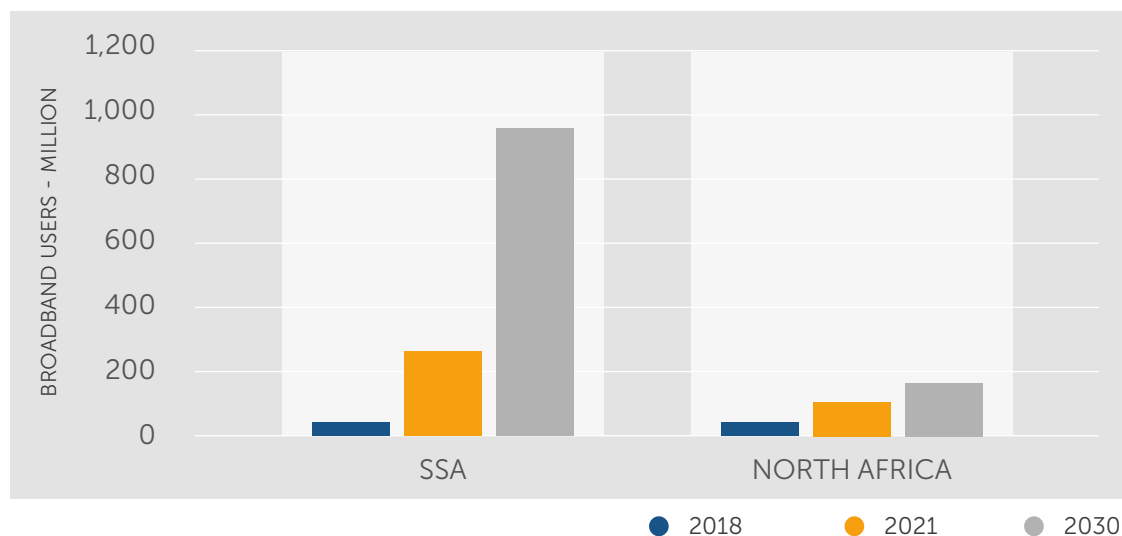
Figure 4.6. **Relative Size of Investment Needed by Country for Universal Access by 2030**



Connecting the unconnected is about more than just infrastructure. About 20 percent of required investment concerns the need to build the user skills and local content foundations to ensure that the deployed infrastructure is used adequately, in a manner that would support its long-term viability. Another two to four percent of investment will have to be allocated to building adequate policy and regulation frameworks to create market conditions that foster technology deployment, the development of a broader technology ecosystem, and overall broadband service affordability. A framework for the development of adequate sector policy and building digital skills is discussed in more detail in chapters 5 and 6, respectively.

The investment challenge appears especially difficult in Sub-Saharan Africa. SSA accounts for nearly 90 percent of estimated investment requirements to achieve universal access to broadband in the region (see figure 4.6). With average broadband penetration of about seven percent in 2018 (based on 10 Mbps speeds), countries in SSA would need to add about 900 million new broadband-connected users by 2030, more than 85 percent of the overall regional target (see figure 4.7). While there has been more significant progress in North Africa, substantial efforts are also needed to continue to improve access to connectivity and connect 130 million new users. 4G networks only cover about 60 percent of the population in North Africa, leaving ample room for growth.

Figure 4.7. **Expected Broadband Penetration Growth (2018, 2021, 2030)**



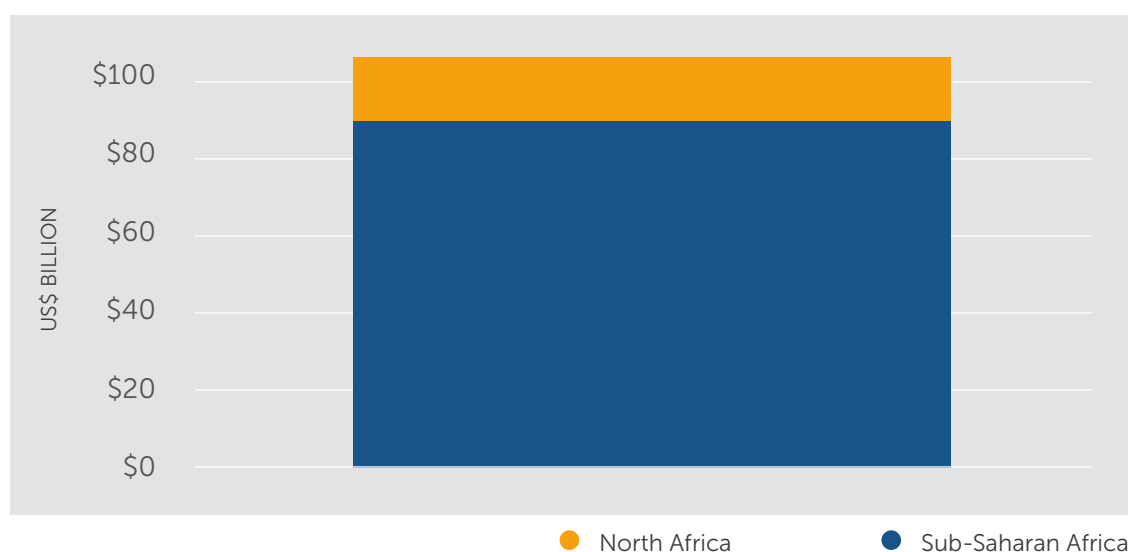
Source: Xalam Analytics estimates.

Note: 2018 and 2030 based on 10 Mbps and faster; 2021 based on 3 Mbps and faster.

Five countries (Nigeria, the Democratic Republic of Congo, Ethiopia, Tanzania, and the Arab Republic of Egypt), three of which are LDCs, account for about 46 percent of all the region's projected requirements (see figure 4.6). These markets have large populations and 4G penetration levels which, while improving, are still relatively low. Taken collectively, they will have an inordinate impact on the probability of achieving the presumptive targets.

The requirements are also significant beyond this group of countries. About 10 markets in the region have an estimated cumulative investment requirement of about \$2 billion; another dozen have broadband investment requirements of \$1 billion or more, underscoring the broad-based nature of the need for additional investment.

Figure 4.8. **Investment Needed to Achieve Universal Access to Connectivity by Region**



Source: Xalam Analytics estimates.

The background is a solid black field. It is decorated with numerous bright blue, glowing streaks of varying lengths and thicknesses. Some streaks are straight, while others are curved, creating a sense of motion and energy. A large, bold, white number '5' is positioned on the left side of the image, partially overlapping the blue streaks.

5

Policy and Regulatory Frameworks to Enable Digital Transformation

Government policies and practices can significantly influence the development and impact of universal, affordable, and good quality broadband connectivity in a variety of ways. The optimal mix of policies for any given country will vary depending upon a range of economic, demographic, geographic, political, and other factors.

Nevertheless, there are certain core principles and established good practices that have proven effective in accelerating broadband growth and adoption across many different countries, regions, and economies. To support the development and implementation of policy and regulatory core principles and good practices, the previous section of this strategy identifies the estimated costs associated with those needs and integrates these actions in the roadmap to achieve the 2030 target. These costs are estimated as a fixed percentage of the infrastructure costs for each country. These targets can only be achieved if proinvestment policies are put in place that reduce the costs and uncertainty around spectrum allocation and assignments, remove obstacles to network deployment, and promote best practices on tax policy.

Public policy, legal, and regulatory frameworks need to be up-to-date, flexible, incentive-based and market driven to support digital transformation across all sectors and across the continent's regions. In this respect, policy makers and regulators need to keep pace with advances in technology, address new regulatory challenges, and create the foundation upon which digital transformation can achieve its full potential.

This chapter presents an analytical framework and priority recommendations for evaluation and review, to guide the adoption of public policies in support of broadband infrastructure development objectives under the Mobilizing Finance for Development approach. It highlights the range of policy approaches that may be considered, and the various aspects of the infrastructure-supply components of the broadband ecosystem that can be influenced by such policies. It then presents a high-level matrix of key priority options for governments to incorporate in their national broadband strategies and matrixes of ICT sector reforms. This framework informs the sequence of steps and actions to be identified in the strategy roadmap.

Public Policy Options

The array of public policy measures that can be employed generally fall into several distinct categories, although there may be considerable synergy across broadband policy initiatives. The following briefly summarizes the key features of the main types of policy options:

- **National ICT Policies and Digital Strategies:** The basic foundation for establishment and promotion of broadband, including national digital strategies (holistic approaches to digital development and planning) and policy principles, directives and targets for sector-specific national ICT strategy as well as general principles for competition policy aiming to increase levels of competition in the market.

- **Laws, Legislation, Regulation:** Regulatory agencies, instruments, rules, decisions, and oversight, which implement and enforce legal and policy mandates, and govern overall broadband/ICT sector performance.
- **Public Funding, Investment:** Direct public funding of broadband projects through various vehicles, including government subsidies and public financing through public-private partnership (PPP) arrangements. Note that public funding refers to funding managed by the government/public sector but largely provided by MDBs and other donors.
- **Programs, Initiatives:** Government-sponsored or supported programs to promote broadband awareness, adoption, and use, including education and training.
- **Government Adoption, Procurement:** The role of government as a user of broadband in its operations at all levels, including network connectivity, procurement of equipment and services, and aggregation of government demand and adoption across agencies.
- **Taxation, Fiscal Policy:** Tax, tariffs, fees, and other fiscal policies that affect costs and incentives for broadband service and equipment suppliers, investors, entrepreneurs, and customers. An adoption of the Information Technology Agreement (ITA) for tariff elimination has also been proved to be effective in bring down the costs of digital devices.³⁷

Broadband Ecosystem Components

Each of the above forms of policy intervention can influence one or more aspects of the overall broadband ecosystem. As with all ecosystems, the various elements of the broadband ecosystem are interdependent and mutually reinforcing. Ideally, governments should, therefore, design coordinated national broadband strategies which will simultaneously influence multiple aspects of the ecosystem at the same time, generating ripple effects which can become self-sustaining.

In general terms, there are four major interrelated components of the broadband ecosystem: supply; demand; economic impacts; and social impacts. Each of these, in turn, comprises a wide range of elements which can be subject to stimulation, expansion, investment, and strengthening through policy initiatives – or conversely, which can be inhibited through suppression, neglect, or misguided policies. While the primary focus of this analysis is on the supply of digital infrastructure, it is important to recognize that each of the other ecosystem components plays an important, mutually reinforcing role in enabling and promoting infrastructure investment.

The following summary highlights some of the key elements of each aspect of the broadband ecosystem which can be most influenced by various policy, regulatory, and other government strategies:

Supply:

Telecommunications and related ICT infrastructure, networks, services, and facilities, together with related hardware and software, which deliver broadband connectivity and capabilities to end-users. These include:

37. See Information Technology Agreement — an explanation. https://www.wto.org/english/tratop_e/inftec_e/itaintro_e.htm
The ITA has had a positive impact on trade and the economy but not all participants have benefited from trade opening in the same way. The costs associated with tariff elimination and market opening must be counterbalanced.

- **Backbone networks:** High capacity long-haul transmission networks, typically fiber optic, microwave, and/or satellite components, linking national and international centers to local distribution networks.
- **Telecommunications distribution and service networks:** All electronic and transmission components that make up digital telecommunications transmission networks and services, from antennae and processing facilities to back-office systems, and also including the investments in labor necessary to install and operate such systems.
- **Supporting and passive infrastructure:** Nontechnical components of ICT infrastructure necessary to support and access communications transmissions, including roads, electrical power, as well as poles and towers.
- **Local access connectivity:** Last-mile wireless and wireline network access connections which connect end-users to the national broadband network.
- **Data centers, internet exchange points (IXPs):** Large-scale data storage and exchange facilities that improve data security and efficiency.
- **Devices, equipment:** Computers, tablets, smartphones, servers, and all related and peripheral hardware that connect to and utilize broadband networks, including the rapidly growing range of machinery that constitutes the Internet of Things (IoT).
- **Software:** The full range of operating systems, end-user programs, personal computer and mobile applications, as well as content and services purchased and utilized across the ICT universe.

An additional consideration for the supply side is the need to facilitate the entry of new and innovative technological backhaul to last mile solutions. Thus, policies should be technology-neutral and should also be flexible enough to accommodate new ways of providing backhaul (for example, low Earth orbit satellites), or last mile solutions (for example, TV white spaces). This can include policies and regulatory frameworks that are subject to periodic review.

Demand:

End-user demand for and use of broadband services and applications, and the factors which determine willingness and ability to pay for such capabilities:

- **Relevance** of services for consumers and awareness by consumers of the opportunities and benefits of advanced ICTs.
- **Accessibility** of services and products is key to ensure that all users, regardless of circumstances, are able to benefit fully from ICTs.
- **Affordability** of services, devices, and applications for different classes of users relative to incomes and needs.
- **Digital content and applications** that are understandable (for example, in native languages), of relevance, interest, and value to various user groups within the population, including women, people with disabilities, entrepreneurs, smallholder farmers, and so on.
- **Digital literacy and skills:** Citizens' ability to trust, utilize, understand and take full advantage of the capabilities of advanced ICTs in their lives, jobs, and homes.

Economic Impacts:

Use and adoption of broadband-enabled ICT services in various forms of economic activity, which drives investment, revenues, cost savings, and overall economic growth, hence justifying government intervention.

- **Entrepreneurial opportunities**, which support the creation of new business models, including e-commerce and online marketing.
- **E-finance, m-finance**: Use of ICTs to drive financial inclusion by providing access to banking and digital financial services, such as mobile money, to expand payment, insurance, savings, and credit options to all citizens.
- **Broadband in productive sectors** such as agriculture and other industries: Deployment of advanced broadband ICT tools and applications to promote more efficient operations in the agriculture sector as well as other key national industries.
- **Employment, training**: Use of ICTs to support worker training, especially in technology-related skills, to improve employment prospects.

Social Impacts:

Social benefits arising from adoption and use of broadband on a society-wide basis, which improve citizens' quality of life, and drive both market demand and political support for broadband policies.³⁸

- **Broadband in education**: Enhancement of education through distance-learning, ICT tools, teacher training, digital curriculum, and so on.

- **Broadband in health care**: Telemedicine, e-health programs, streamlined and efficient electronic patient records and monitoring systems, health education, and awareness programs.
- **E-government services**: Improved efficiency, access to information, and citizen engagement via online government services.
- **Social media, entertainment**: Improvements in quality of life, cultural experience, family and community integration via digital communications and applications.
- **Political engagement, free expression**: Enhanced democratic participation, awareness, accountability owing to expanded information sources, involvement.
- **Environmental impacts, protection**: Use of ICT-based tools, monitoring, alternative resources, information, and innovations to improve environmental conditions and awareness.

Broadband Digital Infrastructure Policy Options

Using the above framework of public policy options in the context of the various ecosystem components, a matrix can be developed which classifies the range of options to promote needed investment in digital infrastructure, to be aligned with other parallel policy initiatives and principles at the national

38. For relevant examples, see, <http://connectaschool.org/?q=node/496>; http://www.elearning-africa.com/pdf/report/postreport_eLA2009.pdf; <http://projects.worldbank.org/P131290/e-health-project?lang=en>; <http://www.infodev.org/articles/egovernment-handbook-developing-countries>; https://www.researchgate.net/publication/312120096_ICT_and_Environmental_Sustainability_A_Global_Perspective

and regional levels. Note that many policies may be designed to influence multiple factors at the same time. The topics below offer a list of the most significant potential options to encourage and/or mandate various forms of infrastructure investment and development opportunities. These are presented as a menu of options by category within each group, but are not an exhaustive list of all options.

This approach requires a holistic understanding of digital development, one where the ICT sector provides the foundation to advance each sector of the economy. For this reason, the government must embrace and be committed to multistakeholder collaboration during the policy formulation and decision-making steps in the process. This will ensure full support from stakeholders towards digital development.

National ICT policy and digital strategies which sets broad

- **National ICT policy and digital strategies which sets broad** ICT development targets, roles, responsibilities for infrastructure and service expansion, while supporting improved access to information about the sector including the use of open data where feasible: such a policy framework should provide guidelines for all other policy initiatives, while defining the broad sector goals and linkage with other national development objectives and policies.
- **Building trust in the digital ecosystem**, with protections against online harms such as hate speech, misuse of data, and interference in democratic processes.

Laws, Legislation, Regulation:

- **Legislative framework mandating open markets, private competition, investment:** General legislative

principles which define the country's approach to ICT sector development, including a commitment to market-oriented, competitive principles to encourage robust investment.

- **Legal foundations of all regulatory and other key policy institutions and mandates:** specific authorizations and parameters for the responsibilities of the (independent) regulator and other offices, to ensure that they have the ability and resources to oversee effective market investment, development, and competition.
- **Legal mandates for access to rights of way, with limitations on local control, fees:** requirements that restrict the extent to which local authorities may impose unreasonable, excessive, or inconsistent costs or restrictions on the build out of infrastructure.
- **Licensing, market entry:** Regulatory practices to promote open competitive market entry on a nondiscriminatory basis, including unified licenses, licenses to new alternative operators, and reasonable licensing fees.
- **Spectrum:** Spectrum allocation policies which favor competitive access to frequencies, dynamic spectrum allocation, refarming, and availability for innovative services, reasonable spectrum fees, ensuring maximized efficiency of spectrum usage.
- **Infrastructure sharing, open access:** Rules supporting shared access to passive and active network infrastructure, including wholesale and supporting network infrastructure providers (for example, tower companies, wholesale fiber optic operators), equitable cost sharing, as well as access to excess capacity on alternative fiber optic networks (alongside energy grids, railways, and so on).

- **Competition regulation:** Regulatory principles and practices to promote fair and equitable competition among all service providers regardless of physical location, including cost-oriented interconnection charges, prevention and enforcement of unfair competitive practices, regulation of market dominance.
- **Consumer protection and quality of service:** regulatory principles and practices to ensure that consumer digital rights are protected (including privacy, security and personal data) and minimum quality of service standards are upheld (to guarantee broadband access as defined in this strategy).
- **Open data practices in sector regulation:** where possible to support infrastructure mapping, spectrum allocations, and better network planning.

Public Funding, Investment:

- **Public-private partnerships:** Contractual arrangements for government and private investors to cofund targeted infrastructure projects, such as international or national backbone, data centers, and other large investments.
- **Universal service and access fund:** Sector and donor financed mechanisms, implemented by a government agency to channel subsidy funding toward economically challenging, rural areas and support affordable services to expand beyond the commercial market's limits. Such funding mechanisms are critical and it is important to support these agencies to increase their transparency and effectiveness through a consultation process with all sector players and impact.

- **Local community networks:** Community-based telecommunications operators, such as cooperatives or publicly or cofunded local access services.
- **Public funding, construction of supporting infrastructure:** Funding programs and partnerships to build out electrical power grids (including clean energy initiatives), roads, land, and buildings required to support or enable ICT infrastructure investments.

Programs, Initiatives:

- **Public digital access center programs:** Facilities which provide free or low-price use of computers, broadband connections, e-services, and digital skills training available in centralized public locations.
- **Public Wi-Fi access networks:** Transmitters/routers installed in public locations to provide broadband wireless signals covering wide areas, typically arranged in partnership with private internet service providers (ISP) under contract with the government, which allow for low-cost connection to broadband services, especially for those unable to afford full mobile or fixed broadband subscriptions.
- **Public access digital facilities and services at post offices, libraries, government offices:** Computers, internet connections, kiosks, and e-government service portals installed at facilities which citizens frequently visit.
- **Government initiatives to reduce administrative burdens:** Streamline and harmonize administrative procedures and approvals (for example, a coordinating agency to address all permits and authorizations required at the different levels of government).

Government Adoption, Procurement:

- **E-government network:** Procurements of telecommunications network infrastructure and service, establishing broadband connectivity at government offices, including wide area networks and extensions to town and village centers, which can also serve as “anchor tenants” that can support costs of commercial operators’ overall network infrastructure deployment.
- **Government services portals and applications:** Contracts to engage experts to design, host, and operate government online services and information, utilizing broadband connectivity (see box 5.1 for an overview of digital public platforms).
- **Government procurement of ICT equipment and software:** Bulk purchases of computers, tablets, servers, operating systems, data storage capacity, and other various IT resources for internal government purposes across the public sector, expanding the market for such technology suppliers.
- **Employ open contracting** (that is, making public contracts available in an open data format). Providing this kind of open data can improve competition in the bidding process, allow greater transparency in the allocation of subsidies, and, perhaps most importantly, make the allocation of funds more efficient and cost effective.³⁹

39. Alliance for Affordable internet (A4AI). 2018. 2017 Affordability Report. A4AI. <https://a4ai.org/affordability-report/report/2017/>



Box 5.1. Digital Public Platforms

Digital public platforms – which may be provided by the government or through hybrid models in partnership with the private sector – serve as a layer on which multiple public and private sector organizations can build new or better services and solutions. These platforms include three foundational components. First, digital ID systems and trust services facilitate secure transactions between people, institutions, and devices. Second, interoperability layers and shared services facilitate data exchange and leverage common resources across disparate hardware devices, communication networks, cloud providers, operating systems, applications, and interfaces. Finally, applications for core government functions, digital service delivery and civic technology (CivicTech) provide the technology and interfaces through which governments deliver core functions and services and engage with the public. Together, these core components create an integrated public platform that enables end-to-end digital processes and transactions that are presence-less and paper-less. Government agencies can then leverage this platform to transform front-end service delivery and back-end processes to improve convenience for users, reduce costs, increase efficiency, and support the social contract by making governments more transparent, responsive, and accountable.

Source: African Union. 2019. *The Digital Transformation Strategy for Africa (draft)*, June.

Taxation, Fiscal Policy:

- **Adoption of the ITA** to reduce the fiscal burden on the sector.
- **Reduced import tariffs** on all forms of ICT network-related equipment and materials needed to build out infrastructure, especially for high-cost components, including consumer devices, that must be obtained from foreign suppliers.
- **Reduced or eliminated fees for network operator access to rights-of-way**, especially including uniform and reasonable charges (and streamlined procedures) from local government authorities.
- **Reasonable fees and taxes on ICT service providers**, including spectrum fees, income, and value added taxes, to balance the goal of government revenue with the objective of stimulating growth of the digital economy.
- **Tax systems should be simple and certain.** Governments should seek to limit unpredictable tax and fee changes, and streamline their levies of taxes and fees (see box 5.2).
- **Tax systems should be forward looking**, and designed for the digital era. The application of taxes should not discriminate against locally based service providers.

Box 5.2. The Impact of Taxation on Affordability

In order to close the digital gap and achieve universal access for everyone on the continent, the issue of taxation must be dealt with in a holistic, dispassionate, evidence-based manner. A holistic approach is particularly important and necessary in attaining the **UN Sustainable Development Goal 5** on gender equality and **Goal 9c** on ICTs and universal internet access, both key to the discussion around taxation.

A4AI's latest mobile broadband pricing data shows that Africans face the highest cost to connect to the internet – just 1 GB of mobile data costs the average user in Africa nearly nine percent of their average monthly income. The reasons for this include a **slowdown of policy improvements in access and infrastructure**. While governments must of course raise revenue to deliver public services, any interventions in the ICT sector should be designed to support economic growth and social inclusion.

A4AI's recent research findings have shown that:

- An assessment of the impact of **social media tax can prove beneficial for governments prior to tax implementation**. These holistic assessments can demonstrate that taxes may in fact decrease internet use and have negative spillover effects on the economy as a whole.
- Governments must **pay particular attention to the impact taxes have on women and other groups who are excluded from digital spaces**. The ability of people to pay the taxes depends largely on their sociodemographic status. The taxes are therefore likely to deepen digital inequality between the rich and the poor. In addition, one of the main barriers keeping many women offline is skills. The taxes are likely to exclude those who could most benefit from the ease of use of select services, widening the digital divide between those with and without digital skills.

To prevent the digital divide from growing starker, telecommunications industry leaders and stakeholders, including regulators, entrepreneurs, investors, and civil society, must consider the impact of these taxes on the lowest income earners, especially women, who are particularly affected. By focusing on a multistakeholder and consultative approach to tackle this issue, policy makers, industry, and civil society can collectively help in shaping regulation for a future of improved connectivity rates and increased innovation.

Source: A4AI, <https://a4ai.org/why-we-need-a-new-approach-towards-taxation-of-data-and-ict-services-in-africa/>

6

Digital Skills and Local Content Development



To reap the benefits of a fully digitalized society, people must become digitally literate, and the content online must be relevant for all. In the 2018 GSMA Intelligence Consumer Survey that included selected African countries,⁴⁰ a lack of literacy and digital skills was identified as one of the most important barriers preventing consumers from using the mobile internet.⁴¹ As such, digital infrastructure investment ought to be complemented by investments in developing digital citizens equipped with digital skills that prepare them as workers, producers, creators, innovators, as well as in producing the local content to support such needs. Note that this section refers to digital skills education necessary for basic digital literacy and content creation and does not include advanced education in the ICT sector (that is, education necessary for someone to become a network engineer, for example⁴²).

To bring nearly a billion new users online from the continent, the global community must also invest in digital skills and local content development – in particular, in local language – as part of the effort to increase connectivity and prepare people as active and informed digital citizens. Given that most of the population still offline are from marginalized groups, including women, the poor, and rural communities, there is a need to invest in developing basic digital skills and supporting a local digital ecosystem to increase relevant local

content and knowledge that support development opportunities, including for women and girls. Closing the coverage gap on the continent by 2030 means that millions of citizens will access the internet for the first time. In this context, it will be critical to help people living in newly covered areas to understand the value of the internet and how to use it, as well as to build their digital resilience. Investing in promoting basic digital skills will also be particularly important to ensure citizens democratically participate in their countries by equipping them with the necessary skills to access already existing or newly developing e-government platforms and services. Moreover, to reach the 36 percent illiterate population on the continent, voice-based solutions and applications should also be built as part of local content development.

To reach the 2030 goal, in aggregate, investment of \$18 billion is needed in basic digital skills and content development.⁴³ Improving the ability of people to use internet-based technologies to access information and increased training opportunities, and produce content, are some of the important elements of the *DE4A initiative*. Investment must come from all stakeholders – private companies, governments, civil society, and international donors – to prioritize necessary policies and programs to develop digitally ready populations, for example, national governments

40. The seven countries were Algeria, Cote d'Ivoire, Kenya, Nigeria, Mozambique, Tanzania, and South Africa.

41. GSMA. 2019. *The State of Mobile Internet Connectivity*.

42. A strategy for advanced digital education is included in the Digital Skills pillar of the DE4A Initiative.

43. The estimated investment is based on basic training needed per new internet user (\$15), along with an estimated local content cost per user (\$2). Basic digital literacy training was defined as short one-on-one or group training sessions in which new users are provided the skills necessary to navigate the internet and to use commonly available local applications. See: World Economic Forum. 2017. *Internet for All: An Investment Framework for Digital Adoption*. http://www3.weforum.org/docs/White_Paper_internet_for_All_Investment_Framework_Digital_Adoption_2017.pdf; and http://www3.weforum.org/docs/IFA_models_for_year.xlsx

sponsoring ICT educational development programs for worker retraining, multilateral development organizations investing in education programs for vocational schools, civil society organization implementing digital skills education initiatives, and the private sector investing in local content development (see box 6.1). Digital skills and content development programs should incorporate public- and private-led interventions, as well as those targeted at women and girls

and rural communities (see box 6.2 and box 6.3). Indeed, the *DE4A initiative* has its own pillars on digital skills and digital entrepreneurship, which will complement the suggested strategy in this document for broadband networks infrastructure. Proactive engagement of UNESCO affiliated international nongovernmental professional organizations in science, engineering and technology should be utilized to the full.⁴⁴

Box 6.1. Addressing Digital Skills and Local Content

Based on WEF's Internet for All investment model for digital adoption, two barriers must be addressed to increase the number of internet users: digital skills and local content. WEF recommends the following to overcome these barriers:

1. To increase internet users, basic digital literacy must be improved by facilitating formal and informal training programs targeting at least one person per family.
2. To increase local content, supporting the digital content ecosystem is key. Studies show that tech hubs in emerging markets have an impact on fostering local ICT companies.

Source: World Economic Forum. 2017. *Internet for All: An Investment Framework for Digital Adoption*. http://www3.weforum.org/docs/White_Paper_internet_for_All_Investment_Framework_Digital_Adoption_2017.pdf; and http://www3.weforum.org/docs/IFA_models_for_year.xlsx; Sambuli, N. and J. P. Whitt. 2017. *Technology Innovation Hubs and Policy Engagement: Making All Voices Count*. Research Report. Brighton: Institute of Development Studies, https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/12860/RReport_TechHub_Online.pdf

44. For example, the World Federation of Engineering Organizations (WFEO) with 30 million professional engineers worldwide, the InterAcademy Partnership of some 130-national academies of science, engineering, and medicine, and the International Science Council of international scientific unions and scientists in natural and social sciences are committed to helping humankind achieve the SDGs through science, engineering, and technology.

Box 6.2. Closing the Digital Skills Gap for Nigerian Women and Girls

Girls and women in Nigeria are 40 percent less likely to have access to the internet than men, and support from the government and private sector is critical in closing this gap. Driven by Nigeria's National Broadband Plan (2013-2018), which envisioned a highly connected society and views access to broadband as a key factor in facilitating socioeconomic development for the country and its people, the Ministry of Communications led the Growing Girls and Women in Nigeria program. The initiative supported projects that bridged the gender gap in digital access and empowerment, such as:

- Smart Woman Nigeria was an online network of women in Nigeria who received important information about topics such as health, education, and agriculture via their mobile phones. This initiative enabled rural and less privileged women to access information to help them meet their socioeconomic needs (for example, information about health, education, agriculture, and so on).
- Digital Girls ICT focused on developing ICT interest and skills among secondary school girls through their participation in digital clubs that included exposure to cutting-edge training in ICT skills. Though women represent more than 50 percent of Nigeria's population, they occupy fewer than 20 percent of ICT jobs in the country. Digital Girls Clubs encouraged young girls to embrace ICT in order to bridge the existing digital divide between men and women.
- Nigeria Federal Ministry of Communication and Huawei's 1000 Girls leveraged a PPP with an ICT company to train 1,000 girls in practical ICT skills and knowledge to increase employability.

Source: Paradigm Initiative, <https://paradigmhq.org/offline-and-silent-new-report-shines-light-onto-reality-of-womens-internet-use-in-nigeria-womensrightsonline/>; Federal Ministry of Communications, http://www.commtech.gov.ng/Doc/The%20Nigerian%20National%20Broadband%20Plan%202013_19May2013%20FINAL.pdf; Alliance for Affordable internet (A4AI), 2015-16 Affordability Report, <https://a4ai.org/affordability-report/report/2015/>

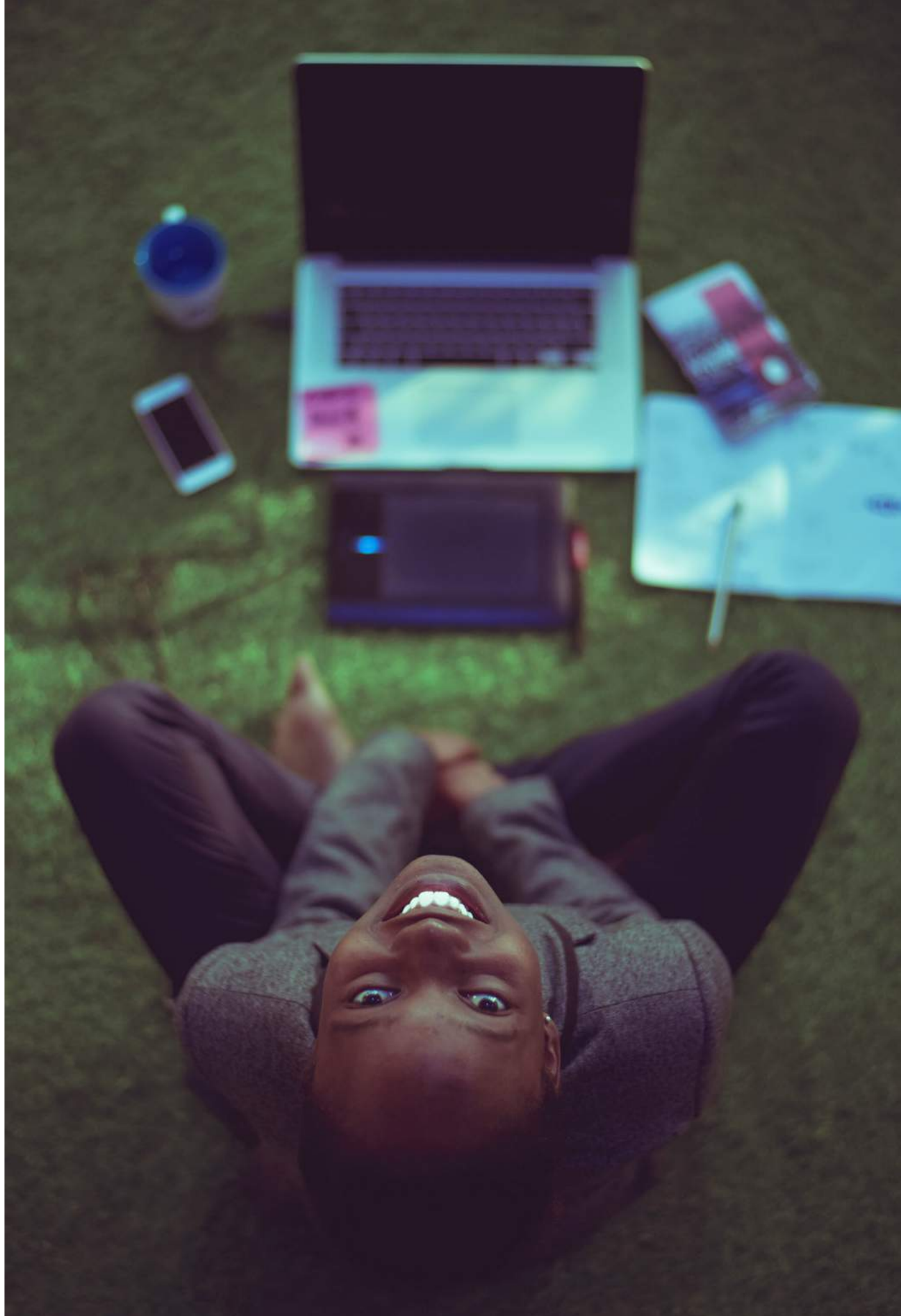
Box 6.3. Technology Bootcamp Empowers Young Tanzanian Women

To address the gender digital divide and ensure that women are provided an opportunity to develop as successful entrepreneurs, the African Technology Foundation conducted a series of technology bootcamps for women at the University of Dar es Salaam, Tanzania. Implemented in partnership with the College of Information and Communication Technologies (CoICT) at the University of Dar es Salaam, Buni Divas, and Help to Help, the bootcamp was designed to achieve the following:

- Give female students studying at higher education institutes in Tanzania computer skills training and an introduction to online learning tools to meet the needs of universities as well as future employers.
- Train young Tanzanian women to become technology ambassadors, who can teach basic computer skills to fellow students, as well as in their home and business communities, with a focus on expanding into rural communities.
- Encourage employers in Tanzania to increase their hiring quota for skilled women, and to design roles based on realistic workplace challenges.

Bootcamp participants were trained and then tested on their basic computing skills. They were introduced to various elements of basic computing, including word processing, presentation technologies, coding, and software development, and a number of women were invited to develop and present their ideas for potential new business startups.

Source: Alliance for Affordable Internet (A4AI), 2015-16 Affordability Report, <https://a4ai.org/affordability-report/report/2015/>; African Technology Foundation, <http://www.thea25n.com/>; College of Information and Communication Technologies (CoICT), <http://www.coict.udsm.ac.tz/>; Buni Diva; and Help to Help.



The background is a solid black field. In the upper left, a large, bold white number '7' is partially visible. The lower half of the image is filled with numerous thin, curved, blue-white light streaks that sweep across the frame from left to right, creating a sense of motion and energy.

7

Targeted Approach for Device Affordability

Affordability remains one of the main challenges in addressing the global digital divide. Respondents to national surveys typically report the high cost of internet access (for example, mobile data plans) as one of the main barriers to getting online.⁴⁵ In Africa, on average, 1 GB of mobile data costs eight percent of monthly income, well above the “1 for 2” affordability threshold, where 1 GB of mobile data should cost no more than two percent of the average income.⁴⁶

The relatively high costs of getting online also include the costs of purchasing a mobile device. As highlighted before, mobile is the most common form of broadband connectivity in Africa. In 2018, the median cost of an entry-level internet-enabled device in Africa was 40 percent of monthly income,⁴⁷ and the mean average was 62 percent of monthly income. For the poorest 20 percent of the population, the average cost of a device in Sub-Saharan Africa was 375 percent of monthly income in 2018. Furthermore, the affordability of devices has not significantly improved in most African countries between 2016 and 2018.⁴⁸ Thus, although there is justifiably a significant focus on the relatively high cost of mobile data plans, device costs are equally important. This chapter explores the extent to which device costs are part of the affordability challenge, how device costs can be reduced through innovative business

models and policy initiatives, and how interventions that lower costs can be balanced with maintaining equity in the user experience.

Affordability of Devices

Device affordability across the world mirrors mobile broadband affordability, where those in higher income countries are better off on average. The region that faces the greatest challenge in terms of the affordability of an entry-level mobile device (that is, the cheapest device available that supports at least basic internet applications such as browsing and social media) is Sub-Saharan Africa (see figure 7.1). The combination of expensive entry-level mobile data plans and entry-level devices keep the majority of people in the region offline. For example, in an A4AI analysis using mobile broadband prices from 60 low- and middle-income countries, when the price of a hypothetical, low-cost smartphone (\$48) was added to that of a 500 MB broadband plan, in almost all countries the number of people that could afford both a broadband plan and a low-cost smartphone fell on average by 20 percent.⁴⁹

An additional concern is the mobile gender gap (that is, the extent to which a woman is less likely to use the mobile

45. World Wide Web Foundation. 2015. *Women's Rights Online: Access into Empowerment*. Washington, DC: World Wide Web Foundation. <https://webfoundation.org/research/womens-rights-online-2015/>; After Access. 2018. “The Inside internet Story of Africa, Asia, and Latin America,” <http://afteraccess.net/wp-content/uploads/After-Access-Website-layout-r1.pdf> ; <https://webfoundation.org/research/womens-rights-online-2015/> ; <https://webfoundation.org/research/womens-rights-online-2015/>

46. A4AI. 2019. “New Mobile Broadband Pricing Data Shows Uneven Progress on Affordability,” 20 March, <https://a4ai.org/new-mobile-broadband-pricing-data-reveals-stalling-progress-on-affordability/>

47. GSMA Intelligence analysis of pricing data provided by Tarifica. GDP per capita data is sourced from the IMF.

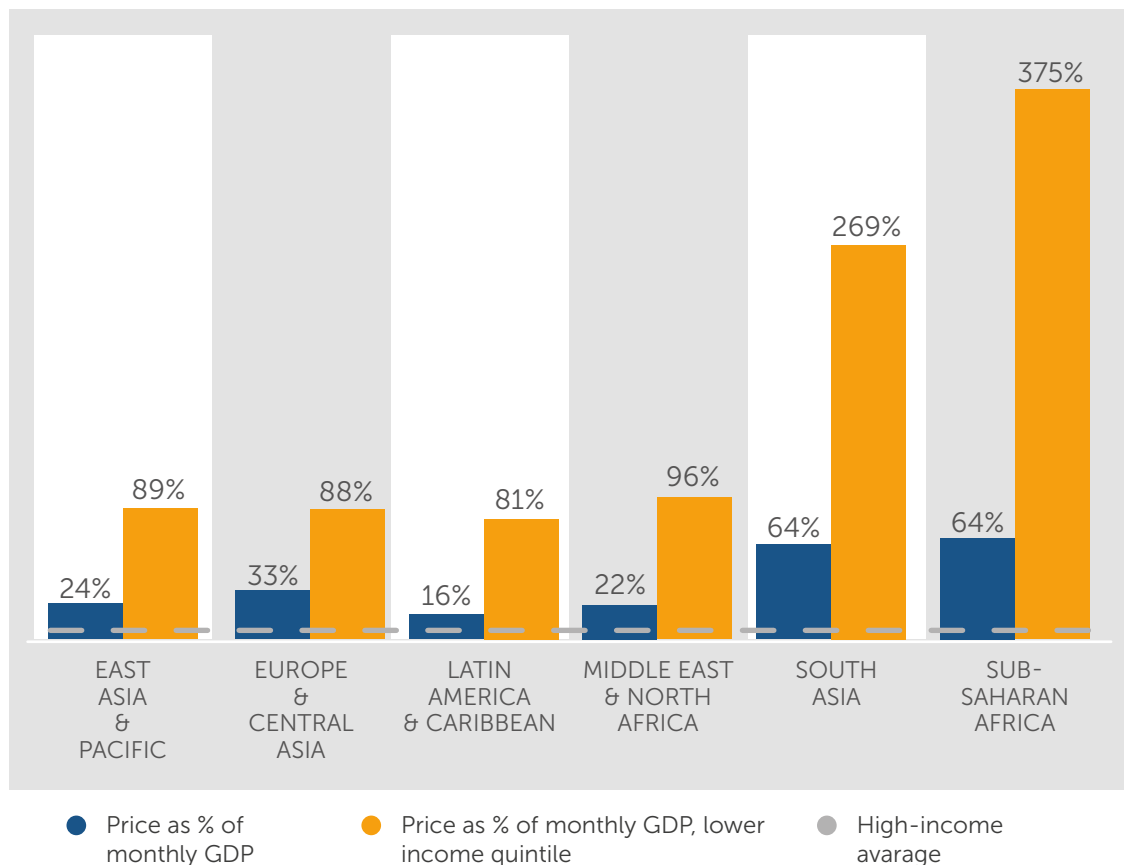
48. GSMA. 2019. *The State of Mobile Internet Connectivity*.

49. A4AI. 2015-16 Affordability Report. <https://a4ai.org/affordability-report/report/2015/>. A4AI, 2015-16 Affordability Report.

internet compared to a man). In Sub-Saharan Africa, this gap is estimated to be 41 percent – only South Asia as a region has a higher gender gap in mobile internet use.⁵⁰ In Africa, affordability is the highest barrier to mobile ownership.⁵¹ Note that the gender gap has also evolved over time as it is typically

higher when overall penetration rates are low.⁵² However, as more expensive smartphones enter the market, we may continue to observe a persisting gender gap in mobile phone ownership and mobile internet use, driven in part by the underlying gender wage gap in almost all countries.⁵³

Figure 7.1. **Affordability of Entry-Level Device in Low- and Middle-Income Countries by Region**



Source: GSMA. 2019. *Connected Society. The State of Mobile Internet Connectivity*.

Note: Score based on normalized price of an entry level internet enabled mobile device (higher score means more affordable devices).

50. GSMA. 2019. *Connected Women: The Mobile Gender Gap Report 2019*. London: GSMA. <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/03/GSMA-Connected-Women-The-Mobile-Gender-Gap-Report-2019.pdf>

51. GSMA. 2019. *Connected Women: The Mobile Gender Gap Report 2019*. London: GSMA. <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/03/GSMA-Connected-Women-The-Mobile-Gender-Gap-Report-2019.pdf>

52. Gillwald, Alison, and Onkokame Mothobi. 2019. *After Access 2018: A Demand-Side View of Mobile Internet From 10 African Countries*. Cape Town: Research ICT Africa. https://researchictafrica.net/wp/wp-content/uploads/2019/05/2019_After-Access_Africa-Comparative-report.pdf

53. WEF. 2018. *The Global Gender Gap 2018*. Geneva: World Economic Forum. <https://www.weforum.org/reports/the-global-gender-gap-report-2018>

The challenge for any major initiative that seeks to double broadband access in a short timeframe, particularly one that relies on mobile internet use as is the case in Sub-Saharan Africa, must also consider ways to improve device affordability. The following section reviews several existing initiatives that aim to achieve this.

New Business Models to Lower Device Costs

While smartphones remain expensive, feature phones or dumbphones (that is, mobile devices that primarily provide voice and SMS services but with only limited features of a smartphone such as smaller displays, less processing power, and often only General Packet Radio Service (GPRS)/Enhanced Data rates for GSM Evolution (EDGE) connectivity) are much more affordable. When considering prices of entry-level internet-enabled handsets in U.S. dollars, the median price in low- and middle-income countries since 2016 has been just over \$45; in Africa, it has been slightly less at \$35-40.⁵⁴ Indeed, sales of these devices are growing globally and are driven by the demand for more affordable devices.⁵⁵ The challenge, of course, is that feature phones by definition do not support the same broadband connectivity experience as a smartphone.

To address both the affordability challenge and the need for a better user experience, some device manufacturers and their partners have developed smart-feature phones. These devices have a

similar form and look to a feature phone but include hardware and operating systems that can support broadband internet access and use similar to smartphones. Crucially they are much cheaper than smartphones, and their manufacturers argue that they can provide an important bridge to the future adoption of smartphones and internet services.

One of the potential limitations of a smart-feature phone is that the globally and nationally dominant Android operating system (OS) is designed for, and works best on, a smartphone. Thus, Android's dominant operating system means there are few viable alternatives for smart-feature phones. In 2015 Mozilla and Orange partnered to offer a \$40 phone⁵⁶ (with included data and voice minutes) running on Firefox OS in 11 African countries, but this venture only lasted a year as it faced several challenges including difficulty in competing with Android.

Some companies working on producing low-cost devices (including smart-feature phones) include UNISOC (part of Tsinghua Unigroup), Huawei, SICO from Egypt, and KaiOS (see box 7.1).⁵⁷ Interviews in May 2019 with representatives from such firms noted that the key price point for a mobile device that will be affordable for those currently offline is about \$15-20. However, this implies a low profit margin for the manufacturer. Strong partnerships between the device manufacturer and mobile network operator are therefore needed to ensure viability, such as KaiOS' current engagement with MTN in Nigeria.

54. GSMA. 2019. *The State of Mobile Internet Connectivity*. This price range is consistent with previous research; see, for example, GSMA. 2017. Accelerating affordable smartphone ownership in emerging markets.

55. Counterpoint. 2019. "SmartFeature Phone A \$28 Billion Opportunity in Next Three Years." 18 February. <https://www.counterpointresearch.com/smart-feature-phone-28-billion-opportunity-next-three-years/>

56. Shankland, Stephen. 2015. "Firefox OS comes to Africa with Orange's \$40 package deal." 1 March. <https://www.cnet.com/news/firefox-os-comes-to-africa-with-oranges-40-package-deal/>

57. See <https://economictimes.indiatimes.com/industry/telecom/telecom-news/working-with-indian-telcos-to-bring-more-affordable-phones-unisoc/articleshow/64663860.cms>; <https://uk.reuters.com/article/us-egypt-economy-sico/egypts-first-smartphone-maker-sees-market-share-rising-by-2020-idUKKBN1JS20E>

Box 7.1. KaiOS: Affordable Smart-Feature Phones

A new low-cost phone was introduced in India in 2017: the Jio Phone, which costs about \$23 to produce compared to the typical entry-level smartphone at the time, which cost almost twice as much to produce at \$55. The Jio Phone was based on a novel and alternative OS to Android that is optimized for smart-feature phones: KaiOS.

KaiOS enabled mobile operator Jio to offer content and other over-the-top services through its native app store and on its 4G network. Such services were key in bolstering the business case for a smart-feature phone. While the typical quarterly average revenue per user (ARPU) for 2G feature phones was \$0.45, the quarterly ARPU for Jio Phone users was \$2. To maximize the opportunity for data services, Jio subsidized the cost of the device on its launch and priced it at \$20. Thus, Jio's business model was to overcome the device affordability challenges through a more affordable 4G alternative to smartphones, with a focus on mobile data services to consumers. More recently, KaiOS partnered with MTN Group and Orange to offer similar \$20 phones in Nigeria, Rwanda, and other places in Africa.

One concern, however, is the potential for vertical integration by a dominant mobile network operator which could potentially offer exclusive content services on its network only. In the case of India, Jio controls almost 50 percent of the mobile broadband market in India.

Source: Counterpoint; Shira Ovide. 2019. "The Next Big Phones Could Bring a Billion People Online." 7 June. <https://www.bloomberg.com/news/features/2019-06-07/the-next-big-phones-could-bring-a-billion-people-online>; A4AI. 2016. *The Impacts of Emerging Mobile Data Services in Developing Countries*. https://1e8q3q16vyc81g8l3h3md6q5f5e-wpengine.netdna-ssl.com/wp-content/uploads/2016/11/MeasuringImpactsOfMobileDataServices_ResearchBrief3.pdf; GSMA Intelligence, Q1 2019 data, <https://www.gsmaintelligence.com/data/>

Another way of addressing the affordability barrier for devices is the availability of payment plans. While in the majority of high-income post-paid markets consumers have the opportunity to purchase a device in monthly instalments, this option is often not available to potential mobile internet users in Africa, meaning that they face a significant one-off purchase.

The availability of transparent, easy to understand, and low-credit payment plans could therefore represent a significant opportunity to enable the unconnected to acquire an internet-enabled device. There are an increasing number of examples of such offers, including Safaricom's Maisha Ni Digital Campaign in Kenya.⁵⁸

58. See <http://biasharaleo.co.ke/index.php/2019/04/23/third-edition-of-safaricom-s-maisha-ni-digital-campaign-launched/>

Public Policy Impacts on Mobile Device Costs

The high cost of devices as a barrier to internet use is also recognized by governments. However, there are few, if any, examples of government programs that focus on subsidizing mobile devices on the continent. That said, we can still draw on experiences elsewhere. For example, in 2016 Colombia launched the Internet Móvil Social para la Gente⁵⁹ program to increase ICT access and use in the country, particularly among low-income communities. This program was part of an overall package of welfare services targeted at people with low incomes. In addition to offering reduced prices for mobile data, eligible participants could also purchase a smartphone at a subsidized price. This approach can also be applied to other devices including computers and laptops, as is the case in Costa Rica.⁶⁰

In these examples, the resources to support these programs came from universal service and access funds (USAFs); in most countries, however, these funds are typically underutilized. More efficient and targeted use of these USAFs could, therefore, help improve device affordability, especially among those least likely to use the internet. In the case of Africa this would include women. Unfortunately, a recent study showed that USAFs on the continent dispersed funds inefficiently (indeed

almost \$400 million was estimated to be unspent), lacked transparency, and also had little if any focus on women.⁶¹ One of the challenges of any targeted approach using public funds (including those that focus on women) is its political feasibility. Where this is a concern, government can instead target broader groups such as rural farmers who are also more likely to be women.

In addition to implementing targeted approaches, governments should also assess existing policies, particularly with regard to taxation. In many African countries, devices are subject to value added tax (VAT) as well as luxury taxes, customs duties, or excise taxes on the value of the device.⁶² The combined effect of such taxes can be significant in terms of the impact on economic productivity and achieving universal access. One study on the ICT taxation regime in Mozambique found that reducing custom duties on mobile devices (as well as other devices and equipment) could increase GDP by about \$443 million over four years.⁶³ This economic growth would result from the expected increased uptake in mobile phone and ICT use. While there are few examples of governments rolling back taxation, one change from Kenya is instructive. In 2009, the government of Kenya decided to remove the imposition of VAT on mobile handsets, which was correlated with an estimated increase in the mobile penetration rate from 50 percent to 70 percent.⁶⁴

59. Colombia Ministry of Information Technology and Communications. 2018. "Internet móvil para los colombianos más necesitados," 1 September. <https://www.mintic.gov.co/portal/604/w3-article-16860.html>

60. Sutel. 2016. Rendición de cuentas y transparencia. https://sutel.go.cr/sites/default/files/informes_fonatel/fonatel_informe_anual_de_transparencia_y_rendicion_de_cuentas_fonatel_2016.pdf

61. A4AI. 2018. 2018 Affordability Report. <https://a4ai.org/affordability-report/report/2018/>

62. GSMA. 2019. Rethinking Mobile Taxation to Improve Connectivity. London: GSMA. <https://www.gsmaintelligence.com/research/?file=8f36cd1c58c0d619d9f165261a57f4a98download>

63. A4AI. 2015. Driving Economic Growth in Mozambique: Recommendation for Strategic Taxation for Telecommunications. <https://1e8q3q16vyc81g8l3h3md6q5f5e-wpengine.netdna-ssl.com/wp-content/uploads/2015/07/A4AI-Mozambique-Rationale-for-Customs-Duty-Reduction-Full-Analysis-English-FINAL.pdf>

64. Deloitte and GSMA. 2011. Mobile Telephony and Taxation in Kenya. <https://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/mobiletelephoneandtaxationinkenya.pdf>

Policy Recommendations: Supporting Public and Private Initiatives to Lower Device Costs

Any policy strategy that seeks to double broadband penetration in Africa must appreciate the important role of device costs in meeting these goals. The following should be part of such a strategy:

Increase device affordability and adoption through targeted public policies:

- Research can point to regions and populations less likely to use the mobile internet. In the case of Africa, this will more likely include women relative to other regions in the world, as noted above. Broadband policies, including those aimed at improving device affordability, should be gender responsive and address the unique barriers to internet access and use faced by women.⁶⁵
- One approach can be to better use existing USAFs to subsidize device costs for underserved groups such as women as part of initiatives aimed at improving last-mile access solutions. This can be done in partnership with mobile network operators and other ISPs, including community networks.
- Given the potentially significant impacts that disproportionate taxation on devices can have on affordability, it is important that governments work to identify and implement a balanced taxation regime for ICTs, and devices in particular – one that does not

emphasize short-term revenues at the expense of medium- to long-term economic impacts through increased penetration of broadband. Adoption of the ITA is critical to achieve this.⁶⁶

- Daily, weekly, or monthly installment plans, can significantly improve the affordability of mobile broadband capable devices. This can be accomplished through targeted interventions to catalyze financing capital, promote financial inclusion, and remove restrictions on technologies that promote handset financing such as SIM locking, mobile device management, and mobile money.

Support business models offering low-cost devices on the market:

- One threshold to establish from the outset is the minimum key features of devices that will enable people to use the internet meaningfully. This can include minimum requirements on mobile technology (for example, 3G or 4G), ability to use basic internet applications, and so on. Establishing this minimum will give governments, device manufacturers, and mobile network operators a clear guide on what kinds of devices can help meet the government's access goals.
- Governments can provide a range of incentives to support the provision of such devices including exempting specified devices (those meeting the government's minimum features) from duties, and excise and other taxes. Other options include prioritizing support through government investment agencies for ventures (between local and foreign firms or PPPs) that seek to offer low-cost devices to the market.

65. A4AI and World Wide Web Foundation. 2018. *React with Gender Responsive ICT Policy: The Key to Connecting the Next 4 Billion*. <https://webfoundation.org/research/react-with-gender-responsive-ict-policy/>

66. 20 years of the Information and Technology Agreement. Boosting trade, innovation and digital connectivity. https://www.wto.org/english/res_e/publications_e/ita20years2017_e.htm

- It will also be important to consider the competitive effects of low-cost devices such as smart-feature phones on the market. This should be done both in terms of potential vertical integration by a dominant operator offering exclusive content and also within the open source (OS) space (including the app store). In the case of the latter, as Android does not operate in the smart-feature phone space, the emergence of a dominant OS could ultimately lead to similar monopoly-related issues that Android has created for smartphones.
- Support policies that promote local innovation and research and development for internet-enabled devices such as handsets. The long-term impact of such policies and programs could be greater focus on African products while reducing Africa's dependency on external innovation. A recent example of a smartphone produced in Africa is the Maraphone,⁶⁷ which although not yet affordable (the cheapest smartphone is currently advertised at \$125) points to the potential for locally produced devices.

Engage with the private sector and other partners to lower manufacturing costs for devices:

- The private sector, government, and academia should also examine the challenges posed by, and effects of, royalty stacking in the smartphone industry.⁶⁸ Observers suggest that up to 31 percent of the cost of a \$400 smartphone can be attributed to patent royalties.⁶⁹ Indeed, in some cases, the cost associated with patent royalties for a smartphone represents more than the cost of the phone's physical components. This matter requires closer examination so that the royalty payments would not discourage potential new market entrants to invest, innovate, and compete in the smartphone industry. This is particularly relevant for low-cost devices which, as noted above, have much smaller profit margins for manufacturers and their partners.

67. See <https://maraphones.com/>

68. A4AI. 2015-16 Affordability Report. <https://a4ai.org/affordability-report/report/2015/>

69. Armstrong, Ann, Joseph J. Mueller, and Timothy D. Syrett. 2014. *The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Modern Smartphones*. 29 May. Boston: WilmerHale. <https://www.wilmerhale.com/en/insights/publications/the-smartphone-royalty-stack>



8

**Roadmap and
Action Plan
to Achieve
Universal,
Affordable,
and Good
Quality
Broadband
Across Africa**

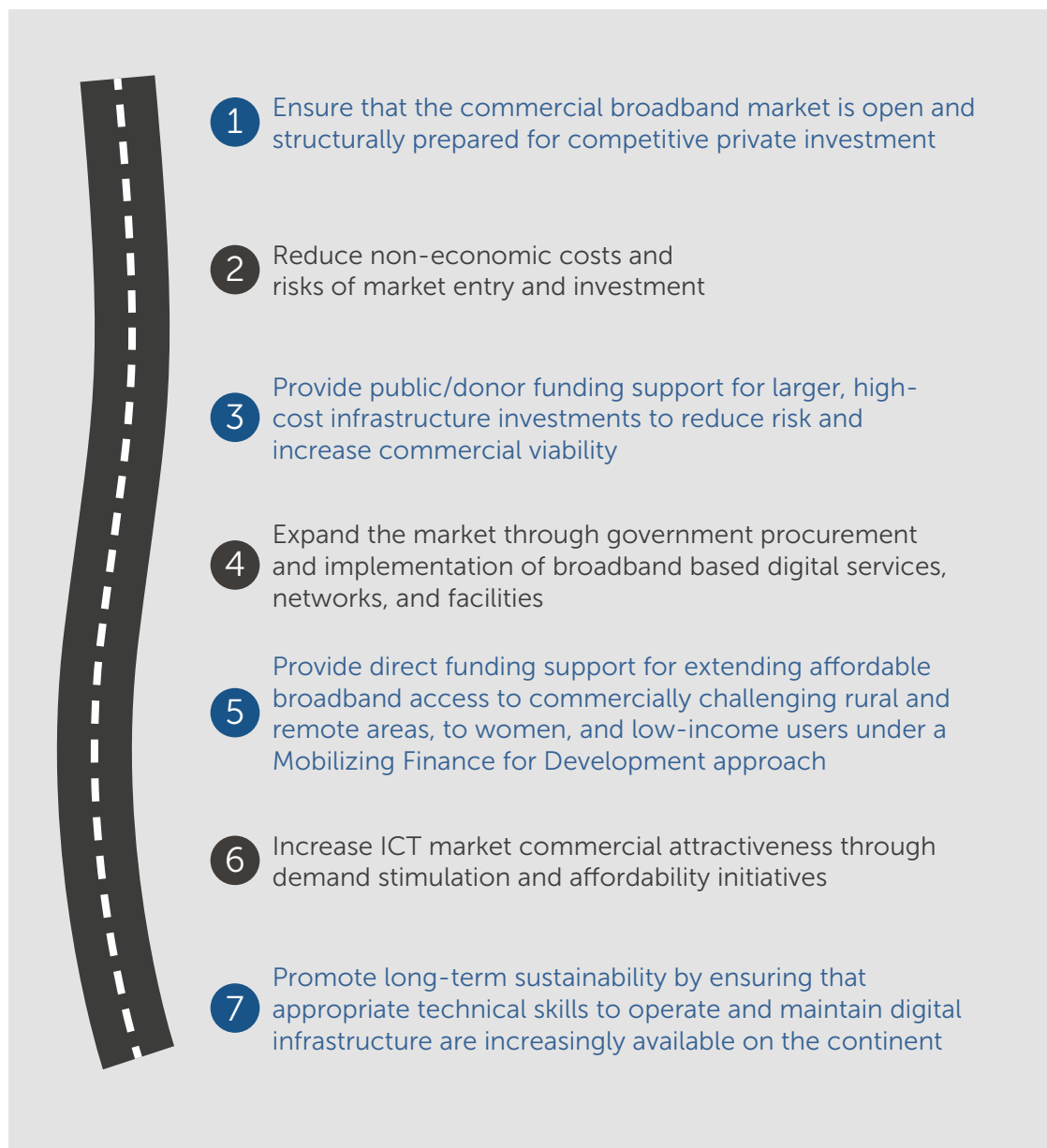
The strategy and requirements to achieve broad digital infrastructure growth in any country will vary depending upon a wide range of market conditions and other factors. In general, each country is likely to already be on a path toward universal broadband access with some key milestones already accomplished and others still to be reached. At a high level, the main features of the broadband development roadmap⁷⁰ by 2030 (see figure 8.1), for any country or market, include the following sequence of key objectives⁷¹ and are fully aligned with the principles presented in chapter 3 of this report.

- Ensure that the commercial broadband market is open and structurally prepared for competitive private investment.
- Reduce noneconomic costs and risks of market entry and investment.
- Provide public/donor funding support for larger, high-cost infrastructure investments to reduce risk and increase commercial viability.
- Expand the market through government procurement and implementation of broadband-based digital services, networks, and facilities.
- Provide direct funding support for extending affordable broadband access to commercially challenging rural and remote areas, to women, and low-income users under a Mobilizing Finance for Development approach
- Increase ICT market commercial attractiveness through demand stimulation and affordability initiatives.
- Promote long-term sustainability by ensuring that appropriate technical skills to operate and maintain digital infrastructure are increasingly available on the continent.

70. Note that this Roadmap and Action Plan exist within the framework of the DE4A Initiative and form an integral part of this larger effort.

71. These are aligned with those suggested, for example, in Gelvanovska, Natalija, Michel Rogy, and Carlo Maria Rossotto. 2014. *Broadband Networks in the Middle East and North Africa: Accelerating High-Speed Internet Access. Directions in Development*. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/16680>

Figure 8.1. **Roadmap for Universal Access to Affordable and Good Quality Broadband**



In establishing its own policy, funding, and project priorities, each government (and funding partner) should review the extent to which it has addressed each of these elements, and what next steps need to be followed to achieve the relevant objectives.

The discussion below highlights key aspects of each objective and identifies both immediate/short-term actions and medium- to longer-term actions that countries should review and consider undertaking or enhancing to maximize

broadband ICT sector growth potential. It also identifies key responsible parties for each objective.

The list of responsible parties is not exhaustive, but rather indicative of the key stakeholders who would take a certain level of ownership and responsibility toward the objectives. The efforts will require multistakeholder engagement to develop, implement, and operationalize a roadmap of strategies and translate policy commitment into effective action.

Objective 1: Ensure that the commercial broadband ICT market is open and structurally prepared for competitive private investment

The most effective and desirable source of investments in digital broadband networks infrastructure will come from private investors acting on business opportunities in a country's ICT market. To attract such investors under a Mobilizing Finance for Development approach, the policy framework must enable and encourage competitive market entry, by minimizing institutional and regulatory barriers, and ensuring that opportunities to build successful, competitive network operations are equitable and transparent at all levels of the value chain and both at the retail and wholesale level. Effective policies and enforcement minimizing risks of cybercrime and data insecurity should also be in place (sometimes referred to as second generation ICT laws).

Immediate/Short-Term Actions:

- Adopt open wholesale and retail telecommunications market entry policies, especially competitive and unified licensing regimes, and liberal, dynamic spectrum policies. Such policies should also accommodate community and nonprofit focused network operators who offer services in underserved areas.
- Support infrastructure sharing and initiatives for major active and passive broadband network components, to permit more cost-effective and commercially viable investments.
- Streamline licensing procedures, requirements.

Medium/Long-Term Actions:

- Adopt uniform, cost-oriented network interconnection charges and rules.
- Adopt procompetition regulatory practices, which ensure equitable treatment of all market participants regardless of physical location and enforce restrictions on anticompetitive behavior, especially by dominant service providers.
- Develop a harmonized legal, policy and regulatory framework for cybersecurity, data protection and privacy that is aligned with regional and international conventions including action plans and projected budgets. Support the African Union's efforts for the ratification of the "Malabo Convention" on cybersecurity and data protection through regional initiatives in collaboration with existing regional organizations and operational bodies to enable member states to share information, experiences and resources.
- Establish reasonable licensing and spectrum fees.

Responsible Parties:

- Governments, including policy makers, sector regulators, data protection authorities, cybersecurity authorities.
- African regional economic communities (REC) and African Union (AU) Commission.
- Partners investing in policy and regulatory reform, such as the multilateral development banks (MDBs).

Box 8.1. Facebook's Shared Backhaul Projects

A lack of reliable backhaul infrastructure can frustrate efforts to provide broadband services in Africa. Backhaul investments can allow mobile operators to expand capacity, reduce network costs, and improve performance. Facebook's Shared Backhaul projects provide connectivity between towers, points of presence (POPs), and core switches and enable multiple service providers to benefit from the resulting infrastructure driving down the cost of bandwidth for each provider. For example:

- Facebook worked with Airtel Uganda and BSC to complete a 770 kilometer fiber network in northwest Uganda, which will help make mobile broadband available to more than three million people.
- In South Africa, VAST and Facebook connected the underserved communities of Diepsloot and Katlehong to Wi-Fi hotspots backhauled by 100 kilometers of fiber.
- In Nigeria, Facebook and MainOne built 900 kilometers of fiber across the metropolitan areas of Abeokuta, Ogun and Benin City, Edo; and additional backhaul through rural Ogun.

Source: <https://connectivity.fb.com/network-investments/>

Objective 2: Reduce noneconomic costs and risks of market entry and investment

The costs and risks facing prospective investors can be directly influenced by a range of noneconomic factors (that is, factors not fundamentally driven by the economic conditions of the market), which are typically within the control of governments. Actions which reduce such costs and risks can have a direct and significant impact on investors' perception of the attractiveness of the broadband ICT market and willingness to commit their own capital to expand infrastructure. Policies that ensure market competition should be implemented. In this regard, government intervention should be engineered to increase competition and promote the entrance of wholesale, open access service providers that can commercialize or operate new and

existing broadband infrastructure, and mandate the incumbent to make local access lines available to competitors at wholesale prices. Therefore, it is essential for the government to create an enabling environment for its businesses by embracing competition and preventing incumbent firms from acquiring monopoly power. Addressing these issues may involve political challenges, and may require tradeoffs between short-term government revenue and longer-term market growth benefits.

Immediate/Short-Term Actions:

- Ensure that license and spectrum fees for new entrants and existing telecommunications operators are reasonable; reduce fees where possible and avoid spectrum/license auctions that artificially drive up entry costs. Also, assess the feasibility of unlicensed spectrum use particular for innovative technologies that target underserved communities.

- Establish and enforce reasonable, low-cost access to rights-of-way, including streamlined and simplified procedures and regulations to avoid undue restrictions by local authorities.

Medium/Long-Term Actions:

- Review and reduce taxes and import tariffs on telecommunications equipment and services, especially unnecessarily high tariffs on essential (foreign-sourced) equipment needed to build and operate telecommunications network infrastructure.

Responsible Parties:

- Governments, including policy makers, sector regulators, local governments.
- Regulators, competition agencies
- Partners investing in policy and regulatory reform, such as the MDBs, development aid agencies.
- African regional economic communities (REC) and African Union (AU) Commission.
- Partners involved with, and affected by, the required policy reforms.

Objective 3: Provide public/donor blended funding support for larger, high-cost infrastructure investments to reduce risk and increase commercial viability

In general, the greatest challenge in attracting private market investment in ICT infrastructure involves the buildout of network components which require large, long-term capital commitments with uncertain payback horizons. These include

major backhaul networks, such as national and international fiber optic backbones, which represent an essential prerequisite for delivering broadband services. Similar forms of supporting infrastructure projects can also directly reduce costs and risks for investors who might otherwise have to finance such components. Once such basic infrastructure is in place, the costs to the market of constructing and operating related network components will be reduced, improving competitive entry opportunities at the level of local access and distribution, for example.

Immediate/Short-Term Actions:

- Develop PPP policies and frameworks to enable the implementation of major national and international backhaul networks (see box 8.1).
- Develop public/donor investment projects for key elements of supporting infrastructure: electrical power, roads, and so on. These might be included as part of telecommunications backhaul infrastructure PPP projects, or as standalone initiatives.

Medium/Long-Term Actions:

- Establish PPPs for other major digital components such as data warehouses and internet exchange points (IXPs) to reduce costs of major broadband service supply.

Responsible Parties:

- Governments, especially finance ministries, communications sector policy makers.
- Regulators, competition agencies
- African Regional Economic Communities (REC) and African Union (AU) Commission.
- Partners investing in PPP arrangements, such as the MDBs, private sector, development aid agencies.

Box 8.2. Reverse Subsidy Auctions as a Mechanism for Widening Rural Access

Under the Regional Communications Infrastructure Program (RCIP) in Tanzania, which closed in 2017, some 2.5 million people were provided with rural connectivity for the first time.^a Commercial mobile operators competed in a reverse subsidy auction (that is, the CapEx grant was awarded to the operator bidding for the lowest level of subsidy). In total, some \$30 million in International Development Association (IDA) funding leveraged around \$70 million in private sector investment with four companies taking part (that is, the average CapEx subsidy from IDA was 30 percent). It is proposed to develop a similar scheme in rural Niger, in cooperation with the local mobile operators, but with a focus on extending 3G/4G coverage rather than just 2G coverage that was the focus in Tanzania.

This methodology for promoting rural coverage has a number of advantages:

- It is private sector led, and maximizes finance for development;
- It is a transparent process in which subsidies are awarded to the operator requesting the lowest level of subsidy, which is presumably the most efficient because it has the lowest cost structure in a given area;
- Risks are shared between the public and private sectors, and funds from IDA can be used alongside national funds from the USAF;
- The methodology is sufficiently flexible to allow, for instance, mobile operators to compete for subsidy against specialized tower companies, or even to allow local communities to self-provide coverage.

In addition to the lessons learned from the IDA-funded RCIP project in rural Tanzania, GSMA, an industry association and a member of the World Bank-led Digital Development Partnership (DDP), conducted a trial project in a further six villages in rural Tanzania using national roaming that generated promising results. Under national roaming, the operator that installs the tower benefits from a year of exclusivity, but thereafter undertakes to offer connectivity to all other operators, without roaming charges, allowing them to compete for customers. Results suggest that the benefits this brings, for instance, for increased mobile money usage, means that the required level of CapEx subsidy is reduced.^b

Note: a. See RCIP-3 ICR, <http://documents.worldbank.org/curated/en/414221531333372143/pdf/ICR00004013-07062018.pdf>; b. See https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/02/GSMA_Tanzania_Jan.pdf

Objective 4: Expand the market through government procurement and implementation of broadband ICT-based e-services, networks, and facilities

Governments under an e-government approach can strongly promote the market for investment in ICT networks and services through their leading role as customers and users of these services, which can benefit citizens in both urban and rural areas in multiple ways. For instance, the Broadband Commission addressed the important question of digitalization through the launch of the Digitalization Scorecard report.⁷² Digitalization goes hand in hand with e-government implementations and the scorecard report looked at which policies and regulations can help advance digitalization across various sectors of the economy because of their high socioeconomic impact: agriculture, education, healthcare, government, and transportation.

Through public procurement of e-government networks, contracts, and services – which extend broadband connectivity to public buildings, schools, health facilities, and so on, beyond major city centers – these government purchases pay directly for much of the required infrastructure while providing anchor tenant revenue assurance to private telecommunications operators, which can utilize the same infrastructure to deliver affordable service to public customers.

Immediate/Short-Term Actions:

- Develop a national government ICT framework, with clear plans and projected budgets, in collaboration with government agencies and ICT industry providers, for design and implementation of e-government networks and services, to signal to the market that such demand will be forthcoming.
- Develop parallel plans to support the use of similar government services by population segments that are not yet online.
- Consider reverse subsidy auctions (see Box 8.2) to develop relevant digital services, networks and facilities for the private sector.

Medium/Long-Term Actions:

- Roll out coordinated e-government (including e-education, e-health, and so on) networks, facilities, and services through contracts with private operators.

Responsible Parties:

- Governments, especially finance ministries, communications sector policy makers.
- Partners investing in the sector, especially private sector and other supporting investors/funders.

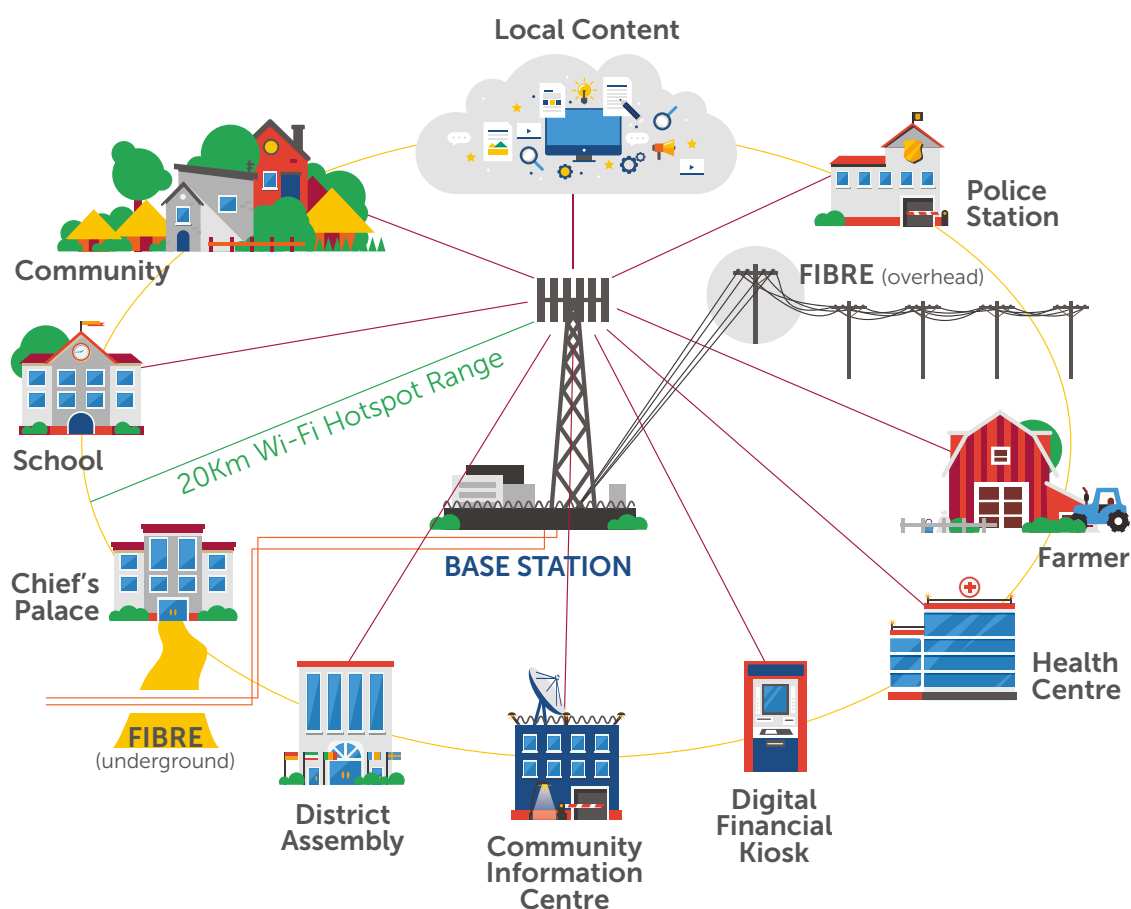
72. Broadband Commission for Sustainable Development. 2017. *Working Group on the Digitalization Scorecard: Which Policies and Regulations Can Help Advance Digitalization*. <https://broadbandcommission.org/Documents/publications/WG-Digitalization-Score-Card-Report2017.pdf>

Objective 5: Provide direct funding support for extending affordable broadband access to commercially challenging rural and remote areas, to women, and low-income users

It is likely that in most countries there will be significant geographic areas and population segments, perhaps 15-20 percent, for which market-

based broadband services will not be commercially viable on their own in the near or medium term. Ensuring that these regions and citizens are able to benefit from broadband ICTs is a critical component of overall sector development objectives. Universal service programs and funding should not be treated as a "last resort" for such groups, even where commercial growth might eventually emerge, as this would only consign them to long delays and exclusion from digital development opportunities. Proactive funding and support projects should be coordinated with other infrastructure initiatives to ensure that affordable access to broadband expands for the least advantaged citizens at the same time as the commercial market grows.

Figure 8.2. **Ghana Investment Fund for Electronic Communications - Smart Community Architecture**



Source: GIFEC. 2018. *Closing the Digital Gap Using Universal Service Funds – Key Lessons from Ghana.*



Immediate/Short-Term Actions:

- Establish and/or support universal service and access fund (USAF) mechanisms based on innovative operating models and technology solutions, to channel funding resources toward noneconomic areas and programs, including regulatory framework, industry contributions, and implementation procedures.

Medium/Long-Term Actions:

- Employ USAF funds and procedures or pay and play mechanisms to support construction and operation of rural broadband distribution and access networks that are based on supporting communities with a multitude of services (see figure 8.2 for the example of Ghana's GIFEC Smart Community Architecture).
- Develop, fund, and implement public ICT access facilities and programs, including telecenters and public Wi-Fi, in both rural and urban areas, to offer low-cost public service for those least able to afford commercial broadband (see box 8.3 and box 8.4 for examples of this type of action in practice).

- Thoroughly monitor and evaluate the impact of USAF funds against set objectives.
- Pay increased attention to urban centers because of the high rural-urban migration rate in Africa. Providing reliable connectivity to cities will contribute to making them smarter, safer, and more sustainable (see box 8.5 for the Smart City Playbook report).

Responsible Parties:

- Governments, especially policy makers, sector regulators, USAF.
- Partners investing in policy and regulatory reform, such as MDBs, development aid agencies, and others supporting USAF to become effective mechanisms for investment in rural and remote areas.
- Private sector, including satellite operators and small, medium and/or alternative providers, such as community networks, rural operators, among others.

Box 8.3. Huawei: Innovative Infrastructure Solution to Expand Access to Rural Areas

Huawei's RuralStar solution enables rural networks to provide cost-effective mobile broadband services as well as traditional voice services in remote areas. Specifically, the solution provides lightweight coverage for 2G voice, SMS, and mobile money services, and 3G broadband data services. In over eight countries, including in Kenya, Ghana, and Nigeria, Huawei has partnered with local operators to roll out RuralStar networks to expand mobile internet access.

In Ghana, in partnership with MTN Ghana, the **RuralStar solution was deployed in over 300 sites** to expand rural mobile internet coverage. RuralStar proved to be cost-effective (with less need for upfront investment and expenditure on electricity networks) and increased return on investment in low-density population areas, and expanded network coverage in rural and remote areas where it was deemed unprofitable. Similarly, in Kenya, Huawei has partnered with Safaricom to bring RuralStar to a rural town in Kenya, and their endeavor has **produced notable impacts**, such as improved healthcare, increased access to finance, better security, and improved education.

Source: <https://www.gsma.com/futurenetworks/wiki/ruralstar-huawei-safaricom-case-study/>; https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/02/Huawei_RuralStar_MTN_Ghana_Rural_Innovation_Connectivity_Case_Study_Nov18.pdf

Box 8.4. Microsoft's Airband Initiative

Microsoft's Airband Initiative partners with equipment makers, and local internet and energy access providers to deploy technologies and business models that help more people affordably get online. These projects align with national level strategies and provide not only internet access, but digital skills training, telemedicine services and small business empowerment. In Africa, the Airband Initiative has led two notable projects:

- **Mawingu (Kenya):** Mawingu Networks is providing affordable internet in rural Kenya, by using low-cost wireless technologies, and solar power. Utilizing technologies such as Wi-Fi and various fixed microwave technologies, Mawingu is delivering internet access for as little as \$4 per month and has a five-year projected population coverage of 3.6 million people.
- **Brightwave (South Africa):** In partnership with the Universal Service and Access Agency of South Africa (USAASA), Brightwave is providing broadband to over 600 schools and clinics in the rural Eastern Cape municipalities of King Sabata Dalindyebo and Mhlontlo Local. Using a hybrid network solution, combining fiber and various fixed microwave technologies, Brightwave is extending its network to connect previously unserved rural areas and covers over 200,000 people, with eventual coverage projected to be over 400,000.

Source: <https://www.microsoft.com/en-us/airband>; <https://news.microsoft.com/features/empowering-kenya-and-the-world-with-high-speed-low-cost-internet/>; http://download.microsoft.com/download/6/C/9/6C955541-5053-4A1C-BF0E-22F3BA34CE0F/Microsoft_Airband_Brightwave_Casestudy.pdf

Box 8.5. Nokia's Smart City Playbook

The Smart City Playbook, a strategy report that documents best practice for smart cities, provides concrete guidance to city leaders on successful strategies used by other municipalities to make their cities smarter, safer, and more sustainable. Commissioned by Nokia and developed by Machina Research, the playbook was developed through primary research into the strategies and progress of 22 cities around the world.

While the study found significant differences between cities, even amongst those following the same route, it also concluded that there are several particular practices used by successful smart cities that would appear to be of universal benefit, including:

- Successful cities have established open and transparent rules for the use of data (on which all smart cities are dependent) by government departments and third parties, whether shared freely or monetized to cover data management costs.
- Many cities that are advanced in their smart city journeys have committed to making both ICT and IoT infrastructure accessible to users both inside and outside of government, and have avoided the creation of silos between government departments.
- Governments (and their third-party partners) that have worked to actively engage residents in smart city initiatives have been particularly effective, most notably those where the benefits are highly visible such as smart lighting and smart parking.
- Smart city infrastructure needs to be scalable and sharable, so it can grow and evolve to meet future needs.

Source: Machina Research Strategy Report. *The Smart City Playbook: Smart, Safe, Sustainable*.
<https://pages.nokia.com/T003V0-what-are-cities-doing-to-be-smart.html>

Objective 6: Increase ICT market commercial attractiveness through demand stimulation and affordability initiatives

Market growth and affordable access will also be enhanced by programs and

policies which address demand-side constraints, as discussed in previous sections. Such programs on affordable devices, digital skills development, and relevant content and applications will help stimulate demand across all user groups, improving the commercial viability of private infrastructure investments. In this regard, public-private partnerships in support of building digital skills and offering affordable digital devices can be considered to stimulate demand-side factors.



Immediate/Short-Term Actions:

- Adopt frameworks, plans, targets for demand stimulation programs, with special attention on women and girls, the poor, marginalized, and rural populations.
- Commence digital skills and content initiatives, to increase attractiveness and value of broadband access, and hence willingness to pay.

Medium/Long-Term Actions:

- Establish affordable digital devices programs through subsidies, payment plans, and device financing to improve affordability for all, especially for low-income users.
- Promote innovative business models and new technologies (see box 8.6 and box 8.7).

Responsible Parties:

- Governments, especially ministries of education, science and technology, labor, gender, and youth.
- Partners investing in digital skills and content development, such as the MDBs, development aid agencies, private sector, public and academic institutions.
- Private sector, including satellite operators, device manufacturers, and small, medium and/or alternative providers, such as community networks, rural operators, among others.

Box 8.6. Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps

A study by the World Bank shows how new technologies and business models can help developing countries expand high-speed internet access. By reviewing 70 internet-related infrastructure projects and innovative last-mile solutions from across the world, spanning all segments of the broadband value-chain, the report examines creative approaches to closing the global digital divide and ensuring everyone can reap the social and economic benefits of digital development – including poor or isolated communities where traditional strategies may not be economically viable. These case studies provide a framework to analyze their applicability based on key attributes, and measures that contribute to their relative success. With wireless technology leading the way in connecting individuals, the report also analyzes key trends related to spectrum policy and planning.

Meanwhile, the report finds that most successful broadband initiatives have been driven by the private sector. Public agencies play a crucial role by implementing effective sector regulation, addressing potential market failures, and creating the conditions for an open, competitive broadband sector. Increased competition for broadband services, including where appropriate the infrastructure itself, has led to significant improvements in the coverage and affordability of high-speed internet. Recent technological progress and innovations highlighted in the report include, among others, broadband deployment using low-cost satellites, small cell solutions, as well as drones, balloons, and other nonpermanent structures.

Source: Gallegos, Doyle, Junko Narimatsu, Oana Ariana Batori, Janet Hernandez, Daniel Leza, Ivan Skenderoski, and Erik Whitlock. 2018. Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps. Washington, DC: World Bank Group. <http://documents.worldbank.org/curated/en/674601544534500678/Innovative-Business-Models-for-Expanding-Fiber-Optic-Networks-and-Closing-the-Access-Gaps>

Box 8.7. Intelsat's Partnership with UNHCR to Bring Internet Access to Refugees

Globally there are nearly 25.4 million refugees, over half of whom are under the age of 18. At the end of 2016, Africa hosted 5,531,693 refugees. The lack of digital connectivity increases the vulnerability of people who were forced to flee by depriving them of opportunities for communication, information, education, financial transactions, self/community/social development, and work. This makes it difficult for refugees to restore independence, to rebuild productive lives as well as to maintain family links and other social relations. Access to the internet is one of the tools which provide equal opportunities for development, empowerment, and protection.

AMPAIN CAMP, GHANA

In 2016, the United Nations High Commissioner for Refugees (UNHCR) and Intelsat jointly developed an internet access pilot program for the Ampain refugee camp in Ghana. The ICT center at Ampain provides refugees with computers to access online courses. To date, 280 online courses were completed by 220 camp inhabitants. The service is now being packaged as a low-maintenance, solar-powered, satellite-connected Wi-Fi service which provides quality internet access to refugee camps in remote locations.

THE SOLUTION

Using Intelsat's Ku-band service, the program delivers quality internet access using small dish antennas (± 1 -meter diameter), which are light and easy to install. The Wi-Fi service provides coverage and internet access for users in and around the ICT center in Ampain refugee camp, and are also expanded to cover larger areas of the camp. Where the electricity supply is insufficient or absent, a solar power platform is installed to provide power to the satellite and Wi-Fi equipment.

Objective 7: Promote long-term sustainability by ensuring that appropriate technical skills to operate and maintain digital infrastructure are increasingly available on the continent

For digital infrastructure, services, and related industry operations to become truly sustainable in the medium- to long-term, it is vital that African labor

markets develop – and retain – growing pools of skilled technical workers. Often, outside investors will bring in their own (foreign) labor force to build out networks and infrastructure, and even to manage and operate services, without always transferring these skills and responsibilities to the domestic population. Such practices risk inhibiting the viability and growth of the digital ecosystem, shutting out many potential avenues of high-paying, high-skilled employment, and/or creating undue dependence on foreign labor. Policies which encourage, and even mandate, the training and employment of technical workers from within the host country can provide strong assurances of sustainable growth and transformation toward a robust digital economy.

Immediate/Short-Term Actions:

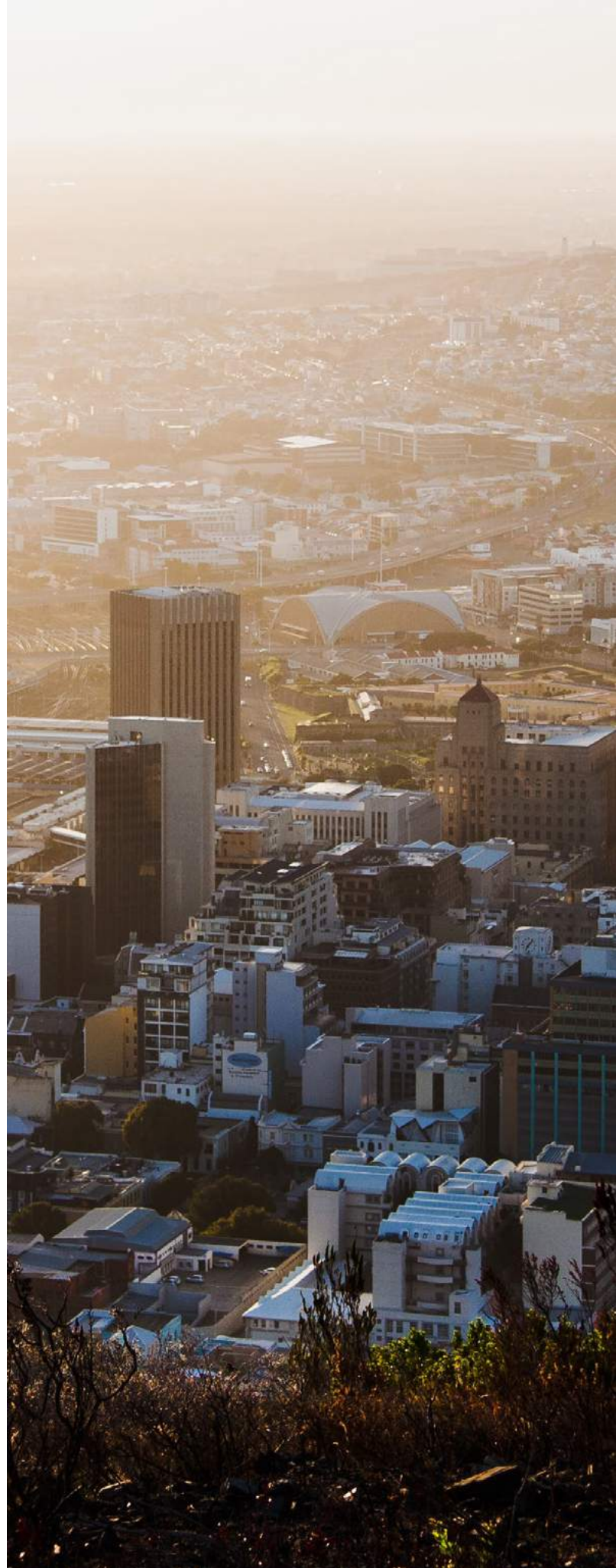
- Conduct a comprehensive review and study of the scope of technical skills, needs, training options, and employment, and develop plans to expand education and training opportunities and incentives (including requirements for gender equality).

Medium/Long-Term Actions:

- Invest in advanced technical training programs at universities and specialized institutes (including via industry partnerships) to expand the potential pool of skilled workers in the ICT sector.
- Incorporate domestic labor requirements, including training elements as needed, in PPP projects to build and operate digital infrastructure, taking account of the expected size and skills of the labor force.
- Develop plans to create incentives for skilled technical workers to remain within the country, and to serve in nonurban and remote locations, including tax and financial incentives and bonuses.

Responsible Parties:

- Governments, especially ministries of labor, education, science and technology, gender, and youth.
- Partners investing in digital skills development and training, such as the MDBs, development aid agencies, private sector, public and academic institutions.
- Private sector investors, particularly international firms contracting to build and operate major digital infrastructure projects incorporating significant skilled work forces, under licenses or partnerships with the government.



A large white number 9 is positioned on the left side of the image. The background is black and features numerous blue light streaks of varying lengths and directions, creating a sense of motion and digital connectivity. The text is white and bold, standing out against the dark background.

9

Financing Mechanisms for the Digital Infrastructure Moonshot for Africa

To ensure that this ambitious initiative achieves its goals and targets, it is of the utmost importance that all funding and investment partners come together and collaborate to put in place the most efficient investment plans and financing mechanisms to support the level of investment required to achieve universal access to affordable and good quality broadband in Africa.

With an overall estimate of \$109 billion in investments needed to achieve the 2030 target of universal access to affordable and good quality broadband, including the milestone for doubling connectivity by 2021, it is important that each partner plays a role in mobilizing necessary resources and focuses their efforts on contributing to this ambitious target.

- **African Union (AU) and regional economic communities (REC).**

It is critical that such a massive initiative be endorsed at continental level by the AU, taking on the role of coordinating efforts and ensure that such efforts are aligned with, for example, its upcoming Digital Transformation Strategy. In collaboration with AU, RECs such as ECOWAS, SADC, COMESA, and EAC, are also central to various transformation programs of the continent. They facilitate accelerated planning, design, development, operation and management of regional broadband infrastructure and other crossborder initiatives for the subregion. RECs also play a key role in coordinating donor support and aligning programs with regional priorities.

- **African governments and respective public investment agencies.**

Governments have the ultimate responsibility to ensure that their citizens have access to affordable and good quality broadband

connections, services, needed skills, and content. Therefore, governments must take an increasing role as investors in public ICT infrastructure and ensure that such infrastructure is in place to support the advancement of their national development agendas. Government resources come in many ways, from universal access and service funds (USAFs) available to invest in the sector (often administered in coordination with the sector regulator), to other national sources of infrastructure investment and support. Governments should review the sources of USAF funds and develop innovative models to ensure the contribution base is broadened to encompass all those who derive economic benefit from the investment. It is critical that governments not only invest their resources effectively but also that they support the development and establishment of enabling policy and regulatory environments that will incentivize and promote investments and market growth. Increased coordination between governments on this agenda, for example in context of the Smart Africa Initiative or within regional economic communities, should be fostered to achieve bigger harmonized markets.

- **Sector regulators.** Regulators have a key role to play in both establishing a level playing field in the market, but also in the implementation of key policies and regulation aiming at achieving universal, affordable, and good quality broadband. It is critical that sector regulators invest in the needed skills and tools and develop their policy and regulatory frameworks for digital markets, with the support of ITU, MDBs, and other relevant organizations.

- **Multilateral development banks (MDBs) and regional development banks (RDB) and other donors.** MDBs should increase their commitment to ICT infrastructure and projects in general and to Africa specifically.⁷³
 - » **The World Bank Group** will mobilize and make available a number of financing mechanisms, notably through the International Development Association (IDA) under a Mobilizing Finance for Development approach, to facilitate and expedite the distribution and allocation of a share of the \$25 billion earmarked for all dimensions of the *DE4A Initiative* to support the implementation of the Roadmap and Action Plan recommended to achieve the 2030 target of universal access to affordable and good quality broadband, including the milestone for doubling connectivity by 2021.
 - » **EU-Africa Infrastructure Trust Fund (EU-AITF)** of EIB also has dedicated fund programs for developing Africa ICT infrastructure.⁷⁴
 - » Other MDBs such as the **African Development Bank, the Islamic Development Bank, the European Investment Bank**, and many others, are invited to join forces with bilateral development partners and with the World Bank to coordinate their investment plans and ensure that together they are making investment decisions that will support this strategy and roadmap.
- **United Nations and other development agencies, including the ITU.** As a leading United Nations agency for ICT, the ITU has a key role in coordinating technical, economic and regulatory matters relating to ensuring universal, affordable, and good quality broadband connectivity. The ITU also finances national, regional, and global ICT development projects through its ICT Development Fund (ICT-DF).⁷⁵
- **Private sector (national and foreign).** Network operators and service providers are expected to play a critical role as key investors in the ICT sector through continued and increased levels of commitment to expand network coverage beyond urban population centers. Achieving commercially sustainable investment would require innovations to lower the CapEx and OpEx of cell sites and infrastructure overall and enhanced demands for mobile services and corresponding market growth. Digital services are increasingly provided by non-network operators and as the infrastructure gap is caused by a funding gap, innovations to finance models may of necessity require obtaining contributions from non-network operators on a direct or indirect basis.
- **NGOs** are another critical player in the DE4A Initiative and should play a key role as implementing partners, in particular in supporting digital skills building, and content development.

73. According to the Alliance for Affordable internet, "...despite increasing recognition of the importance of digital access to the realisation of the Sustainable Development Goals, MDBs are investing just 1% of their total commitments in ICT projects." A4AI and World Wide Web Foundation. 2018. Closing the Investment Gap: How Multilateral Development Banks Can Contribute to Digital Inclusion. <https://1e8q3q16vyc81g8l3h3md6q5f5e-wpengine.netdna-ssl.com/wp-content/uploads/2018/04/MDB-Investments-in-the-ICT-Sector.pdf>

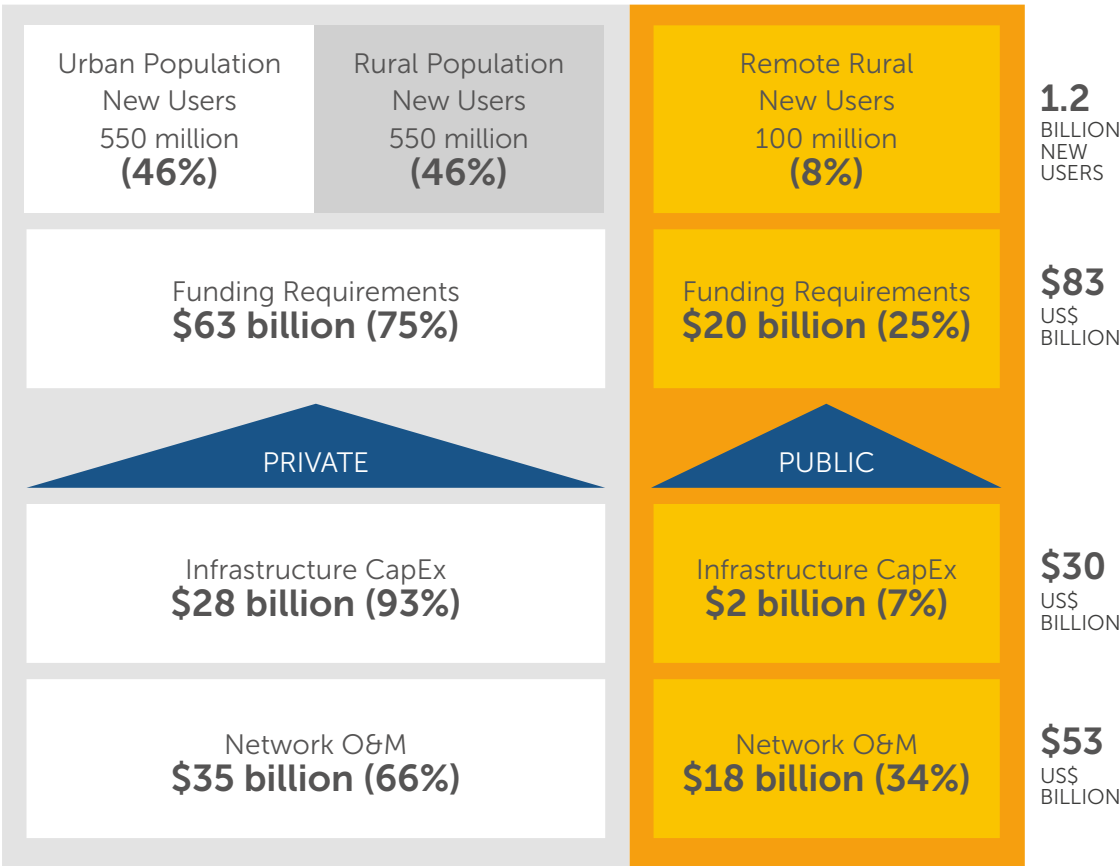
74. https://ec.europa.eu/europeaid/regions/africa/eu-africa-infrastructure-trust-fund-eu-aitf_en

75. <https://www.itu.int/en/ITU-D/Projects/Pages/ICT-DF.aspx?Status=&Theme=&Region=&Country=&ICTDF=1&Keyword=>

All participating organizations must collaborate to ensure that their resources are used in the most effective way. Partnership among the financing partners, as well as other implementing partners, is more likely to result in effective investments, and ultimately, greater impact. Figure 9.1 below provides an indicative distribution of cost sharing between the public and the private for infrastructure capital expenditure

(CapEx) and network operations and maintenance (O&M). Another significant aspect of the MFD approach demonstrates that public investment participants (e.g. MDBs, bilaterals and other development aid agencies) will channel investments in areas that the private sector sees as non-commercially viable.

Figure 9.1. **MFD Indicative Distribution of Cost Sharing**



Note: New users in remote rural area are estimated at ~100m (~15%-20% of the rural population). This represents the low-density areas out of reach of traditional mobile networks.



10 Monitoring Progress towards Broadband for All

Given the magnitude of this initiative, it is critical that all partners involved support the ongoing efforts to monitor progress towards the 2030 goal. It is therefore proposed that a monitoring framework be set up to help Africa track the progress and achievement of targets outlined in the Roadmap and Action Plan in chapter 8 of this report.

A new, crowdsourced monitoring platform could serve as a repository for all projects (public and private initiatives) taking place to help measure the targets against the total investments made under the auspices of the DE4A initiative.

In addition to a database of infrastructure investments, several metrics should be monitored to measure the progress of the overall initiative. The suggested metrics for monitoring progress are:

- **Broadband coverage:** Percentage of the population living within zones with at least 3G and 4G mobile network coverage, respectively. Visualizing such information as well as service areas on maps has proven to be effective in improving the efficiency of the investments and accelerating broadband connectivity in some parts of the world.
- **Broadband penetration:** Percentage of population that have access to affordable and good quality broadband, with segments by gender and rural/urban, gender across urban and rural, age groups, among other relevant metrics.

- **Affordability of broadband services:** Monthly cost of 1 GB per month of mobile data, as a percentage of gross national income (GNI) per capita.
- **Quality of service (QoS):** Upload and download speeds, a minimum amount of data, and device type.⁷⁶
- **Infrastructure location and availability:** Data on exact points and lines – or on an approximate spatial level – representing nodes and routes of the infrastructural network (first mile, middle mile, and last mile). **The ITU, the GSMA and some independent stakeholders have developed mapping projects that are a reference to this indicator (see boxes 2.1-2.3).**⁷⁷

In addition, it is important that progress be measured across all areas of the road map to achieve digital transformation by 2030, such as policy and regulatory frameworks, digital skills and content, and device affordability. For this purpose, we propose the following approach:

- **Policy and regulatory frameworks:** A measure of progress towards agreed best practice policy and regulatory frameworks, such as ITU's ICT Regulatory Tracker and the Affordability Drivers Index (ADI).⁷⁸

76. A4AI is developing a proposed standard for meaningful access based on this quality of service concept. This will be published in the Fall of 2019.

77. See <https://www.itu.int/en/ITU-D/Technology/Pages/InteractiveTransmissionMaps.aspx> and <https://www.mobilecoveragemaps.com>

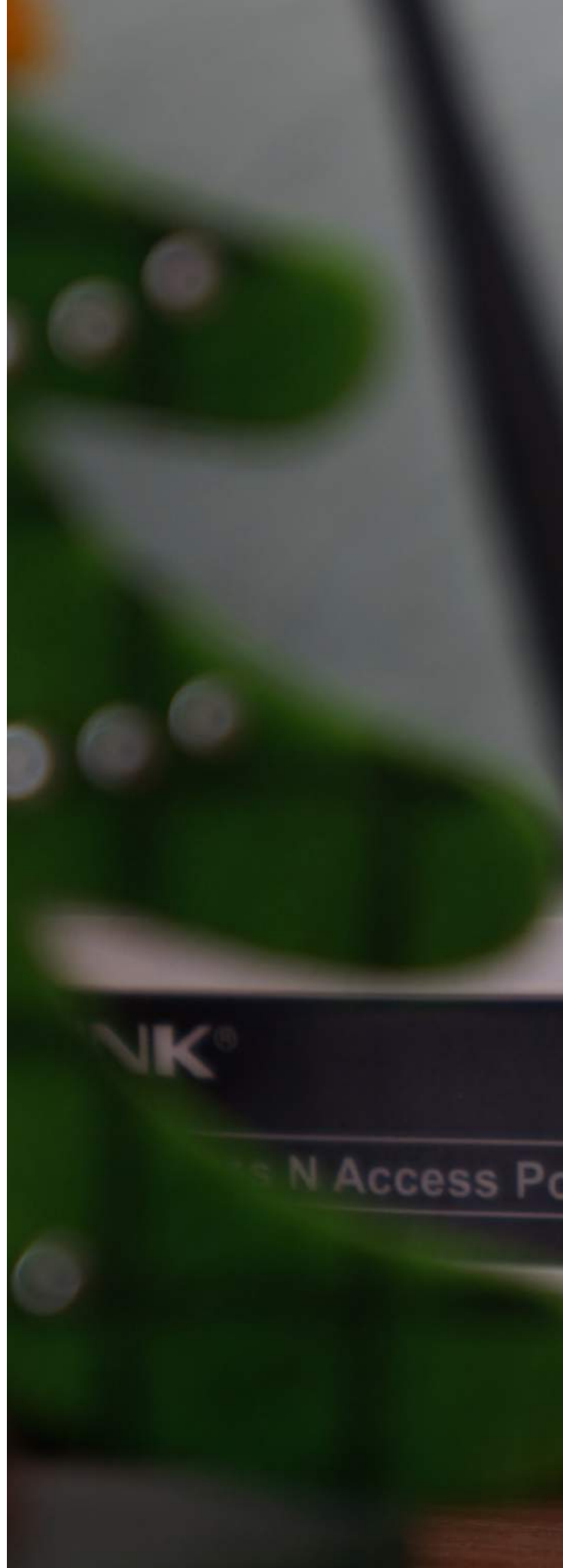
78. See A4AI's Affordability Report, <https://a4ai.org/affordability-report/>

- **Digital skills and content:** there remains a challenge in measuring *digital* skills across countries because of a lack of high-quality comparable data. Under this initiative's framework, suitable metrics need to be identified or developed, in partnership with other relevant stakeholders such as UNESCO, the ITU, and others. *Content development* is another area where better data is needed, though there are some existing indices that measure and track the development and availability of locally relevant content.⁷⁹
- **Affordability of devices:** (1) Percentage of the population that can afford a mobile broadband capable phone with less than 15 percent of monthly GNI⁸⁰ and with ongoing payments related to financing of less than two percent of monthly GNI. (2) Cost of internet enabled devices as a percentage of GNI per capita.

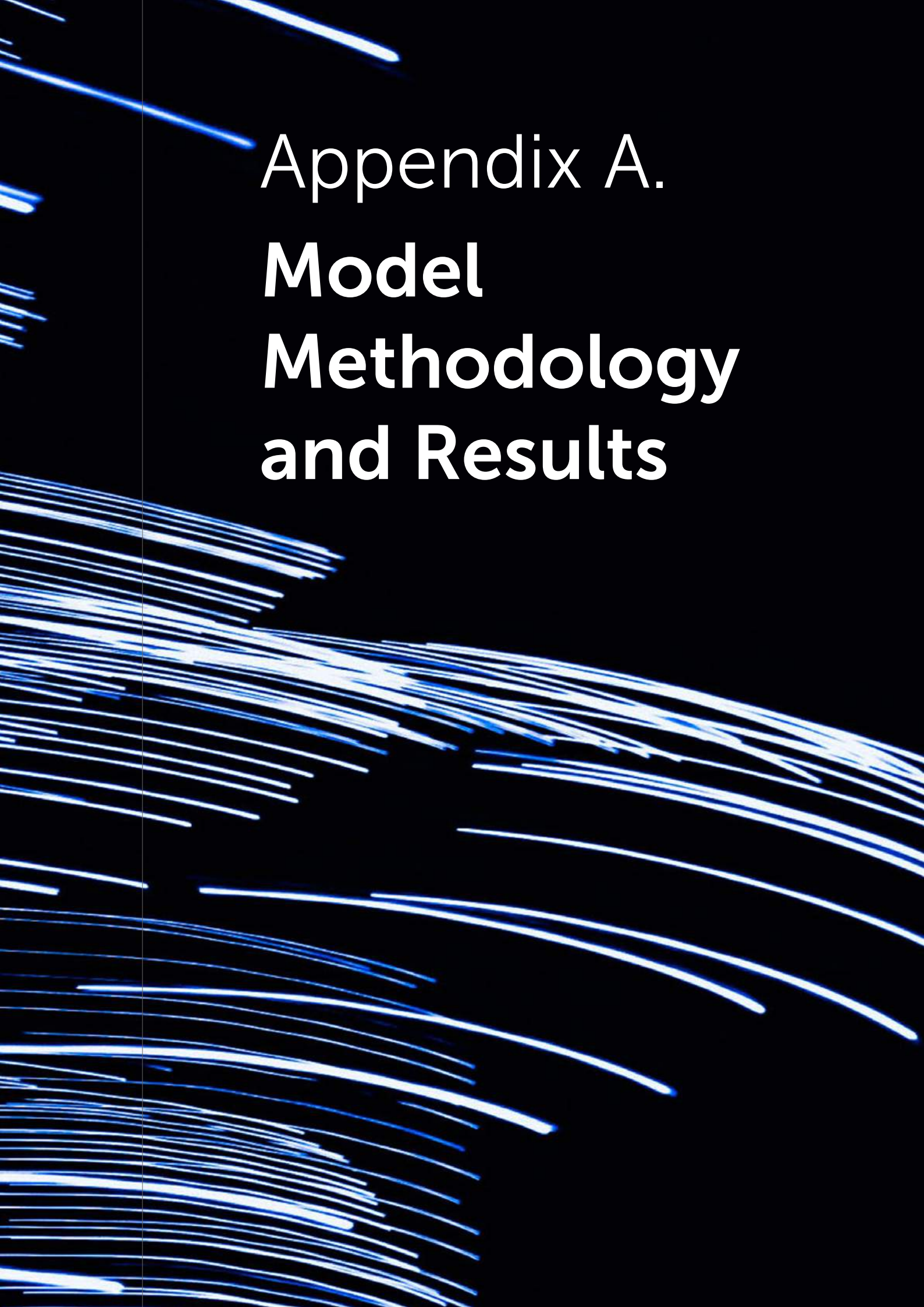
Overall monitoring progress will be publicly available and reported at the country, regional and continent level.

79. See for example, <https://www.mobileconnectivityindex.com/>

80. Analysis of Average Selling Price (IDC) as a percentage of income (C-GIDD) for feature phones and ultra-low-end smartphones in Nigeria, 2019H1. Assumes ordinality between income and corresponding phone purchase, e.g. the top 10% of phones are purchased by the top 10% of income earners





The background of the slide is black, featuring numerous dynamic, curved streaks in shades of blue and white. These streaks are concentrated in the lower half of the image, creating a sense of motion and depth. The text is positioned in the upper right quadrant, rendered in a clean, white, sans-serif font.

Appendix A.

Model Methodology and Results

The estimates outlined in this assessment are subject to the following considerations and caveats:

- The focus and scope of the modelling exercise were strictly on estimating the cost to achieve the stated targets – namely anticipated capital expenditures (CapEx), infrastructure operation and maintenance costs, policy, and skills. While other components of feasibility are acknowledged to warrant strong consideration (notably service affordability, economic feasibility, sources of funding, and a broad assessment of the sustainability of the proposed investments), they are beyond the scope of this particular modelling exercise. These additional factors will be assessed in more detail in separate, dedicated phases of analysis.
- While they share some similarities, the 2021 and 2030 digital transformation targets are considered separately for the purposes of this assessment. They address two related but different questions, that is, how much it would cost to double penetration by 2021 versus how much it would cost to achieve universal access to broadband by 2030. They also use different parameters to define broadband (3 Mbps versus 10 Mbps). While complementary, the results of these two assessments should therefore not be considered cumulative.
- While based on estimates on a country-by-country basis across a sample of 54 markets, the model was primarily built to develop an assessment at the regional level, with attendant constraints with respect to country-level granularity, along with some region-wide, or cluster-based assumptions. The resulting

estimates should be considered high level and directional in nature. More detailed country modelling must be carried out to build a deeper picture of individual country investment requirements and constraints.

- The use of the terms 3G and 4G in this assessment does not represent an endorsement of some technologies at the expense of others. This assessment is technology agnostic, and 3G and 4G are used here only as broad proxies for preferred minimum download speeds, and in recognition of the fact that mobile networks will be central to achieving the proposed targets.

Key Assumptions and Definitions

The following critical assumptions underpin the estimates of investment requirements:

Defining Broadband

The definition of broadband across countries continues to evolve as technologies improve, new generations emerge of wireline and wireless broadband and baseline expectations continue to be raised of what constitutes minimum download speeds for the optimal end-user experience. Our quantitative forecast model seeks to adhere to these changes by applying a definition of broadband that is consistent with the minimum levels of download (and upload) speeds expected to prevail during the period under assessment.

For the purposes of achieving the 2021 objective, “broadband” speeds are thus defined as 3 Mbps or above (download); for mobile connectivity, 3G is used as the primary proxy for broadband. For

the purposes of achieving the 2030 universal access to broadband target, it is anticipated that the definition of what constitutes a basic level of broadband speed is likely to evolve. In turn, “broadband” speeds are defined as 10 Mbps or above (download). For mobile connectivity, 4G is used as the primary proxy for broadband.

Universal Access and Target Population

For the purposes of this analysis, the population aged 10 and older is used as the baseline for calculating broadband penetration. In addition, connectivity penetration numbers are based on the estimated number of “unique” broadband connections, that is, adjusted where applicable for multi-SIM usage. Finally, universal access to connectivity is defined as 90 percent penetration of the population aged 10 and older.

Estimating Broadband Penetration

For the purposes of this model, estimates of broadband adoption are based on unique broadband subscribers. Broadband penetration is obtained by dividing the estimated number of unique broadband subscribers (that is, connections adjusted for multi-SIM usage) by the population aged 10 and older. In addition, the definition of broadband with respect to the 2030 target includes 4G/10 Mbps speeds or above only. As a result, penetration estimates in this model may differ from traditional penetration estimates.

Defining the Baseline and Notional Target Thresholds

For the purposes of this assessment, the year 2016 was established as the baseline from which broadband connectivity will be doubled by 2021. In some markets, however, this initial baseline was too low to be meaningful, and the proposed 2021 target has already been met as of the end of 2018. In such cases, a notional, 20 percent minimum broadband

penetration target for 2021 was set. In effect, the 2021 target is thus “doubling penetration from 2016 levels by 2021, or increasing penetration to at least 20 percent, whichever is higher.”

Network Capital Expenditure (CapEx) Assumptions

Infrastructure investment requirements are estimated for three main network segments:

- **Mobile radio network CapEx:** While acknowledging that other technologies will likely be available, 3G network coverage and 4G network coverage are used as the main proxies for broadband network availability and the baseline for estimating network infrastructure investments for the 2021 target and the 2030 target respectively. Mobile network infrastructure costs are based on the capital expenditure needed to extend coverage to the unconnected population, and provide adequate capacity and allow for network upgrades once new users have been connected and traffic expands. Estimates include a mix of greenfield and upgraded sites, along with existing levels of broadband network buildout and coverage.
- **Network backhaul:** Infrastructure capital investment estimates integrate the need to invest in adequate transmission infrastructure based on metro fiber, microwave, or satellite. The model assumes that a countrywide fiber backbone must be in place to achieve universal access to connectivity, using 4G speeds. Estimates are based on the total fiber backbone kilometers required to meet this overarching objective, based on available data and/or minimum fiber density target levels.

Satellite for remote areas: It is generally anticipated that, for a variety of reasons, a proportion of the rural population in remote locations will typically be

out of the reach of traditional mobile networks. The forecast model assumes this proportion at between 10 and 20 percent of the rural population in most countries, with variations depending on population density levels. Populations in remote locations will generally need to be covered by local solutions consisting of satellite backhaul and fixed wireless access (predominantly Wi-Fi) for the last mile. In turn, infrastructure investment estimates include a satellite/Wi-Fi requirement for remote communities.

Network Operational Expenditure (OpEx) Assumptions

For the purposes of this analysis, infrastructure investment requirements include estimates of network operating expenses, applied on an annual basis. Network operating expenses typically include repair and maintenance, site leases, and other site operating costs. For satellite/Wi-Fi infrastructure, network OpEx includes support, user management platform, and bandwidth capacity recurring costs.

Policy and Regulatory Costs

The model assumes that most countries will require some form of policy and regulatory intervention to develop and strengthen frameworks that promote cost-effective rollouts, lower connectivity retail prices, and increase broadband usage. This includes fostering the availability of adequate spectrum, infrastructure sharing, open access fiber, and other relevant regulations. Top line policy and regulation investment requirements are estimated using assessments of policy support needed in each country and based on the policy and regulation components of the Affordability Driver Index (ADI) score as developed by A4AI.

Skills and Content Costs

The availability of local, relevant content and adequate end-user skills are vital to a broader, more inclusive adoption of broadband connectivity services. Investments in skills and content may take the form of establishing tech hubs, local content ecosystems, or internet literacy training programs. The model integrates these components, by including costs per user for training and content. Baseline estimates are based on a broad framework as outlined by the World Economic Forum.⁸¹

Data Sources

The *Digital Transformation Initiative* investment requirement model uses a variety of sources, including:

- GSMA data, for mobile broadband connections, user, network coverage, and other data;
- United Nations and World Bank, for population and demographic data;
- The Alliance for Affordable Internet, for affordability and policy rating data;
- Xalam Analytics, for supplementary broadband connections, some network assumptions, and fiber backbone data;
- World Economic Forum, for skills and content investment assumptions.
- ITU, for population baseline analysis

In addition, key assumptions in the model are based on service provider data and/or insights garnered through consultations with key stakeholders. This is explained in appendix B.

Model Structure

Figures A.1 and A.2 explain how the investment models for the 2021 milestone and 2030 target were developed.

81. World Economic Forum. 2017. Internet for All: An Investment Framework for Digital Adoption. http://www3.weforum.org/docs/White_Paper_internet_for_All_Investment_Framework_Digital_Adoption_2017.pdf

Figure A.1. **Estimating Requirements for the 2021 Target: Model Structure (Indicative)**

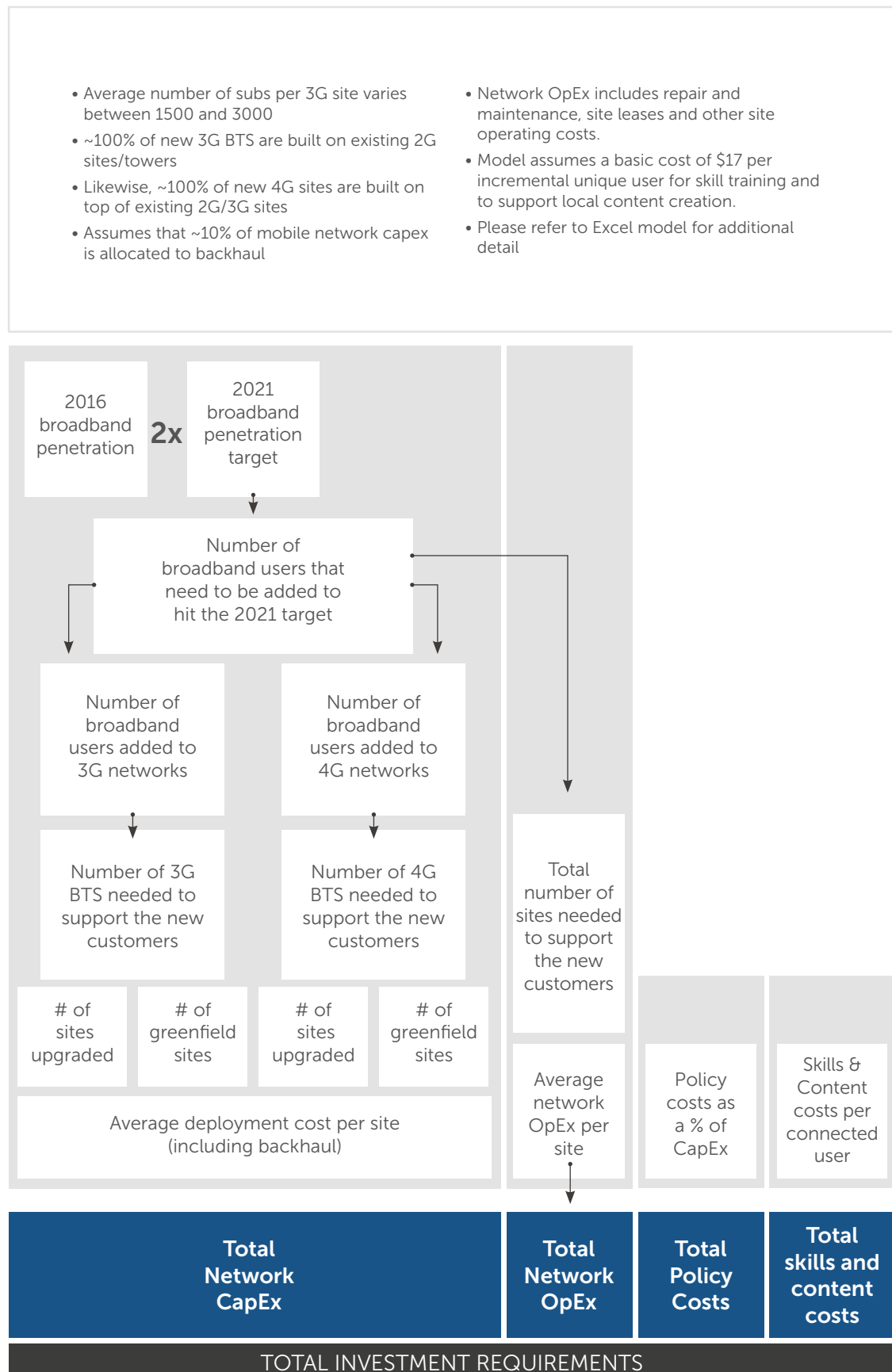
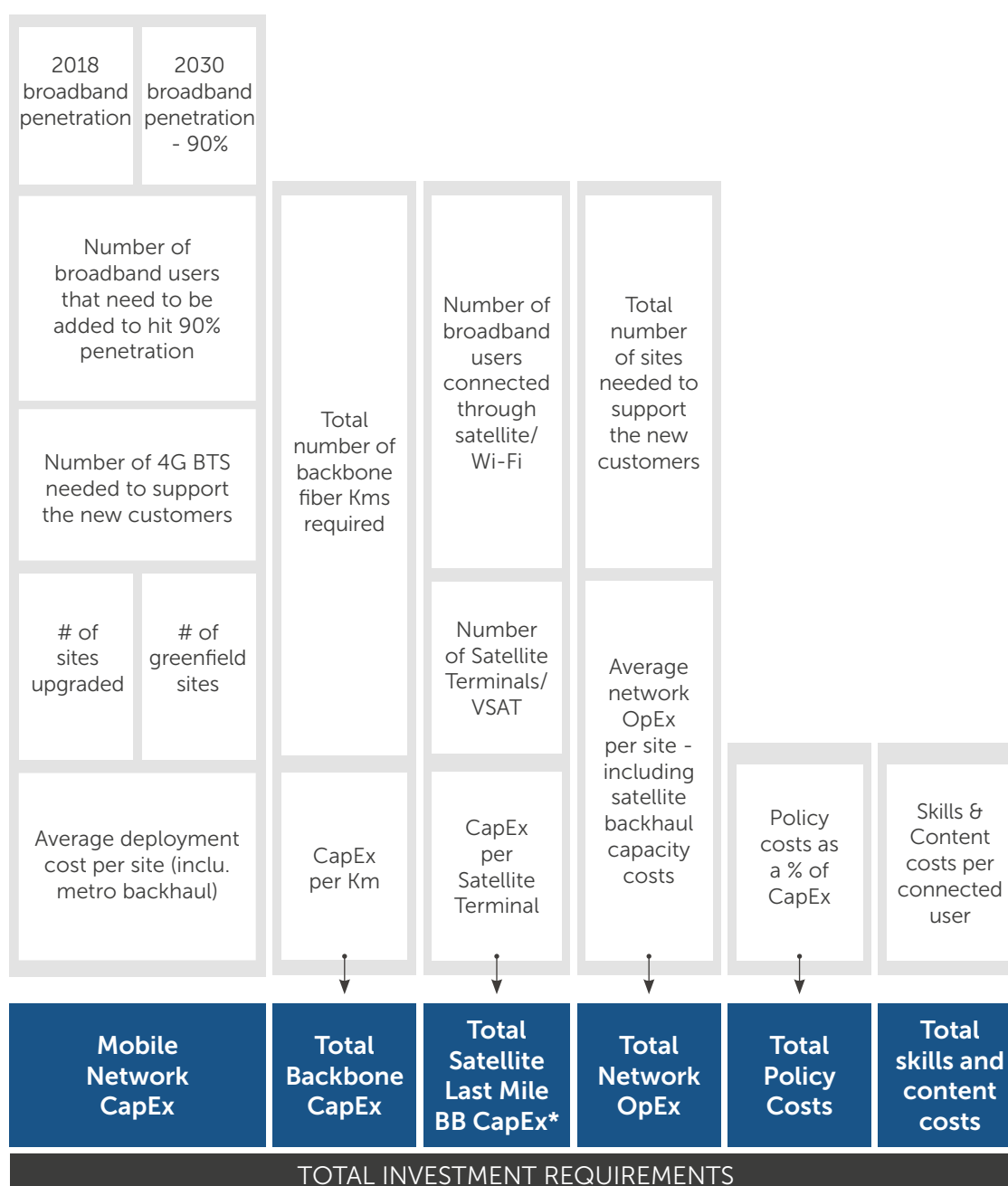


Figure A.2. **Estimating Requirements for the 2030 Target: Model Structure (Indicative)**

- Average number of subs per 4G site averaged at 5000 over the forecast period;
- We assume that new 4G BTS are primarily built on existing 2G/3G sites/towers; any requirements beyond the existing 2G/3G tower base is considered greenfield.
- Assumes that ~10% of mobile network capex is allocated to metro backhaul; backbone CapEx estimated separately based on CapEx per km.
- Network OpEx includes repair and maintenance, site leases and other site operating costs.
- ~10%-20% of rural population only accessible via satellite/FWA infrastructure, depending on density levels;
- Satellite capex only including terminal + Wi-Fi setup; OpEx including costs of backhaul capacity
- Model assumes a basic cost of \$17 per incremental unique user for skill training and to support local content creation.
- While the model does not explicitly split out CapEx dedicated to the connection of public institutions (schools, hospitals, etc.), it implicitly accounts for it. It is assumed that a network that reaches ~100% of the population will similarly reach ~100%+ of institutions.
- Please refer to Excel model for additional detail.



Appendix B.
Additional
Case Studies
for Practical
Understanding
of Universal,
Affordable,
and Good
Quality
Broadband

Benefits of Broadband Infrastructure and Services

Box B.1. ITU'S Smart Village Platform

The Smart Village platform is a multistakeholder, cross-sectoral initiative that showcases how to cost effectively accelerate the implementation of the Sustainable Development Goals in remote areas through an integrated development and technology platform model. Through this model, governments can aim to increase the efficiency, security, and effectiveness of public services while reducing their cost, promote transparency and good governance, enhance traceability of transactions, and encourage data exchanges, among others.

The ITU is collaborating with the Niger Agence Nationale pour la Société de l'Information (ANSI), as well as other UN agencies and stakeholders to support the smart village initiative in Niger, which launched in 2018, to drive sustainable rural development in agriculture, commerce, education, finance, and health.

Source: <https://www.itu.int/en/ITU-D/ICT-Applications/Pages/smart-village.aspx>

Broadband Access Loan and Grant Programs

Box B.2. Broadband Access Loan and Grant Programs

The European Fund for Sustainable Development has developed a guarantee worth €74 million for loans by the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB) to invest in the infrastructure needed to provide affordable high-speed broadband in countries neighboring the European Union – especially outside the main urban centers and in rural, remote, and unserved areas to enable businesses, public administration, and the general public. The program will:

- bring fast broadband to between 300,000 and 600,000 homes in rural areas
- enable new small companies outside the main urban centers and in rural areas to grow and employ local people
- allow people and businesses to take part more fully in the digital economy – for example, by selling goods and services or banking online

Innovative Business Models and Technologies for Expanding Broadband Access

Box B.3. Developing a Public-Private Partnership for International Fiber Optic Connectivity – São Tomé and Príncipe

São Tomé and Príncipe provides one example of a successful partnership. In 2011 and 2012, the Government of São Tomé and Príncipe and the incumbent local fixed and mobile telecommunications service provider, Companhia Santomense de Telecomunicações (CST, a subsidiary of Portugal Telecom), partnered to invest in access to the Africa Coast to Europe (ACE) submarine fiber optic cable, as well as a submarine cable landing station. This shared investment resulted in a substantial expansion of telecommunications infrastructure to and within São Tomé and Príncipe, and sharp price declines for most telecommunications services in the country. This, in turn, helped to achieve the government's related objective of attracting a second mobile telephony and internet service provider to São Tomé and Príncipe in 2014.

The experience in São Tomé and Príncipe highlights the potential of PPPs to absorb early-stage project risk and provide a bridge to substantial private investment, both initially through the PPP and, subsequently, by facilitating the construction of key infrastructure needed by new entrants. The availability of low-cost international connectivity and access to the incumbent's infrastructure at cost-based prices were important considerations in attracting Unitel as a competitive new entrant into the country's telecommunications market – a move which led to substantial decreases in prices for most telecommunications services.

The environment for investment in telecommunications infrastructure in emerging markets has evolved substantially over the past few decades, with important implications for the development of PPPs and other vehicles to fund infrastructure in emerging markets. The factors that have helped to drive this telecommunications infrastructure market evolution include:

- Private operators have experienced massive increases in mobile broadband usage in their emerging market networks, and most now expect that this rapid growth will continue.
- Active acquisition, construction, well-funded private infrastructure investors (both service providers already active in-country and international wholesale infrastructure access providers) are actively acquiring, constructing, and investing in telecommunications infrastructure, including fiber optic networks, towers (through focused tower owner-operators) and data centers.
- Greater interest in sharing the ownership of telecommunications infrastructure and capacity by operators, dedicated infrastructure providers, banks and other high capacity users – both through the purchase of shares and indefeasible right of use (IRUs) by, helping to create a market and set tangible commercial values for such infrastructure assets.
- Lower cost and more proven infrastructure technologies that provide high-speed broadband connectivity, including less expensive fiber optic cable installations, more efficient software overlays that make fiber optic terrestrial and submarine cables more productive, and wireless technologies that provide broadband solutions for low-density areas and irregular terrain.
- Increasing awareness by the government of the importance of infrastructure sharing in reducing the cost of telecommunication deployment – either by requiring operators to share infrastructure (for example, towers), or by providing access to roads, railway lines or power grids through a PPP.

These developments have reduced the risks to private operators in financing and constructing telecommunications infrastructure, and have underpinned a surge in telecommunications investment across emerging markets. While the role of governments will remain important in structuring future PPPs, the increase in available private funding would free up government funding to achieve other pressing policy objectives while encouraging further use of PPP structures that acknowledge the reduced risk and evolving interests of private investors.

Source: A4AI. <http://a4ai.org/wp-content/uploads/2015/11/PPPs-in-Sao-Tome-and-Principe.pdf>

Box B.4. OneWeb – Strategy to Connect Remote, Rural Villages and Roadways

OneWeb is building a global communications network powered from space to deliver low-latency, high-speed broadband services globally. With commercial services due to start in 2021, OneWeb will provide backhaul to last-mile networks (for example, mobile and fixed wireless networks, and community Wi-Fi hotspots) and direct-to-premise connectivity (for example, institutions, enterprises, and households). A key market priority involves the thousands of unserved rural/remote communities – especially those in sub-Saharan African countries.

Despite the advantage of having no barriers from geographic location or terrain, traditional satellite solutions have been considered a solution of last-resort because of high-pricing and performance limitations (that is, slow speed, high latency). Moreover, common business practices have exacerbated risks for business cases already economically challenged (for example, lower densities, ARPU, and/or adoption rates).

The OneWeb network will consist of 650 low earth orbiting (LEO) satellites that will provide bandwidth comparable to high-speed fiber or 5G wireless networks. Furthermore, OneWeb's business model addresses the financial viability risks through: sale of bandwidth ("pay as you grow") and managed services packages; upfront capital investment limited to the user terminal equipment and installation; and public-private partnerships that pool capacity demand and dynamically shift provision to areas of highest demand.

OneWeb considers such markets as a core part of its mission of bringing the "Internet to everyone, everywhere."

- **Small, Scattered Villages:** The average village has less than 500 people with school enrollment at less than 50 students. The willingness to spend is limited to \$2-3 per month/user on internet access. Microwave links and fiber lines are technically or economically infeasible, especially without central planning and coordination.
- **Operator Dynamics:** Potential operators of a Wi-Fi network are fragmented. The MNO may soon deploy a 3G network; however, 4G services are only planned for the distant future given the low investment returns.
- **Government Programs:** Universal service funds are limited, unavailable, or small for sustainable purposes.

Potential Service Package and Deal Structure via Public-Private Partnership

The potential solution design can vary, but the following public-private partnership arrangements are being considered:

- **Pooled Purchase Contract:** Government stakeholders and operators (for example, MNO, ISP) may band together to aggregate demand and purchase capacity. The master contract holder would then assign bandwidth to each group member, and service packages to each user-terminal, through OneWeb's service portal.
- **Multidimensional Network and Cost Sharing:** The last-mile solution envisages a community Wi-Fi public hotspot that also has a fixed wireless link to a school. The school would serve as the anchor client for the hotspot owner. The government would have access to reporting and analysis regarding usage at the school level. Capital expenditures (for user terminal and base station) would then be shared across different user segments.
- **Redundant Links:** The government and/or operators could seek satellite services for redundant links to their terrestrial network. Otherwise, bandwidth would be fully utilized for everyday broadband. During the increasingly common event of a fiber-cut, mission critical sites could be quickly activated through OneWeb. This approach is cost effective as it obviates the need to purchase dedicated capacity for redundancy. But the option to have this a redundant backup would incur a charge, which in effect would contribute to the contract value and further drive volume discounts.
- **Alignment of Cost with Usage:** The MNOs will be able to dynamically allocate capacity to remote and rural roadways and towns with limited usage – aligning cost with usage. Similarly, public hotspot operators would only pay for the usage, as long as the master contract calls for a minimum amount of capacity purchased.

Box B.5. KT's Copper Wire-Based Gigabit Internet Technology Solution

KT developed GiGA Wire solution to improve gigabit broadband accessibility for old buildings and historical sites where fiber installation is not available or difficult. FTTH is considered to be the best solution for fixed broadband access, however, last mile deployment is not possible in every situation. Since it can cause environmental impact because of overhead cable installation, cable attachment on the facade and cable work inside of the building, GiGA Wire was introduced to provide gigabit broadband through existing copper/coaxial infrastructure.

The GiGA Wire is a field-proven, market-oriented solution to provide over 1.4 Gbps of speed with existing copper/coaxial infrastructure. GiGA Wire can provide gigabit broadband service to customers with shorter lead-time and smaller investment cost than FTTH. In particular, GiGA Wire prevents damage to buildings because it does not require any additional wiring by utilizing existing lines and provides a quick and easy installation.

GiGA Wire is based on the international standard, ITU-T Gigabit Home Networking, G.hn standard. It can be provided through copper and coaxial cable and can also coexist with legacy xDSL technology and different vendors' solutions in the same bundle.

KT implements GiGA Wire solution in old apartment complexes and historic sites where difficult to attach fiber on façade or deploy fiber in vertical shaft. It provides broadband speeds seven times faster than legacy VDSL.

KT has developed partnerships with several governments and companies in the United States, Malaysia, Botswana, and so on, and pilot projects have been conducted in Turkey and Egypt.

Box B.6. Talia's Quika Brings HTS Ka Band Services to Remote Locations

Quika has partnered with GEO, High Throughput Satellite (HTS), Ka band providers to provide low-cost internet services to remote locations with 0.75m antennas: Arabsat-5C for Afghanistan and Iraq; Yahsat-3 for eleven countries in Africa. Later in 2019, OneWeb's LEO constellation will provide low latency services in the Middle East and Africa regions with potentially full global coverage.

Quika's unique business model integrates advertising and content to make high-speed, low-latency broadband affordable as well as sustainable. Quika Free's consumer model is free to the consumer and funded by advertising or government-funded Public Service Announcements (PSAs). The integrated Wi-Fi network with the satellite system allows user access by computer or smartphone. Communities have become empowered through the transformational educational, economic, and social benefits online connectivity brings.

Quika addresses the availability, affordability, throughput, simplicity and sustainability issues of broadband services to the over 70 percent of African households unconnected. Quika partners with local licensed operators and regulators using USAFs to implement current and expanded coverage in African and the Middle East. Quika's service platform is scalable to support the regional expansions and consumer-oriented applications.

Box B.7. The Smart Africa Broadband Strategy Document

In an effort to improve the situation of broadband and internet, Smart Africa launched an initiative with the aim of making broadband accessible and affordable for the member states and organizations. This project seeks to define a strategy which will serve as an overarching guideline for the member states, on increasing the broadband penetration in Africa, with specific focus on pragmatic ways of increasing the broadband penetration and finding innovative economic models to support the projects that come out of this strategy.

The vision of this strategy is encompassed into the Alliance global strategy to transform the continent into a single digital market and a knowledge-based economy by 2030.

A working group comprising of representatives from all member states and some selected private sector members such as Facebook, Inmarsat, SES, Orange, AfDB, GIZ, RISA were present at the first consultative meeting held on the 30th and 31st July 2019 in Kigali, Rwanda.

The purpose of the working group was to identify the policies, rules and guidelines the countries must put in place to ensure they are on the path to achieving the Alliance vision, both individually and collectively, through broadband connectivity. At the end of the workshop, a vision to “Achieve affordable broadband connectivity of 50% increase for Africa Citizens by 2025 facilitated by harmonized policy and regulation that emphasizes private sector at all levels to enable the transformation of the continent into a single digital market and a knowledge-based economy” was agreed upon.

Smart Africa Projects Towards the development of affordable digital infrastructure in Africa:

- **Inter-African cross border connectivity:** This project being a collaboration between the private sector, the republic of Guinea and Smart Africa, is set to connect all the African Countries either by Submarine, Terrestrial or Satellite technology. In its first phase, 3 countries comprising Mali, Guinea and Senegal have been connected, 4 more are being worked on to be closed by the end of 2020. The second phase consists of ten (10) African countries and scheduled to complete by 2021. The remaining African countries, with priority on the Smart Africa members will be in the third and final phase, planned to be completed by 2025.
- **One Africa Network:** The goal of this project is to build infrastructure to keep Africa traffic within Africa and to lower the tariff and costs of roaming. This initiative started about 3 years ago and, until now, 7 west African countries have activated this agreement as well as 3 east African countries.
- **Data centers:** The lack of local infrastructure, such as datacenters, diverts internet traffic from Africa, poses quality problems (latency) and makes internet costs high. African countries thus have no control over their data, which leads to security and governance problems. Africa must face these problems quickly, by focusing on developing storage and data processing infrastructures in Africa.

Digital Skills Development

Box B.8. GSMA's Mobile Internet Skills Training Toolkit

GSMA's Connected Society program has developed the Mobile Internet Skills Training Toolkit (MISTT), a resource for mobile operators, NGOs, development organizations, and governments wanting to provide training to improve people's basic knowledge and understanding of the mobile internet. It provides a visual and easy-to-understand introduction to using the mobile internet on an entry-level smartphone:

- The MISTT is available in English, French, Hindi, Bengali, Kinyarwanda, and Swahili and may be translated into other languages.
- The GSMA has been working to implement the training with a number of partners including Tigo Rwanda, Banglalink in Bangladesh, DOT and the Government of Rwanda, Ooredoo and Facebook in Myanmar, and several others with positive results with large increases in internet adoption levels.
- In 2017, a pilot study of the toolkit was conducted in Sub-Saharan Africa, by Tigo Rwanda. This resulted in over 300 sales agents being trained to use the MISTT, who in turn trained over 250,000 data-paying customers. Overall, Airtel Tigo Rwanda witnessed substantial benefits with 77 percent of MISTT trained customers increase their data usage in the period after their sales agents introduced the training, and MISTT trained sales agents managed to increase the number of new data subscribers by 15 percent. This led to a 240 percent increase in quarterly return on investment.
- More recently, by using a force of 3,200 sales agents, Banglalink trained over 117,000 customers over three months following which, amongst customers who were trained, there was a 228 percent increase in mobile internet usage, a 143 percent growth in data revenue, and increased traffic to Banglalink's self-care app.

Those who received the training were able to access key services in the areas of education, health, financial services, often for the first time, leading to increased economic empowerment and socioeconomic opportunities.

Source: <https://www.gsma.com/mobilefordevelopment/connected-society/mistt/>

Box B.9. KT's GiGA Island Initiative

KT's GiGA Island Initiative cooperated with Bangladesh ICT Department, International Organization for Migration (IOM), Korea International Cooperation Agency (KOICA) and local nonprofit and nongovernment organizations to improve the standard of living in Moheshkhali Island in Bangladesh. KT introduced GiGA network and ICT solutions to solve social problems including digital skills, education, medical services under Bangladesh government's national development policy named "Digital Bangladesh 2021."

Moheshkhali Island has a population of 320,000 with a density of 900 per square kilometer. The island, geographically isolated, lacks access to universal services. The average literacy rate of the island is 30 percent, much lower than the Bangladesh average of 50 percent. Additionally, there are a number of public institutions, including schools and local medical clinics; there are not enough teachers capable of teaching foreign languages or upper-level courses. In medical services, there are limited hospitals, a low ratio of doctors to the population – which is only 11: 20,000 – and a lack of female doctors to deliver medical support and reproductive services that the population deserves. KT has addressed digital skills and local content in four major industries, successfully, as follows:

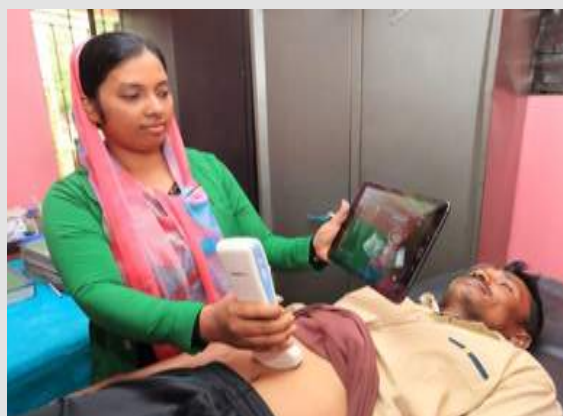
1. Remote education – creating/providing smart classrooms and e-learning content

- Partnered with the NGO Jaago Foundation, created smart classrooms in 12 elementary schools
- Provided English and literature classes using e-learning content (Teacher's Portal)



2. Digital healthcare – connecting through telemedicine and mobile health system and devices

- Connected community clinics using the telemedicine system
- Utilized mobile health check-up devices for diagnosis (Sonon (ultrasound device), Yodoc (urine tester), myCheck (blood tester))



3. Information access – teaching ICT skills and building IT space

- Created IT space which can be used as an IT classroom and provides IT information
- Developed a recruiting website specifically for low-skilled, manual workers



4. E-commerce – manage and connects to customers through digital platform

- Partnered with KOICA, created an e-commerce platform that directly connects to customers
- Activated the AICC (Agriculture Information and Communication Center) and IPM (Integrated Pest/Crop Management) by connecting to an e-commerce platform



Source: KT Economics and Management Research Institute. 2018 B20 Taskforce Digital Economy, and KT Integrated Report. 2019. Industry 4.0 Policy Paper.

Box B.10. ISTIC's Double Hundred Universities Cooperation Project

The International Science Technology and Innovation Centre for South-South Cooperation (ISTIC), which operates under the auspices of UNESCO, is an international platform for cooperation among developing countries to increase the capacity for the management of science, technology, and innovation in developing countries. ISTIC has many programs promoting south-south cooperation, prioritizing initiatives with African countries.

One example is the Double Hundred Universities Cooperation Project, started in 2017, a mentorship initiative that matches one hundred technical universities in China with one hundred technical universities from countries with relations with China, many of which are from African countries. Faculties and students involved in the project focus on emerging technological issues, such as big data, artificial intelligence, and the Internet of Things (IoT). The project will enhance digital skills, nurture digital entrepreneurs, encourage digital startups, and also train personnel in proper maintenance and operation of digital infrastructure and the application of digital technologies with support from digital technology corporations.

Source: <http://www.istic-unesco.org>

Box B.11. WomEng South Africa with One Million STEM Girls Project



NAADIYA MOOSAJEE
Co-founder



HEMA VALLABH
Co-founder

WomEng was established in South Africa in 2006 by Cofounders Naadiya Moosajee and Hema Vallabh. Naadiya is on the World Economic Forum Global Future Council on Gender Education and the Future of Work, while Hema holds a seat on the World Federation of Engineering Organizations (WFEO) Women in Engineering Standing Technical Committee.

WomEng was founded with the objective of encouraging girls to consider STEM (Science, Technology, Engineering, Mathematics) as a career by creating STEM awareness for girls and developing, mentoring, and supporting them through their engineering journey. The model for extending the reach of STEM awareness to one million girls is based on an exponential train-the-trainer scaling model, working with individuals and/or organizations passionate about STEM, who can sign up for a #1MillionGirlsInSTEM toolkit to become an official WomEng Activator. The reach is tracked on a live Google Map showcasing the number of countries, cities and girls reached. The #1MillionGirlsInSTEM campaign is a key component of WomEng's efforts to meet the Sustainable Development Goals by investing in girls' education and creating gender equity for the entire engineering sector.

WomEng has gained international recognition by winning awards and honors, such as Special Mention and Award by the Government of China and UNESCO at the BRICS Summit, China, 2017; "Fortune" Most Powerful Women Awardee 2017; Global finalist for the 2015 Qatar WISE Award for Innovation in Education; Finalist for Airbus Diversity Award in 2015; Best Practice in TVET awarded by the African Union in 2015, and Top NGO in South Africa awarded by Top Women Magazine in 2014.

Source: <https://www.womeng.org>

Box B.12 Shared-Value Partnership for Equitable Access to Digital Literacy in Kenya

Nokia and the Finnish National Committee for the United Nations Children's Fund (UNICEF) and UNICEF Kenya have launched a shared-value partnership, to increase equitable access to digital literacy for some of the most disadvantaged children in Kenya. This includes girls and children with disabilities in urban informal settlements and some of the most remote areas of Kenya.

The partnership builds on the Government of Kenya's investment in the Digital Literacy Project which provided one million tablets to primary schools with a focus on improving the availability and use of quality digital content. In order to address challenges and unlock opportunities for digital learning and literacy, the partnership between Nokia and UNICEF Kenya brings together:

- Stakeholders from the Government of Kenya's Ministries of Education and ICT.
- The Kenya Institute of Curriculum Development (KICD).
- Children, teachers, content providers, and mobile network operators in Kenya.

As an initial step, the Accessible Digital Textbook with special features for children with hearing, visual and intellectual disabilities, was successfully piloted in schools during the first quarter of 2019 and will be launched by the Government of Kenya more widely. The textbook, which is the first of its kind, was produced by KICD with the active involvement of disability stakeholders who infused different media overlays with audio for children with visual impairment, simplified text for children with intellectual disabilities, and Kenya Sign Language video inserts for children with hearing impairment.

Source: Nokia press release, <https://www.nokia.com/about-us/news/releases/2019/06/12/nokia-and-unicef-launch-partnership-to-boost-digital-literacy-in-primary-schools-in-kenya/>

The background of the slide is black, featuring a series of dynamic, curved, and straight streaks in shades of blue and white. These streaks are concentrated in the lower half of the image, creating a sense of motion and energy. The text is positioned in the upper right quadrant, rendered in a clean, white, sans-serif font.

Appendix C.

Multistakeholder Consultation Process

As part of the strategy development process, the WBG and A4AI facilitated multistakeholder consultation meetings with key ICT industry actors between December 2018 and July 2019, including with the Commissioners from the Broadband Commission for Sustainable Development's Working Group on Broadband for All, A4AI members and partners, and WBG partners. The consultation members helped identify possible ways of increasing connectivity and reaching full coverage in Africa. The group included representatives from over 35 private companies, international organizations, and civil society groups (see below for a list of the members).

A number of consultation meetings took place as follows:

- December 11, 2018 – WG Kick-Off Meeting to discuss objectives, approach, and outline of deliverables (Virtual)
- February 4, 2019 – (Virtual)
- February 21, 2019 – Meeting on a preliminary assessment, methodology, and assumptions (Virtual)
- February 27, 2019 – (Mobile World Congress 2019)
- March 21, 2019 – (Virtual)
- April 15, 2019 – Meeting on strategy and roadmap outlines, core principles, and monitoring framework (Virtual)
- April 17, 2019 – Meeting to review the final investment model and draft strategy and roadmap outline (Virtual)
- April 28, 2019 – (Broadband Commission Annual Meetings)
- May 22, 2019 – (Virtual)
- July 9, 2019 – Meeting on draft report (Virtual)

Throughout this process, in the spirit of open communication and inclusivity, the consultation members were encouraged to provide feedback to the investment estimate modeling process, explain their organization's suggested technological and policy approach to doubling connectivity and reaching full coverage in the two regions (including investment estimates associated with each investment option), and other thoughts on the strategy of the initiative. The consultation group's inputs were incorporated throughout this strategy document.

Members of the Multistakeholder Consultation Group

- African Development Bank
- African Union
- Alliance for Affordable Internet (A4AI)
- America Móvil
- Association of Progressive Communications (APC)
- Avanti
- Bluetown
- Collaboration on International ICT Policy in East and Southern Africa (CIPESA)
- Ericsson
- European Commission
- EUTELSAT IGO
- Facebook
- Google
- GSMA
- Huawei
- Inmarsat
- Intelsat
- International Telecommunication Satellite Organization (ITSO)
- International Telecommunication Union (ITU)
- International Trade Centre (ITC)
- Internet Society
- KaiOS
- Kenyatta University
- Korea Telecom (KT)
- MainOne
- Microsoft
- MTN
- Nokia
- Novartis Foundation
- OneWeb
- Organisation for Economic Co-operation and Development (OECD)
- Paradigm Initiative
- SAMENA Telecommunications Council
- Smart Africa
- Talia/Quika
- Telefonica
- The Office of Electronic Communications (UKE), Poland
- United Nations Development Programme (UNDP)
- International Science, Technology & Innovation Centre for South-South Cooperation (ISTIC-UNESCO). Malaysia
- UNISOC
- United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS)
- United States Agency for International Development (USAID)
- Vieira de Almeida
- Village Telco
- Web Foundation
- World Economic Forum (WEF)
- Xalam Analytics

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#ConnectAfrica
#ICT4SDG

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