Telecommunications Industry in the Post-COVID-19 World

Report of the VII ITU Economic Experts Roundtable

Discussion Paper

April 2021

Acknowledgements

The following report was prepared by the rapporteur of the Economic Experts Roundtable, Dr. Raul Katz, Director of Business Strategy Research (Columbia Institute for Tele-Information) based on the input from the participants of the ITU Economic Experts Roundtable[1] and from a survey sent to the roundtable panelists. The following paper provides a summary of the responses to the survey, complemented with their comments in the course of the roundtable.

Doreen Bogdan-Martin, Director, Telecommunications Development Bureau (ITU) on behalf of ITU would like to thank Steve Brazier, President and CEO (Canalys); Mario Cimoli, Adjunct Secretary General (UN Economic Commission for Latin America and the Caribbean); Shaun Collins, CEO (CCS Insight); Benoit Denis, Senior Economist (European Investment Bank); Alison Gillwald, Executive Director (Research ICT Africa); Tim Kelly, Lead Digital Development Specialist (World Bank); Paul Lam, Strategy Officer - Digital & Technology (Asian Infrastructure Investment Bank); Alastair Macpherson, Partner and Head - Strategy Regulatory and Economics Practice (PwC); James Sullivan, Managing Director – Asia Equity Research (JP Morgan Asia); Alexandre Ménard, Senior Partner and Global Leader (McKinsey's Centre for Advanced Connectivity); Imme Philbeck, Chief Economist (SAMENA Group); Karim Taga, Managing Partner and Global Practice Leader - Telecommunications, Information Technology, Media & Electronics Practice (Arthur D Little); Fernanda Viecens, Former Commissioner at Competition Commission (Argentina) and professor of Digital Competition Law (University of San Andres-Argentina); Matt Yardley, Managing Partner (Analysys Mason); Guy Zibi, Managing Director (Xalam Analytics) for participating in the roundtable.

The roundtable was moderated by Sofie Maddens, Head of the Regulatory and Market Environment Division of the Telecommunication Development Bureau (ITU) and Catalin Marinescu, Head, Strategy and Planning Division (ITU).

[1] The ITU Economic Experts Roundtable: the telecommunications industry in the post-COVID 19 world, was organized on 4th February 2021, information is available at https://staging.itu.int/en/ITU-D/Regulatory-Market/Pages/EconomicRoundTable2021.aspx

DISCLAIMER

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of ITU and of the Secretariat of the ITU concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by ITU in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by ITU to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader.

The opinions, findings and conclusions expressed in this publication do not necessarily reflect the views of ITU or membership.

Foreword

A previous Economic Experts Roundtable discussion, held at the outset of the COVID-19 pandemic in June 2020, highlighted the crucial role of digital technologies in keeping our societies and economies functioning. During those discussions, experts warned that the persistent digital divide is acting as a major barrier preventing underserved populations from maintaining a semblance of 'life as normal' under the pandemic. It was in this context that a second Economic Experts Roundtable was held to look at specific solutions to address the chronic lack of digital access that is leaving unconnected communities ever further behind.

This roundtable shifted the focus away from assessment of the impact of the pandemic on the functioning of digital infrastructure and the implications for urgent actions, to the search for longer-term, sustainable connectivity solutions.

As many experts warned, there is no "silver bullet" that will solve the universal connectivity challenge. Country by country, region by region, ubiquitous broadband access will be achieved through the implementation of a combination of enlightened, effective and enabling business models and financing approaches that stimulate investment, which are in turn implemented according to solid policy and regulatory frameworks that prioritize affordability, local innovation, human capacity building, infrastructure and resource sharing, and more.

In line with the theme of the forthcoming World Telecommunication Development Conference (WTDC-21) – *Connecting the unconnected to achieve sustainable development* – the outcomes of this second Economic Experts Roundtable offer a range of responses to the challenges wrought by the COVID-19 pandemic, identifying potential business models, innovative financing approaches and public-private collaboration opportunities that could help pave the way to universal, meaningful and sustainable connectivity.

It is my hope that this report proves useful, both to ITU Members as well as to the broader community of ICT stakeholders from across the entire digital ecosystem, as we learn from the lessons of this pandemic and strive to take concrete, actionable measures that put access to quality digital networks within reach of all and support the development of a thriving global digital economy.

Doreen Bogdan-Martin
Director, ITU Telecommunication Development Bureau

Table of Contents

List of Acronyms and abbreviations

Average Revenue Per User	ARPUs
Corporate Social Responsibility	CSR
Debt Service Reserve Account	DSRA
Development Finance Institutions	DFI
Environmental, Social and Governance	ESG
Federal Communications Commission	FCC
Gulf Cooperation Authority	GCC
Gulf Cooperation Council Interconnection Authority	GCCIA
Mobile Network Operators	MNO
National Broadband Network	NBN
Public-Private Partnerships	PPP
Return On Equity	ROE
Return On Investment	ROI
Sustainable Development Goals	SDGs
Small and Medium-sized Enterprises	SME
Special Purpose Vehicle	SPV
Universal Service Funds	USF
Weighted Average Cost of Capital	WACC

EXECUTIVE SUMMARY

The VIIth Economic Experts Roundtable was convened to understand and take stock further on some of the new business models and potential funding approaches to deliver universal connectivity in the post-COVID 19 world. The roundtable was structured around two panels:

- The first panel focused on promising business and operating models that could be implemented to address the connectivity challenge; and
- The second panel addressed financial models and instruments that can be used to mobilize development finance institutions, institutional investors, private equity and public markets, as well as the public sector, in order to fund the required infrastructure.

The panels were kicked-off by outlining the nature of the challenge that needs to be tackled:

- 49 per cent of the world population does not use the Internet;
- The larger clusters of non-users are located in Africa (71 per cent), Asia and Pacific (55 per cent) and Arab States (45 per cent);
- Furthermore, 19 per cent of the population in advanced economies are also non-users;
- Part of the digital divide can be explained by the lack of network infrastructure: 15.3 per cent of the world population is not yet covered by 4G networks while 30.1 per cent of is unserved by fixed broadband;
- The network coverage gap is even larger for state-of-the art technology: 83.9 per cent of world population is not covered by 5G, while 83.1 per cent of households have not adopted FTTx;
- A large portion of the rural population remains unserved by broadband networks: twenty-nine percent of the world's rural population is not served by 4G networks, while the unserved value for the urban population is only five percent; and
- The unserved rural population is even higher for Africa (78 per cent), Arab States (56 per cent) and Eastern Europe (56 per cent).

The pandemic has exacerbated some of the difficult economic conditions driving the digital divide. Economic contraction, slower growth and rising unemployment have resulted in significant economic challenges across users of digital services. Furthermore, the pandemic has widened the divide in the availability and quality of connectivity between markets, and just as significantly, within individual markets (between urban and rural, primary vs. secondary cities, etc.). The reduction of telecommunications capital spending as a result of the COVID-19 induced economic downturn is having a negative impact on the rate of network expansion, particularly in rural areas. On a structural basis, the downward pressure on revenues due to the fact that rising traffic does not necessarily translate into rising profitability is limiting the capacity of telecommunications service providers to invest. As a roundtable expert reported, while the top five African telecommunications operators spent USD 6.0 billion in 2019 this amount dropped to USD 4.5 billion in 2020.

In this context, the objective from a public policy point of view is to broaden the perspective of how to address the connectivity challenge beyond the use of Universal Service Funds (USF). The views of the first panel around business models that can be implemented to tackle the digital divide are as follows:

- There is emerging global consensus that there is no 'silver bullet' that will solve the universal connectivity problem. On the contrary, ubiquitous broadband access will be achieved through the implementation of a combination of business models and financing approaches that need to be put in place according to specific economic and social conditions.

- The majority of innovative models to address the digital divide have existed prior to the pandemic. The pandemic has merely reinforced the need to accelerate these initiatives, scale them, or expand them to more geographies. The challenge remains scaling those approaches, so they can benefit the millions, rather than the thousands. Digital divide models require extensive cross-sector partnerships between a diverse set of organizations with a varied set of vested interests, which remain a fertile ground for "coordination failures".

- It is important to create a suite of enablers for the development of alternative wholesale access and infrastructure providers to reduce deployment costs, considering for instance, the reduction of taxation on equipment, the streamlining of relevant regulation, and the introduction of infrastructure sharing incentives.

- The potential for infrastructure sharing to reduce deployment costs and enable a positive business case exists along the following elements of the network: backhaul, ducts, towers, spectrum, and last mile access. Some examples of successful infrastructure sharing initiatives include: passive sharing (e.g.: mast, sites) partnerships, active network sharing; partnerships between complementary networks (such as providing backhaul access in exchange for meeting license obligations); revenue sharing between cell site, backhaul providers and operators; and partnerships with electric utilities and railways to enable network expansion.

- While shared network infrastructure agreements may help to drive remote geographic coverage, they may be difficult to implement in practice in the absence of government involvement. Operators are at various stages of network rollout depending on their approach to network infrastructure as a competitive advantage. If an operator has invested heavily in a national network, it is unlikely that it will want to offer its competitors access to that advantage. There are examples where regulatory facilitation has addressed this issue in a successful way. For example, the Shared Rural Network in the United Kingdom developed by the UK's four mobile network operators (MNOs) with support from the government. The project consists of MNOs investing to extend their coverage by upgrading their existing networks, working together on shared infrastructure and building new sites, with new government-funded masts being built to target areas with no mobile coverage from any operator.

- Another alternative for achieving network infrastructure sharing in view of fulfilling rural coverage is through the enablement of wholesale “specialists”. The model evolves around the creation of companies focused on specific value chain stages, thereby capturing the economies of scale and scope necessary to render the deployment business case positive. The examples are numerous at the infrastructure level, such as tower companies and fiber companies.

- The emergence of open network environments can substantially reduce the costs of deployment. The concept entails creating a joint venture of telecommunications and platform companies, supported by Development Finance Institutions to provide wireless service (based on 4G technology) in rural areas. A good example of this model is the “Internet Para Todos” implemented in Peru. The venture, in charge of deploying, operating and owning the mobile infrastructure, is co-owned by Telefonica, Facebook, IDB Invest and CAF Latin America Development Bank. Relying on OpenRAN technology, this network provides a multivendor, multi-operator open ecosystem of interoperable components. Telefonica supplied over 3,000 sites and it is planning to roll out additional ones. Facebook provides capital and technology, while the two development institutions provide additional funding.

- Another way to tackle the digital divide is a model where the downstream “rural e-services” like rural financing, e-commerce, and media platforms drive the demand and need first, which will then encourage telecommunications operators to build up connectivity in rural areas. This model has been successfully implemented in China, where Internet platforms, like Tencent and Alibaba have been important stimuli in driving telecommunications network deployment.

With regard to financing models, roundtable panelists agreed on the following points:

- In addition to traditional models such as the classic project financing model, public private partnerships, Universal Service Funds, and demand subsidization approaches, there are many other possibilities regarding new funding models and financial instruments. They include loss guarantee schemes, collaborative deployment models, government anchor tenant model, multiple-funding model (including service providers and a second party such as a utility company or a digital platform), and demand aggregation models.

- Blended finance is important due to the concern that telecommunications projects in rural areas lack a bankability case. This is important since tackling the digital divide requires to crowd-in investment from a diversity of investors with different risk profiles from equity to senior debt. Those investors may be private equity, pension funds, development finance institutions, commercial banks, and corporates. The issue is how to attract investors to make the projects not only viable but also render the financial benefit proportionate to the risk. In rural telecom projects, there is no

offtake,[2] so financiers need to bear the commercial risk. This is unusual in project finance structures – at least for risk averse infrastructure investors.

- Pooled financing is a well-established and highly successful means of mobilizing private financing for small infrastructure projects in both developed and developing countries. In developed countries, these types of pooled funds mechanisms are established as governmental, quasi-governmental, or legally independent non-profit entities or agencies that aggregate a number of local projects for financing. By "pooling" multiple borrowers needs together, pooled funds (e.g.: State Bond Banks, State Revolving Loan Funds, county improvement authorities, city economic development agencies, and similar agencies) can offer larger debt issues, with better credit ratings. Because pooled issues can be structured to achieve high credit ratings in the primary market, debt-servicing costs are reduced. A pooled financing facility is created to finance multiple small rural telecommunications projects, with several lenders (public or private) taking its pro rata exposure to each of the projects.

- More than ever, the public sector, especially in developing countries, has limited resources to achieve the objectives that the current situation demands. However, governments can significantly support infrastructure projects through in-kind contributions and provision of incentives such as tax credits, free or low-cost permits (such as rights of way), and financial guarantees to investors. In addition, governments can: (i) subsidize capital costs by offering loans with interest rates lower than the market rate and more extended tenor; (ii) co-invest with the private sector if deployment takes place in rural areas;(iii) offer grants through a universal service fund; (iv) reduce property taxes for facilities deployed in rural areas; (v) exempt sales taxes and import duties for equipment acquired for purposes of deploying network infrastructure in rural areas; (vi) Promote aggregation of demand from public entities (schools, safety, health care) in order to create an "anchor tenant" effect; (vii) promote synchronization of infrastructure development (e.g.: trenching) across infrastructure development parties; and (viii) provide access to cell deployment sites on public property (rooftops in public buildings).

- Another complementary approach would be to include "connectivity" in private sector companies Corporate Social Responsibility (CSR) contributions, and consider connectivity expansion as part of Environmental, Social and Governance (ESG) funding and investment objectives. These contributions are usually constrained by the objective or the target industry of the CSR fund of companies in any industries. In most cases, connectivity is not listed among their objectives and telecommunications is rarely included in their target industries, because connectivity is not recognized as an important element to achieve the typical social responsibility objectives, such as fighting hunger, improving education, reducing poverty, or improving healthcare. However, given the impact of Internet access towards development and the achievement of the United Nations SDGs, advocacy for contributions to reducing the

[2] An offtake agreement is an arrangement between a producer and a buyer to purchase or sell portions of the producer's upcoming goods. An offtake agreement is normally negotiated prior to the construction of an infrastructure to secure a market for its future output.

broadband gap should be focused on their role in achieving the SDGs, rather than as a standalone issue.

- Public-private partnerships (PPPs) are an essential tool to satisfy and advance telecommunications infrastructure needs. A PPP for the construction of a telecommunications network infrastructure requires investors (construction companies, banks, pension funds, infrastructure funds) and lenders (private sector project finance banks), and, potentially (although more difficult) access to bond public markets. Under this framework, project finance is a specialized form of financing targeted to a "stand-alone" project (a special purpose project company), whereby lending is based on project-specific cash flow, and lenders rely on project contracts, not physical assets, as a security ("contract-based financial engineering").

- The role of Development Finance Institutions (DFIs) is important in addressing the digital divide. Paradoxically, it starts with doing away with the axiom that the telecoms sector must almost exclusively be driven by private capital, a concept very relevant in the developing world. This has fostered a “middle class-centric” view of ICT markets, whereby private capital investments are primarily focused on the needs of the growing urban middle class.

INTRODUCTION

The VIth meeting of the Economic experts Roundtable convened by the ITU in June 2020 concluded that the digital infrastructure sector needs to re-examine some of the sector's basic fundamental premises that were held before COVID-19. In particular, it was agreed that it is crucial for governments to learn from the lessons of the pandemic and take concrete, actionable measures to enable telecommunications operators and other stakeholders to provide universal access to quality digital infrastructure networks for all and support the development of a digital economy. In this context, there was an agreement among roundtable panelists that, going forward, regulatory frameworks may need to be adjusted to stimulate investment in network infrastructure whilst maintaining a "sensible" level of competition, and shifting from a "purist" to a "pragmatic" viewpoint on related State aid regulations.

In line with this conclusion, the VIIth Economic Experts Roundtable was convened to understand and take stock further on some of the business models and potential funding approaches to deliver universal connectivity in the post-COVID 19 world. While recognizing that the digital divide is driven by supply (i.e. network coverage) and demand (e.g.: affordability, digital literacy, and the like) factors, the primary focus of this roundtable was to explore the supply gap: what needs to be done from a business model and financing standpoint to deploy broadband network infrastructure with universal reach. It should be stated, however, that despite the intention to focus the roundtable on the supply side, some panelists emphasized that the primary driver of the digital divide was on the demand side and, therefore, that should be the area of focus. As stated by one panelist, "the real problem is digital inequality, not connectivity."

In line with this, the focus of this roundtable was:

(a) to explore the business and operating models that will facilitate universal connectivity, and
(b) to outline financial approaches that will facilitate the fulfillment of universal service.

A survey questionnaire was sent to the roundtable panelists. They were also requested to share any relevant research they had generated on the two topics. The following paper provides a summary of the responses to the survey, complemented with their comments in the course of the roundtable and references to the research conducted to date.

As will be explained throughout this report, there appears to be an emerging consensus that no "silver bullet" exists that might solve the universal connectivity problem. On the contrary, ubiquitous broadband access will be achieved through the implementation of a combination of business models and financing approaches that need to be implemented according to specific economic and social conditions.

Chapter 1 sets the stage based on descriptive statistics of the state of the digital divide around the world. Its purpose is to outline the extent of the problem that needs to be tackled. Chapter 2 explores different operational and business models that can facilitate the deployment of infrastructure within the "unserved" population.

Chapter 3 details the funding approaches and instruments to be considered and what is the expected role of Development Finance Institutions, institutional investors, private equity and public markets, as well as the public sector in funding the required infrastructure.

Finally, Chapter 4 outlines potential risks that exist that might stand in the way of addressing the connectivity challenge.

1 THE STATE OF THE DIGITAL DIVIDE

According to the statistics of the International Telecommunication Union, 49 per cent of the world's population does not access the Internet.[3] The digital divide varies by region, ranging from 71 per cent in Sub-Saharan Africa to 17 per cent in Europe (see table 1).

Table 1. Percentage of individuals not using the Internet (2019)

Sub-Saharan Africa	71%
Arab States	45 %
Asia and Pacific	55 %
CIS	27 %
Europe	17 %
North America	9 %
Latin America	31 %
WORLD	**49 %**

Source: ITU estimate

As the data indicates, the digital divide is not only a feature of developing countries, although among developed economies, the divide is 19 per cent, while in developing countries it increases to 56 per cent.

While Internet adoption can be explained by multiple demand variables, such as limited affordability for purchasing broadband service or lack of digital literacy, part of the penetration gap can also be attributed to the lack of network coverage. For example, 84.7 per cent of the world population has access to 4G networks and 69.9 per cent to fixed broadband networks. Network coverage decreases significantly in the developing world (see table 2).

Table 2. Percentage of uncovered population (2020)

	4G Networks	Fixed broadband
Africa	55.7 %	53.3 %
Arab States	38.1 %	23.9 %
Asia and Pacific	5.8 %	37.6 %
CIS	19.2 %	6.2 %
Europe	2.8 %	5.1 %
North America	2.1 %	4.1 %
Latin America	14.0 %	11.0 %
WORLD	**15.3 %**	**30.1 %**

Source: (4G) ITU; Fixed broadband (Eurostat; OECD; Ovum; extrapolation to 2020 by Telecom Advisory Services)

[3] The ITU defines Internet access as those individuals using the Internet from any device (including mobile phones) in the last 12 months. A growing number of countries are measuring this through national household surveys. In countries where household surveys are available, Internet penetration should correspond to the estimated number derived from the percentage of Internet users surveyed. If the survey covers percentage of the population for a certain age group (e.g.: 15-74 years old), the estimated number of Internet users should be derived using this percentage. In situations where surveys are not available, an estimate can be derived based on the number of broadband subscriptions.

While the coverage of 4G networks and fixed broadband has reached a significant level in the past years, this is not the case for more advanced technologies such as 5G and FTTx. The percent of population covered by 5G and households served by state-of-the-art fixed broadband technology such as FTTx is significantly lower, even in some advanced economies (see table 3).

Table 3. Percentage of households unserved by FTTx (2020)

	Uncovered by 5G	FTTx Non adopting households
Africa	100 %	99.2 %
Arab States	84.6 %	92.8 %
Asia and Pacific	85.0 %	63.8 %
CIS	83.6 %	70.4 %
Europe	75.8 %	63.7 %
North America	36.2 %	76.6 %
Latin America	96.8 %	86.8 %
WORLD	**83.9 %**	**83.1 %**

Source: 5G (GSMA Intelligence); FTTx (IDATE; Fiber Connect LATAM; extrapolation to 2020 by Telecom Advisory Services)

As expected, the unserved population is primarily concentrated in rural areas: twenty-nine percent of the rural population is not served by 4G networks, while the unserved portion for the urban population is only five percent (see table 4).

Table 4. Percentage of uncovered population by 4G networks (2020)

	Urban	Rural
Africa	23 %	78 %
Arab States	24 %	56 %
Asia and Pacific	0 %	11 %
CIS	0 %	56 %
Europe	0 %	11 %
The Americas	2 %	46 %
WORLD	**5 %**	29 %

Source: ITU

To sum up, the main clusters of unserved population worldwide in 2020 are as follows:

- 49 per cent of the world population (or 3,341 million individuals) does not use the Internet
- The larger clusters of non-users are located in Africa (71 per cent or 425 million people), Asia and Pacific (55 per cent or 2,227 million) and Arab States (45 per cent or 121 million)
- That said, 19 per cent (170 million individuals) of population in advanced economies are also non-users
- Part of the digital divide can be explained by the lack of network infrastructure: 15.3 per cent of the world population (1,043 million) is not yet covered by 4G networks while 30.1 per cent of households (or 540 million) is unserved by fixed broadband

- The network coverage gap is even larger for state-of-the art technology: 83.9 per cent of world population (5,721 million) is not covered by 5G, while 83.1 per cent of households (1,489 million) have not adopted FTTx
- As expected, the coverage gap of advanced network technologies is even larger in the developing world: 96 per cent of the population in the developing world is not served by 5G, while 93 per cent of households in the same regions have not adopted FTTx
- A large portion of the rural population remains unserved by broadband networks: twenty-nine percent of rural population is not served by 4G networks, while the unserved value for the urban population is only five percent
- The 4G unserved rural population is even higher for Africa (78 per cent), Arab States (56 per cent) and Eastern Europe (56 per cent)

COVID-19 has exacerbated some of the difficult economic conditions driving the digital divide. Economic contraction, slower growth and rising unemployment have resulted in significant economic challenges across users of digital services. Furthermore, the pandemic has widened the divide in the availability and quality of connectivity between markets, and just as significantly, within individual markets (for example, between urban and rural, as well as primary vs. secondary cities). As anticipated in the VIth Roundtable with regard to 5G deployment, service providers in countries with relatively advanced development will continue with their roll-out plans, while operators in nations with embryonic deployment (e.g.: developing countries) would slow down 5G investment. For those carriers pursuing 5G roll-out, investment in network modernization would be primarily focused on urban environments, postponing deployment of new technology in suburban and/or rural areas. The low average revenue per user (ARPUs) in developing countries would force telecommunication operators to postpone capital spending in 5G. As mentioned by one expert: "The reduction of telecommunications capital spending as a result of the COVID-19 induced economic downturn will have a negative impact on the rate of network expansion, particularly in rural areas." In addition, some experts considered that "delayed deployment of 5G and extended high-speed and fiber networks in many countries means a longer period before businesses and consumers in these markets get access to higher speeds and advanced services."

The dichotomy is clear in terms of network deployment. For example, we are witnessing an acceleration of fiber/4G/5G deployments in some advanced markets while other regions continue relying on 3G connectivity. Similarly, access to cloud services and applications remains highly uneven. This trend of reinforcement of social and technology inequalities remains a long-term challenge with no short term/visible solutions. In the words of a panelist, "the divide may get worse before it gets better".

On the supply side, the pandemic has also affected the capability of ICT service providers to tackle the challenge of unserved populations. On the positive side, as explained by a panelist, "the old perception of lumbering telecommunications operators that lacked agility to respond to environmental changes has disappeared. Operators were able to respond quickly in some of the direst circumstances". That said, despite being largely resilient in the face of the pandemic, the ICT sector remains exposed to broader economic headwinds, undergoing considerable pressure on working capital and liquidity. At the macrolevel, telecommunications service providers are facing limited incremental revenues, combined

with rapidly increasing operating costs, which drive declining margins. For example, Asian telecommunications service providers have witnessed a decline in median earnings before income tax from 17% in 2013 to 11% in 2018 and 14% in 2019.[4] As anticipated in the VIth Roundtable, service provider capital requirements are growing while their marginal profitability is under pressure.[5] On the one hand, there is a strong pressure to increase CAPEX to expand capacity and coverage, compounded by the pressure to kick off the next cycle of spectrum investments (5G) with still limited visibility on revenue models. Moreover, strong data usage leads to a significant increase in base station requirements and, consequently, higher CAPEX demands. On the other hand, the downward pressure on revenues due to the fact that rising traffic does not necessarily translate into rising profitability is limiting the capacity to invest. As an indication of the declining ability of telecommunications service providers to capture value, it is estimated that more than 35% of revenues created on content is being captured by content creators (in 2008 the percentage was approximately 12%).[6] This supply side situation adds to the pressure to find other innovative approaches to address digital access inequality.

On a related matter, a view was shared among panelists that universal service funds (USF) cannot on their own address the huge demands for connectivity. As mentioned by a panelist, "If we look at Africa, for example, a study that was done in 2018 for 37 countries, observed that there were USD 408 million in undisbursed funds. This amount is insufficient when set against the gap of USD 100 billion, calculated by the recent moonshot report that the Working Group at the Broadband Commission did to achieve universal access to broadband connectivity by 2030." In other words, we need other solutions.

2 BUSINESS AND OPERATING MODELS

Innovative business models to address the digital divide have existed prior to the pandemic. The pandemic has merely reinforced the need to accelerate these initiatives, scale them, or expand them to more geographies. In fact, technology-based operating models that have considerably slashed the cost of delivering basic Internet access to lower income groups already exist. For example, fiber and/or satellite backbones supplemented by Wi-Fi hotspots, the use of local caching and IXPs to reduce transmission costs, the use of renewable sources of energy to power remote base stations are some of the approaches already used in developing markets, with a moderate level of success. In the words of a panelist, "the provision of a blend of mobile and fixed technologies to these economically challenging environments should become a very significant part of government and operator agendas".

Additionally, zero-rated models have also been implemented in a range of markets. Zero rate access to key health and education applications on the web through mobile has become an important initiative. Once the COVID-19 health emergency has eased, it will be very hard for the operators to roll these offers back partly because operators have been required to

[4] Sullivan, J. (2021). *How we think about thinking about telcos*. J.P. Morgan Asia Pacific Equity Research (February), p. 15.
[5] As stated by Sullivan, J. (2021). Ibid. "Since 1-Jan- 2017: Telcos have underperformed by c.100% driven by three factors: (i) Market realization that increasing data usage does not lead to faster revenue growth; (ii)Market realization that increasing data usage leads to increasing capex; (iii) Increasing CAPEX leads to higher OPEX, hence, lower returns on capital"
[6] Ibid., p. 13

consider these communities much more acutely than in the past, especially as lockdown has compromised so many vulnerable and at-risk groups.

In sum, in the view of a roundtable panelist, "the problem is (less finding other models but) scaling (the existing ones) so they can benefit the millions, rather than the thousands. That remains extremely difficult to do. Digital divide models require extensive cross-sector partnerships between a diverse set of organizations with a varied set of vested interests. In this context, imposing a model at scale has consequences that are far-reaching, difficult to appreciate – and highly political." As stated in McKinsey's Report on worldwide connectivity, "(addressing the digital divide) would require the public sector, and other private investors to step in to support rural coverage to ensure more inclusive access."[7] In the words of a panelist, "There is a need for business models and regulations that make it possible for providers to move outside of the traditional profitability paradigms and expectations to deliver the type of access to connectivity that is both meaningful and affordable for most people."

The following section presents a list of business and operating models that are likely to become instrumental in closing the connectivity gap. The objective is to broaden the perspective of how to address the connectivity challenge beyond the use of Universal Service Funds (USF). In the words of a panelist, "USFs are not the ideal way forward to close the gap. There are many other solutions that may turn out to be better and less distorted ways to do this. If a country wishes to keep the USF in place or establish one, two things need to happen: first, contributions to USFs that are and have been made need to be subject to effective disbursement mechanisms and used for the purposes that they were collected for as a necessary condition. Secondly, the total amount of the funds needs to grow and one way to achieve this, it is through broadening the contributing basis, to include all of those that derive economic benefit from the investment."

2.1 Wireless Infrastructure sharing

The potential for wireless infrastructure sharing to reduce deployment costs and enable a positive business case exists along all elements of the network. Among the most common infrastructure sharing initiatives, the following should be considered:

- Network infrastructure sharing partnerships;
- Partnerships between complementary networks (such as providing backhaul access in exchange for meeting license obligations);
- Revenue sharing between cell site, backhaul providers and operators; and
- Partnerships with electric utilities and railways to enable network expansion.

However, as stated by a panelist, "sharing is a great idea that is difficult to implement". While shared infrastructure network agreements are the right way to approach the connectivity challenge in rural areas, some panelists recognized that they are difficult to implement without government intervention. Infrastructure sharing does not come as a natural strategy to operators. Operators at various stages of network rollout may have different attitudes

[7] Gripnik, F. et al. (2020). *Connected world: an evolution in connectivity beyond the 5G revolution*. McKinsey Center for Advance Connectivity Discussion paper.

towards network infrastructure as a component yielding competitive advantage. Clearly, if an operator has invested heavily in a national network, it is unlikely that it will want to offer its competitors access to that advantage.[8] As stated by one panelist, "under some competitive market conditions, operators might on their own, arrange socially optimal solutions. In contrast, owners of infrastructure that confers dominant positions will not be prone to share it." On the one hand, the competitive differentiator inherent in network investment and deployment is expected to increase with 5G. On the other hand, 5G technology, in its capacity to support broader network diversity, combined with the extent of cloud computing at the core and edge of networks could facilitate the rethinking of new sharing business models.

In this context of the potential "coordination" challenge, some panelists considered that infrastructure network sharing will require third party management and a likely legislative input, regulatory intervention and incentives. For example, infrastructure sharing is being actively promoted in the Arab States region by regulators. The Communications and Information Technology Commission in the Kingdom of Saudi Arabia announced in June 2020 that it wants to introduce favorable legislation to encourage investment by existing and new tower owners geared towards more infrastructure sharing. Regulations are now being issued advocating strong support for both passive and active sharing. As another example, the new National Broadband Plan of Albania includes active and passive infrastructure sharing as one of the key recommendations, including infrastructure sharing with other utility providers. Another type of intervention would be to add to the spectrum auction conditions the need to achieve rural coverage through infrastructure network sharing. However, in the opinion of a panelist, this is unlikely to happen in some cases because governments need the financial outcome of the auction proceeds now more than ever and this condition could erode such proceeds.

Alternatively, some panelists considered that commercially driven infrastructure sharing appeared to be more effective. In this context, governments should build the necessary conditions and allow operators to formalize such agreements on their own. Policies in this domain include allowance for active infrastructure sharing among telecommunications operators and between them and other infrastructure providers such as electric utilities. A panelist observed that in recent months, prompted by the pandemic, some regulators had "relaxed" the conditions under which infrastructure network sharing had to be achieved. In some cases, governments can also drive infrastructure sharing through, for example, public private partnerships (see below).

2.2 Creation of wholesale rural wireless infrastructure company

One approach for achieving network infrastructure sharing in view of fulfilling rural coverage is through the enablement of wholesale "specialists". The model is based on the creation of companies focused on specific value chain stages, thereby capturing the economies of scale and scope necessary to render the deployment business case positive. The examples are

[8] This concept was been studied in depth in the context of platform industries. See Shapiro, C. and Varian, H. *Information rules: a strategic guide to the networked economy.* Harvard Business School Press: Boston, MA, 1999, and especially in Eisenmann, T. (2008). "Managing proprietary and shared platforms", *California Management Review*, Summer 2008, Vol. 50, No. 4.

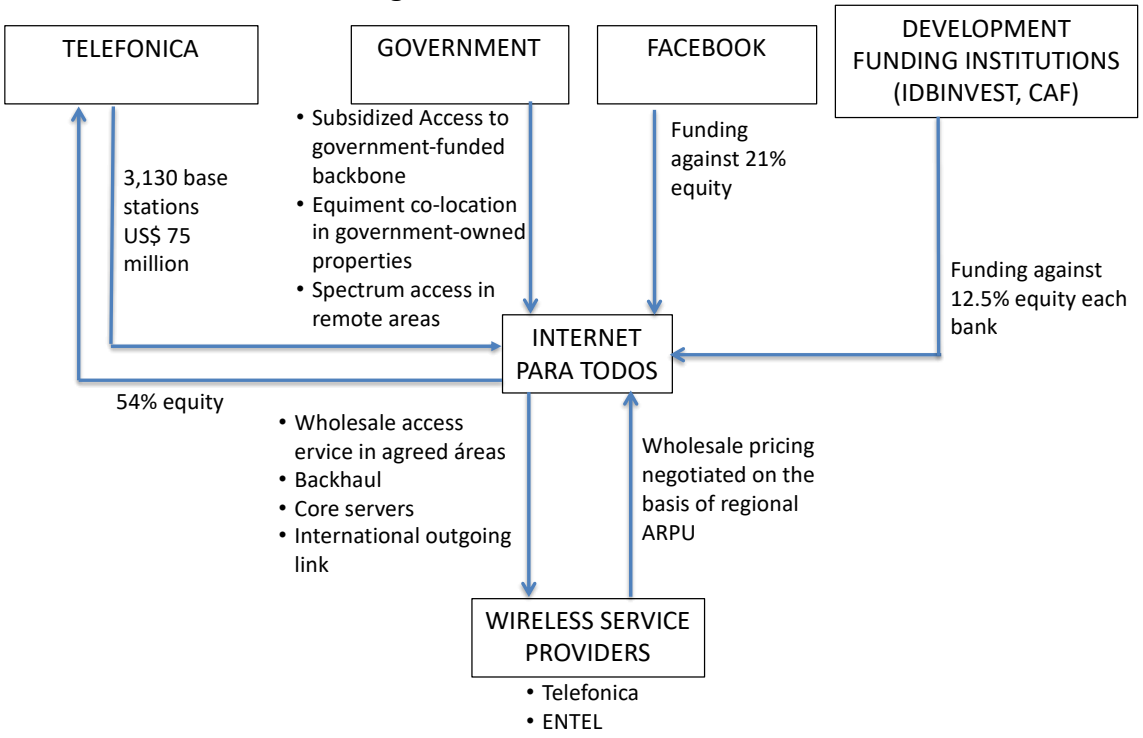
numerous at the infrastructure level, such as tower companies or fiber companies. In the wireless segment, the emergence of open network environments can substantially reduce the costs of deployment. The concept entails creating a joint venture of telecommunications and platform companies, supported by Development Finance Institutions to provide wireless service (based on 4G technology) in rural areas.

One of the most prominent examples of this model is the “Internet Para Todos” implemented in Peru. With a plan to cover over 30,000 remote communities, the venture, in charge of deploying, operating and owning the mobile infrastructure, is co-owned by Telefonica, Facebook, IDB Invest and CAF Latin America Development Bank. Each partner contributes an equity investment resulting in Telefonica owning 54%, Facebook 21%, and each of the two Development Banks, 12.5%. In addition to a USD 75 million investment, Telefonica contributed 3,100 base stations.

The government also contributes to the venture in terms of providing access to the government owned backbone network, the ability to co-locate equipment in government-owned facilities, and access to licensed spectrum in isolated areas of the country. Internet Para Todos is completely autonomous from Telefonica (despite its majority holding, it does not consolidate financial results within the group). The four equity holders have equal decision rights over the venture. Relying on OpenRAN technology, this network provides a multivendor, multi-operator open ecosystem of interoperable components. The venture offers wholesale service in rural and isolated areas to wireless service providers, in addition to backhauling, core servers, and international outgoing link. So far, Telefonica and ENTEL have signed service agreements, although the venture can also sell access to private companies deployed in remote areas (e.g.: mining operations).

As part of the service agreement, the operator defines the areas that it needs to be covered and negotiates a wholesale price per minute as a function of the ARPU in the area to be served (in order to avoid a potential “price squeeze”) (see figure 1).

Figure 1. Internet Para Todos Model



Source: Internet Para Todos

Implicit in this model is the need to broaden the scope of investment in rural projects beyond conventional stakeholders (i.e., telecommunication service providers) and recognize that digital platforms should also play a role. A panelist even went beyond this to suggest that Internet platforms should contribute to the universal service funds.

2.3 Wireline infrastructure sharing

In addition to wireless oriented sharing models, numerous initiatives have been developed so far in wholesale backhaul and last mile shared wireline networks. The model can also include government subsidized networks.

Within the first category, we count examples such as the Red Dorsal in Peru, and the *Agence de l'Informatique de l'Etat* in Senegal. The Red Dorsal in Peru was conceived as a government sponsored neutral network where the State assigned a contract, funded from the Telecommunications Investment Fund to a private party for construction, operation and maintenance for twenty years. The network is comprised of a national backbone and a set of regional networks covering all districts of the country, offering carrier services to other operators for a single national tariff.

In another case, the government of Senegal through its *Agence de l'Informatique de l'Etat* manages a fiber optic network that provides connectivity to government offices in all regional and municipal capitals. The network is based on 4,045 kms of fiber optics providing 10 Gbps transmission capacity, covering 14 regions and 31 departments. The ADIE network is currently undergoing an expansion program (*Projet d'Appui Structurel a la Stratégie d'Aménagement Numérique du Territoire*) with the purpose of extending the network by 340,000 kms.,

improving backhaul links with 75,000 kms. of fiber optic and linking over 400 government buildings.

Multinational wireline sharing networks are also being developed. For example, the Gulf Cooperation Authority (GCC), an institution formed between the Gulf Nations to promote coordination, integration and interconnection among the Member States, created the Gulf Cooperation Council Interconnection Authority (GCCIA), a joint stock company subscribed to by the six Gulf states and based in Saudi Arabia. GCCIA's core activities consist in linking power grids across the GCC countries and operating and maintaining the interconnection grid. In addition, GCCIA leases out to telecommunications operators its fiber-optic cable network along its regional power-line network.

Within last mile fiber network model, there are numerous examples of municipally-owned networks. For example, the Draadloos Groningen (Wireless Groningen) Foundation signed an agreement in 2009 with Unwired Holding to deploy and manage a citywide wireless broadband network.[9] The project began as an "anchor tenant" model in which the founding members (the Municipality of Groningen, the Hanzehogeschool Groningen, the University of Groningen, and the University Medical Center) agreed to fund the network in return for being able to use it for their own communications and services. Each of the initial members agreed to contribute €1 million over four years, which is aimed at guaranteeing the initial financial stability of the network in its start-up phase as well as demonstrating the network's ability to deliver a wide range of services. The plan also calls for Draadloos Groningen and Unwired Holding to sell access to the network to government agencies, businesses, and consumers.

In the domain of government subsidized efforts, we count examples such as the National Broadband Network in Australia and Chorus in New Zealand. The National Broadband Network (NBN) is an Australian national wholesale open-access data network project. It includes wired and radio communication components rolled out and operated by NBN Co Limited. Internet service providers, known under NBN as retail service providers or RSPs, contract with NBN to access the network and sell fixed Internet access to end users.[10]
Chorus is a provider of telecommunications infrastructure throughout New Zealand. The entity is the owner of the majority of telephone lines and exchange equipment in New Zealand. It is also responsible for building approximately 70% of the new fiber optic Ultra-Fast Broadband network. The company was demerged from Telecom New Zealand in 2011, as a condition of winning the majority of the contracts for the Government's Ultra-Fast Broadband Initiative. By law, it cannot sell directly to consumers, instead it provides wholesale services to retailers.[11]

[9] Vos, Esme. 2009. "Groningen, Netherlands Deploys Municipal Wireless Network." *MuniWireless*, April 15. http://www.muniwireless.com/2009/04/15/groningen- deploys-muni-wireless-network.
[10] LeMay, Renai (9 March 2011). "NBN: What does 'retail service provider' actually mean?". *Delimeter*. Retrieved 21 August 2019.
[11] *"Chorus signs $1b broadband deals". 3 News NZ. April 17, 2013.*

2.4 The role of 5G in tackling the digital divide

The deployment of 5G technology is having an impact not only on standard mobility but also in a multiplicity of human endeavors (see table 6).

Table 6. 5G impact domains and use cases

Domains	Use Cases
5G on the move	1. Remote operations to manage workplaces, generating data-driven insights to ensure better productivity as well as safe and secure operations.
	2. Connected transport through real-time vehicle-to-vehicle communication enables a partly driverless future, making travel and transport safer and more efficient.
	3. Mass adoption brings a new wave of smart and personalized services to connect our increasingly integrated digital and physical lifestyles post pandemic.
5G on-site	4. Smart monitoring enables the automation of asset-management processes freeing up time for asset utilization and increasing workplace safety and security.
	5. Environmental protection will benefit from new management techniques, driven by the ability to monitor, assess and act in a sustainable manner as 5G scales up.
	6. Autonomous robotics allows real-time automation to improve efficiencies in carrying out complex and repeatable, sometimes hazardous, operational tasks.
5G in communities	7. Democratizing 5G enables a wider uptake of benefits across communities through public-private collaboration, which results in a more efficient use of scarce, available resources.
	8. Regionalizing 5G by encouraging earlier deployment through incentives, benefiting people and businesses based outside major urban centers.
	9. Experiential living – transforming our interactions socially, in classrooms, while gaming, with families, and in many other social and community settings.

Source: PwC (2021). 5G Outlook Series: Enabling Inclusive Long-term Opportunities

These multiple areas of impact will become more relevant in the post-COVID world. Stimulating 5G deployment in rural and isolated areas will enable communities to benefit from digital innovation. However, as expected, the deployment costs of 5G in rural areas is extremely high relative to areas of high density. The capital per population required to deploy 5G in a rural area has been estimated at USD3,981 (see table 7).

Table 7. **United Kingdom: 5G Capital Investment**

	Town/City (Million)	Population distribution	5G CAPEX ($ billion)	5G CAPEX (%)	CAPEX per population
Urban (cities >1 million)	19.42	29%	$0.89	1.66%	$45.71
Suburban	36.16	54%	$7.13	13.37%	$197.16
Rural	11.38	17%	$45.32	84.97%	$3,981.22
Total	66.96	100%	$53.34	100%	$796.58

Source: Oughton and Frias (2017). Exploring the cost, coverage and rollout implications of 5G in Britain; Telecom Advisory Services analysis

Applying these benchmarks to a country like Mexico would result in an investment requirement of USD27.18 billion[12], in a nation where wireless operators annual CAPEX is approximately USD 2.07 billion.[13] This is why one panelist stated that, "5G will not solve the rural connectivity challenge in the developing world."

[12] Katz, R. and Callorda (2021). *Estimacion del valor economico del uso no licenciado de la banda de 6 GHz en Mexico*. Washington, DC: Dynamic Spectrum Alliance.
[13] Source: GSMA Intelligence.

In this context, governments may choose to provide resources to promote 5G deployment in rural areas. As an example, the Federal Communications Commission (FCC) in the United States recently approved a rural 5G connectivity scheme, which provides funding to private mobile telecommunications operators. The scheme enables them to bid for financial support specifically to deploy 5G networks in rural areas with lower than urban population densities, increasing the possibility that US citizens and businesses in rural areas benefit from 5G sooner.

3 INNOVATIVE FUNDING MODELS

Initiatives for funding network infrastructure deployment in low-income and rural markets is primarily about improving the risk/return profile of the investments. The reality is that "digital divide" projects tend to have unattractive return on investment (ROI) profiles. Development Finance Institutions (DFIs) can use their scale and cross-purpose position to help reduce this risk profile (or redefine it entirely) so other investors can be brought in.[14] In that sense, roundtable participants saw the role of DFIs as vital in taking the lead and making this happen. Paradoxically, in view of a panelist "(this should) start with doing away with the axiom that the telecoms sector must almost exclusively be driven by private capital. This perspective has fostered a "middle class-centric" view of ICT markets, whereby private capital investments are primarily focused on the needs of the growing urban middle class. While broadly successful from a middle-class perspective, the model has shown its limits when it comes to connecting the unconnected and achieving the broader objective of digital inclusion". In this context, DFIs must play a more aggressive role in financing digital inclusion initiatives and stimulating operators to move out of their "comfort zone".

This means implementing approaches that, in the words of a panelist, "are better suited to conceptualizing and financing rural area projects, including new financing and implementation models, and fresh approaches to private sector incentivization". Grants, concessionary financing, earlier stage investments in rural area projects can make them more palatable for other private sector investors. Other approaches include creating funding structures or mechanisms that are more suitable for rural area projects; redefining return expectations for bottom of the pyramid projects – and refocus DFIs' role towards coalescing resources and participation from governments, the private sector and local communities.[15]

Tackling the digital divide requires to crowd-in investment from a diversity of investors with different risk profiles from equity to senior debt. Those investors may be private equity, pension funds, development finance institutions, commercial banks, corporates. The requisite to attract investors is making the projects not only viable but also define the financial benefit proportionate to the risk. In most rural telecom projects, there is no offtake.[16] So,

[14] See Zibi, G. (2018). *Multilateral Development Banks' Investments in the ICT sector*. Alliance for Affordable Internet and the World Wide Web Foundation.

[15] Based on Zibi, G. estimates conducted throughout 2017, multinational development banks (MDBs) have largely focused their ICT infrastructure investments over the past five years on submarine and terrestrial fiber projects. Around half of MDB ICT infrastructure commitments have gone to such fiber transmission projects, with the balance going to broadband connectivity projects (~25% of ICT infrastructure commitments) and supporting cell tower companies (~20% of ICT infrastructure commitments).

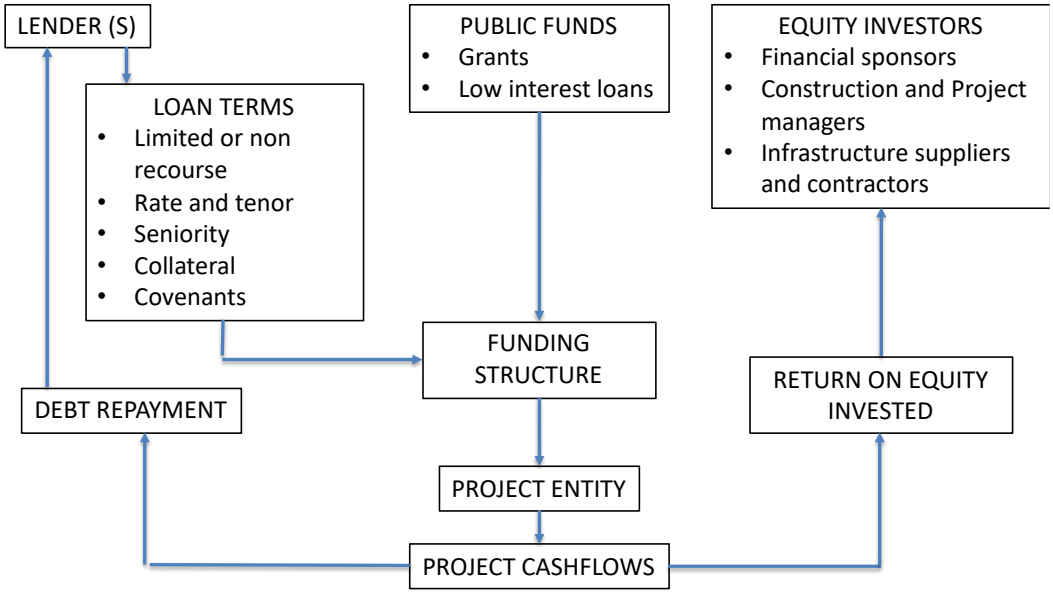
[16] An offtake agreement, typically used in electricity project financing, is an arrangement between a producer and a buyer to purchase or sell portions of the producer's upcoming goods. An offtake

financiers need to bear the commercial risk which is unusual in project finance structures – at least for risk-averse infrastructure investors.

3.1 Classical project finance model

Financing of a rural telecommunications project can be conceived as a particular case of project finance, where an investment in a capital asset generates cash flows resulting in a return to equity investors and the ability to serve the acquired debt (see figure 3).

Figure 3. Classic Project Finance Model



Source: Katz, R. (2014). Broadband Funding mechanisms. Working Paper. CAF Latin America Development Bank, September.

The financing model in figure 2 is composed of three sources of funds: private lenders (through a single institution or a syndicate), public funds (through grants or low interest loans), and equity investors. Debt financing often represents 50 per cent to 80 per cent of total project cost. In the case of DFIs, for example, they typically do not provide credit facilities covering more than 50 per cent of project costs, the remainder needs to be covered through equity, grants, or operating cash flow. The terms of debt financing are generally structured around a fixed interest rate, which results in fixed payments comprising principal and interest, with a maximum tenor ranging between 7 and 20 years. Interest payments are tax deductible. Debt financing can assume the form of "on-balance sheet", where borrowed funds reside in the entity's balance sheet and repayment is secured by project cash flow and collateralized by the entity's assets. Under an "off-balance" sheet approach, the project is structured as a

agreement is normally negotiated prior to the construction of a production facility—such as a mine or a factory—to secure a market for its future output. Offtake agreements are used to help the selling company acquire financing for future construction, expansion projects, or new equipment through the promise of future income and proof of existing demand for the goods.

legally-independent project company financed with nonrecourse debt (and equity from one or more sponsoring firms), whereby the lender has no or limited recourse to other sponsor assets. This approach expands the universe of potential sponsors since it reduces their investment risk and provides them with more flexibility. Finally, the government can extend funding in the form of grants or low interest loans.

An “off-balance” sheet approach is a typical financing approach for companies owning broadband infrastructure that sell capacity to service companies (Network operators) which, in turn, develop and sell services to end customers (service companies). In this case, lending is provided to the infrastructure company, structured as a Special Purpose Vehicle (SPV), and is collateralized by the quality of the assets owned by the SPV and their ability to service debt.

In addition to direct lending to the project company, banks can provide in parallel a loan to other financing partners (such as other investors), where the beneficiary is ultimately the project company. Alternatively, banks can provide a guarantee to the financing partners, thereby sharing the credit risk, and allowing for some capital relief.

Turning now to equity investors, a controlling stake of the project entity's equity can be owned by a single sponsor or group of sponsors, who will generally be involved in the construction and management of the project. As a result, financial investors also take an equity stake in the project. Financial investors are of five types:

- Institutional investors (pension funds, insurance companies, etc.): they tend to focus on stock exchange listed companies, rarely making exceptions (which would then exclude at least for the time being, a rural telecommunications company);
- Banking institutions: driven by current financial markets conditions, they are extremely risk averse, which leads them typically to fund the replacement of existing networks, rather than start-up businesses; their participation is done through funded risk-sharing facilities. Typically, commercial banks do not handle equity financing because of its longer term;
- Private equity and venture capitalists: Private equity funds would be willing to invest in telecommunications infrastructure, while venture capitalists, constrained by a short-term investment horizon, would shy away from it. In the case of venture capitalist, their willingness to invest is driven by a compelling investment thesis, generally focused on growing vertically integrated closed business models; two types of venture capitalists exist: seed/early stage funds and formal venture capital funds;
- Angel investors: these investors fund a business at a start-up point with the purpose of capturing a high upside by virtue of assuming a large equity position; these positions are typically taken at the front-end of a process of a greenfield deployment, and are focused on providing seed financing and supporting investment readiness analysis;
- Governments: driven by policies pointing toward stimulating telecommunications deployment, public finance sources tend to display national blanket coverage approaches, typically focused on providing funding to open access business models.

Additionally, technology infrastructure suppliers can either assume an equity position or extend credit for payment of the equipment.

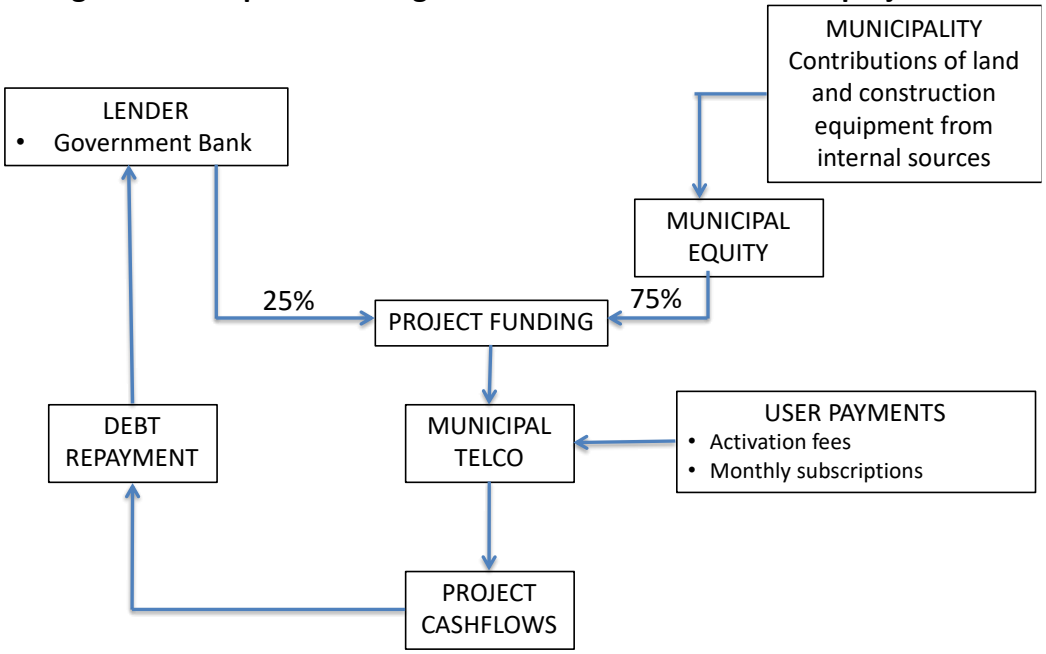
The type of project sponsor has an influence on the selected financing strategies. If a large incumbent handles the telecommunications deployment, the financing model obviously differs in terms that no sponsors beyond the incumbent would share in the equity. That said, co-investment models, where operators partner up with investment funds are becoming increasingly common, especially in Europe. Funding for the network rollout could be handled through capital sourced from either cash flow or borrowed funds through bank loans and/or guarantees. While, as mentioned above, a bank typically finances up to 50 per cent of the eligible project costs, the amount of the loan resides on the balance sheet of the corporation sponsoring the project (as the "on-balance sheet approach" described above) since the guarantee is conceived as the ability of the company as a whole to service the debt. In this case, borrowing costs would benefit from the weighted average cost of capital (WACC) of the incumbent. In general, the WACC of an established incumbent is lower than that of a new entrant due its lower risk profile.

When roll-out responsibility does not lie on the incumbent, the financing model often entails the creation of a legally independent project company, funded with non or limited recourse debt and equity provided by one or more project sponsors. Debt servicing and the return on equity invested are typically funded out of the project cash flow, which means the security of project debt and reliability of return on equity (ROE) depends on the project profitability. While project finance is a complex, and slow form of financing, it is used for some municipal networks.

3.2 Municipal financing models

The classical project finance model reviewed above can be adapted to a rural project where the primary equity holder might be the local municipality (through a cooperative structure) and funds are typically provided by a public sector government bank, although in advanced economies commercial banks have also provided funding. Borrowed from the electric utility industry, a municipal telecommunications network funding model typically entails the participation of the municipality, maybe an investor, and a lender. Based on the classical project finance model presented in figure 2, a municipal telecommunications project could be structured as follows (note in this case, the absence of an investor, although one might envision the presence of a platform Internet company).

Figure 4. Example of funding of a rural telecommunications project



Source: Katz, R. (2014). Broadband Funding mechanisms. Working Paper. CAF Latin America Development Bank, September.

As shown in figure 4, the municipality, as a project sponsor, assumes all responsibility for gaining access for funding and managing the project. Funding under this model may come from internal capital, a public sector or commercial government bank loan, and in-kind contributions from the municipality. Debt repayment is enabled by charging an activation fee and monthly subscriptions. This type of financial model has proven to be suited for broadband projects in small urban centers in developed countries and certain areas of developing nations. The municipality (or its utility division) may provide financial and non-financial contributions to the project, such as funding for an initial feasibility study, acquisition of required permits and rights-of-way, existing dark fiber, and accessibility to infrastructure to facilitate deployment. The potential investor, if it exists, will provide equity for a start-up network against a share of the company that will operate it. Finally, long-term debt must be secured to complete the financing package. Equity investors might require leveraging their equity position by the use of debt and will not be willing to finance the entire project with equity. Typically, a project borrows as much funds as possible, at the lowest interest rate possible, and then completes the funding with investor equity. It is important to mention that lenders will require a collateral interest in the assets of the project, which might include the rights to receive senior pledge of revenues and receivables for debt payments.

There is no single financing model to fit the needs of these municipal ventures. At one end of the spectrum, there is a direct subsidy model, where public funds supplied by the government finance the project in its entirety. In the second model, the local government invests as would a private player in a business venture and borrows funds from a public source. In the third case, the municipality borrows funds from the private credit markets in order to finance the project. Such case is more viable in developed markets although it could apply to areas with higher revenue potential in the developing world. The fourth model is a hybrid of the second and third models, where the municipality or confederation of municipalities borrows funds

both from public and private sources. Each of these four models exhibits advantages and disadvantages (see table 8).

Table 8. Advantages and disadvantages of municipal financing models

Model	Description	Advantages	Disadvantages
1. Direct Subsidy	Public funds pay for broadband project for an open access business model	• Local government retains ownership of infrastructure • Local government can ensure own needs are covered	• Ongoing financing required • Continued reliance on state aid • Public sector assumes market risk • Competitive encroachment could erode project viability
2. Local Investment	Local government invests as would a private player in a private venture deploying the infrastructure	• No state aid • Local government bears the failure risk alone • More lenient credit terms (rates, maturity) based on municipal profile	• Need to rely on public funds to invest • Risk of impacting local taxes • Potential competitive retaliation • Highly dependent on income of population
3. Private credit financing	• Same as above, but funds borrowed from private sources • Service revenues are earmarked to service debt	• No impact on taxes • Does not need to reach critical mass in order to qualify for EIB support	• Potentially, but not necessarily, worse credit terms than from public sources • Forces a period of full service ran by local government • Risk of bankruptcy unless favorable covenants are negotiated
4. Public /Private credit financing	Similar as above, but funds borrowed from public and private sources	• Private lenders tend to follow the more lenient credit terms of public sources, sometimes enabled by partial risk guarantees • No impact on local taxes	Borrowing from private sources could be affected by restricted access to capital

Source: Katz, R. (2014). Broadband Funding mechanisms. Working Paper. CAF Latin America Development Bank, September.

Based on advantages and disadvantages of these alternatives, it would seem that a model were public and private lenders share financing responsibility is the most attractive. The involvement of a DFI can provide a guarantee to the private lenders, thereby sharing the credit risk, and providing for some capital relief. In addition, the reliance on fees from subscribers for supporting connection charges could reduce some of the venture's funding pressure. However, this option could be used by any of the municipal models discussed above.

3.3 Pooled finance models as co-investment mechanisms

As reviewed in chapter 2, the most important telecommunications investment gap is found in rural and isolated areas of the developing world. As stated by a roundtable panelist, tackling this gap is less a matter of developing new business models and more scaling those that have

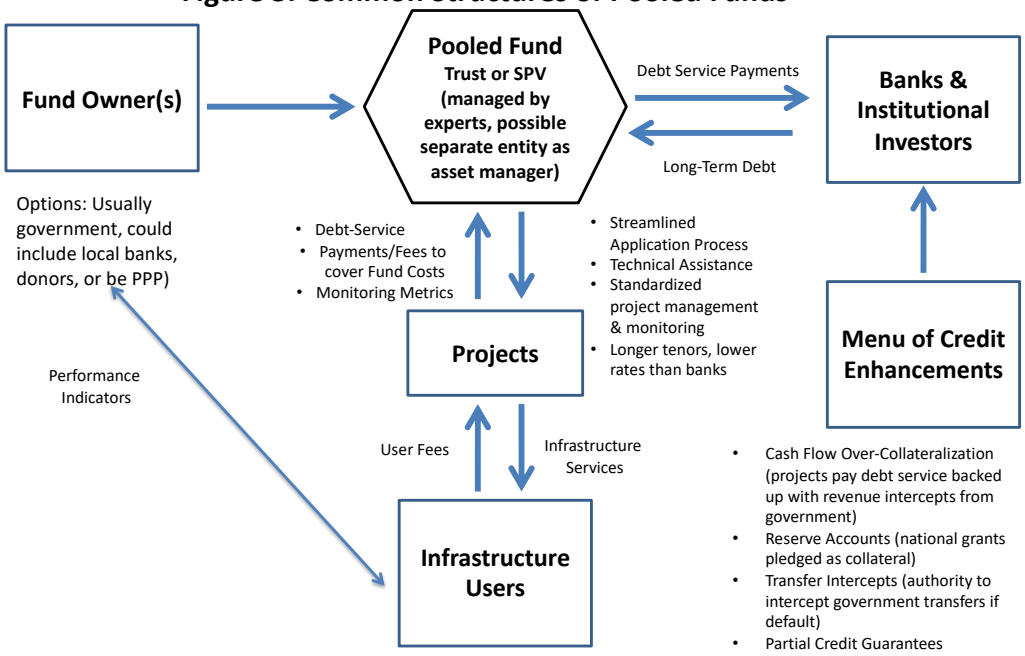
already been developed, and expand them to more geographies. The challenge, therefore, remains, as a panelist mentioned, "scaling those models, so they can benefit the millions rather than the thousands". And there remains the challenge. Digital divide models require extensive cross-sector partnerships between a diverse set of organizations with a varied set of vested interests, which remain a fertile ground for market and coordination failures.[17]

First, despite the effort of Universal Service Funds to address the rural and dispossessed digital divide, these programs do not have sufficient funding to fulfill the enormous needs for infrastructure deployment. Second, private sector funding is often not available for small telecommunications projects. The lack of access to private sector finance is due to a number of factors, including (but not limited to) the lack of working capital and equity, high transaction costs, lender perceptions of high risks, lack of sufficient revenues to cover debt service payments, and the lack of technical capacity (both sector and finance) of project sponsors. Third, the small size of projects falls below the minimum funding size of lenders and projects often require longer tenors than available. Fourth, small projects cannot gain access to support from DFIs because the amounts required fall below the lender's facility limits. These barriers to finance can be addressed by pooled funding facilities.

Pooled financing is a well-established and highly successful means of mobilizing private financing for small infrastructure projects in both developed and developing countries. In developed countries, these types of pooled funds mechanisms are established as governmental, quasi-governmental, or legally independent non-profit entities or agencies that aggregate a number of local projects for financing. By "pooling" multiple borrowers needs together, pooled funds (e.g.: State Bond Banks, State Revolving Loan Funds, county improvement authorities, city economic development agencies, and similar agencies) can offer larger debt issues, with better credit ratings. Because pooled issues can be structured to achieve high credit ratings in the primary market, debt-servicing costs are reduced. Savings are also realized through a reduction in transaction costs associated with the economies of scale in the underwriting process. A generalized schematic of the structure of a pooled fund is provided below.

[17] A coordination failure occurs when a group of firms could achieve a more desirable equilibrium but fail to because they do not coordinate their decision making (see Adserà, A. and Ray, D. (1998). "History and coordination failures" Journal of Economic Growth 3, 267-276.)

Figure 5. Common Structures of Pooled Funds



Source: Katz, R., Samuels, B.; Shepard, B. Callorda, F., Bengyak, K. (2014). Innovative broadband financing mechanisms: Development of Pooled Finance Facilities for Latin American Telecommunications. Caracas: CAF Latin America Development Bank

Pooled funds provide access to private capital markets (bank finance and bonds) at advantageous terms for borrowers (e.g.: communities, non-profits, Small and medium-sized enterprises (SMEs), micro-enterprises, etc.) sharing similar missions or business objectives and similar credit characteristics, but lacking the financial scope and scale, expertise and credit history to access credit markets on their own. By providing credit enhanced financial structures, accountable management processes, and lower transaction costs, pooled finance facilities can serve as efficient, creditworthy links between small projects and sources of private capital.

In developing countries there is a high demand for funding small telecommunications projects, particularly in last mile fixed broadband networks, which can be met through pooled funds. Pooled funds can provide access to finance, and also reduce or avoid the project development and finance problems often associated with loans obtained from the public sector (governments and development banks) as well as local banks (commercial and municipal banks). Importantly, they also serve as cost-effective mechanisms proven to leverage limited public sector resources. The proposed financing model could have the following elements:

- A pooled financing facility is created to finance multiple small rural telecommunications projects, with several lenders (public or private) taking its pro rata exposure to each of the projects;
- The target size of the facility could be at least USD 20 million, which would be sufficient to handle approximately 5-6 small telecommunications projects (assuming that each project would not require funding in excess of USD4 million)

- Projects would be typically majority-owned by public sector sponsors (e.g.: municipalities, regional governments), although the private sector could have an ownership stake if it contributed cash, other assets, or services
- The pooled financing facility will have the support from a public lender, such as a DFI, which would provide credit enhancements, such as loan guarantees that could equal to 50 per cent of the total amount of the facility; other risk mitigation features, such as first-loss facility could also be considered.
- The pooled facility will be ring fenced, whereby loans would be repaid solely from the cash flows generated by individual projects, without affecting the assets or financial resources of local sponsors;
- In addition, projects could apply, through the pooled facility, to receive output-based aid from public funds to supplement the amounts that certain users are to pay for subscription (this could be a positive contribution to narrowing the demand gap);
- Each project will be structured using a project finance approach, with construction cost and technical performance risks being assured through contracts with third-parties;
- Project sponsors will develop the telecommunications projects with technical and operational assistance provided by government entities

The pooled facility could be managed by a Development Finance Institution that would take the primary responsibility for due diligence of prospective projects. At the same time, the pooled facility "manager" could seek to obtain participation in the facility from as many commercial banks as possible to increase the size of the fund. After the portfolio of projects has been operating successfully for approximately two years (a common practice in non-telecom infrastructure), the portfolio could be sold to pension funds and other institutional investors, thus allowing the banks to redeploy the funds in additional projects.

The benefits of pooled funds include:

- Improved market access through use of pooled funds: Pooled funds provide a structure that facilitates access to finance, both public sector and private sector, for many small projects. Pooled funds serve as a cost-effective creditworthy link between local projects and sources of capital.

- Lowered borrowing costs through credit enhancements not available to local banks: By pooling finance in a credit-enhanced structure, long-term finance can be provided to small projects at lower interest rates and with longer tenors than from local banks. Examples of credit enhancements that can be used as the pool level include reserve accounts[18], cash flow over-collateralization[19], partial credit

[18] In Project Finance, a Debt Service Reserve Account ('DSRA'), is a reserve account specifically set aside to make debt payments in the event of a disruption of cashflows to the extent that debt cannot be serviced.

[19] Cash flow over-collateralization is used to offset the revenue risk, by adding assets as collateral on a loan.

guarantees[20], sovereign and local government guarantees[21], first loss-facilities[22], and subsidies (output-based aid).

- Reduced transaction costs: Transaction costs are reduced by providing a streamlined process for project development and finance, and the sharing of transaction costs across all projects.

- Streamlined project identification and vetting: Pooled funds require streamlined procedures and screening processes.

- Technical assistance that bridges the technical capacity gap for local governments and project sponsors: A significant impediment recognized by experts worldwide is the lack of capacity to identify and develop projects, especially by local governments and their business communities.

- More effective and successful project development process: A critical problem in infrastructure is the identification and development of projects. By providing a standardized process, governments and their private sector partners have a well-documented streamlined process for project development that reduces costs and is more likely to result in the successful development of bankable projects and access to finance.

- Provision of effectively targeted grants to unbankable projects that have large developmental impact: Pooled funds are used to provide targeted grants that render unbankable projects bankable. For example, if projects are considered of critical developmental importance, the "viability gap" can be assessed, identifying the required amount of grant finance (to be provided by the government and/or development partner) with the balance in private capital ("blended finance").

- Ability to subsidize interest rates: Some pooled funds use their funding structure to subsidize interest rates to projects.

- Greater domestic capital mobilization: As noted, pooled funds provide a gateway to capital market development, enabling the creation of an "asset class" for investment by institutional investors as well as local banks. The new "asset-class"

[20] A partial credit guarantee is a credit enhancement mechanism for debt instruments (bonds and loans). ... Typically, the guarantee is structured to cover 100% of each debt service payment, subject to a maximum cumulative payout equal to the guaranteed amount.

[21] Sovereign guarantees are given by host governments to assure project lenders that the government will take certain actions or refrain from taking certain actions affecting the project. Although a blanket sovereign guarantee of all project risks is impossible to obtain in any project finance transaction, many of the legal and political risk categories typically encountered in an infrastructure project will be well within the host government's ability to control and may therefore be fairly allocated to such host government.

[22] First loss facility represents the first level of financial support to a special purpose vehicle (SPV), such as a company organized around the provision of wholesale telecommunications, as part of the process in bringing the securities issued by the SPV to investment grade. The provider of this facility bears the bulk (or all) of the risks associated with the assets held by the SPV.

provides high-quality fixed income investment opportunities for domestic institutional investors (pension funds, insurance companies, etc.) that are of greater development impact than alternatives (e.g.: real estate, sovereign bonds, etc.).

- No foreign exchange risk: For projects producing revenues in local currency, loans from international institutions (private and public) are risky for both parties given the mismatch in currencies. By using local currency funding sources, pooled funds protect borrowers from the foreign exchange risk that arises from a mismatch between the denomination of revenue produced by the project and the denomination of the debt service supported by that revenue.

- Leveraging public resources: By using pooled funds, local governments can transition from reliance on national government grants to private sector financing of local projects. In many countries, lending to small projects is limited, with any existing lending coming from on-lending funds from the national government and development banks. Pooled financing can help transition local governments from dependence on sovereign loan resources to private financing. Financing local infrastructure projects through national sovereign loans is not sustainable in the long term.

- Enhanced aid effectiveness: Pooled funds in developing countries have often involved collaboration between several development partners, given the recognition that these financial mechanisms are effective ways to mobilize private capital.

- Self-sustaining operation: Most well designed pooled financing facilities are financially self-supporting and are not reliant on the government or development partners to provide new capital grants each year.

3.4 Public-Private Partnerships

Public-private partnerships (PPPs) are an essential tool to satisfy and advance telecommunications infrastructure needs. A PPP for the construction of a telecommunications network requires investors (construction companies, banks, pension funds, infrastructure funds) and lenders (private sector project finance banks), and, potentially (although more difficult) access to bond public markets. Under this framework, project finance is a specialized form of financing targeted to a "stand-alone" project (a special purpose project company), whereby lending is based on project-specific cash flow, and lenders rely on project contracts, not physical assets, as a security ("contract-based financial engineering").

If planned, designed and implemented properly, PPPs can contribute to tackling the digital divide.[23] Multiple approaches to private-sector participation in such partnerships are distinguished by the degree of risk private parties assume. PPPs are one in a continuum of

[23] See Arthur D. Little (2020). *Successful Public-Private Partnerships*. Luxembourg.

approaches involving, through a long-term contractual relationship, the private sector in public-service delivery and investment. Particular to PPPs is the significant sharing of risk between the public and private sectors in three main areas: financing, ownership and revenue.

Strictly speaking, public-private partnerships encompass various types of financing models. At its most basic level, the public entity may be serving only as an issue of conduit debt, enabling the private party to gain access to tax-exempt financing. Alternatively, the public entity may be guaranteeing the private party's debt. Under this framework, project finance is a specialized form of financing targeted to a "stand-alone" project (a special purpose project company), whereby lending is based on project- specific cash flow, and lenders rely on project contracts, not physical assets, as a security ("contract- based financial engineering"). While project finance is a complex, and slow form of financing, it is used for most major Public Private Partnership projects.

The more traditional model involves the use of public resources or financing capabilities to implement a telecommunications project. Under this arrangement, the public entity (which can be a municipality) provides some combination of tax incentives, public land or other assets, infrastructure investment or financing methods. On the other hand, the private entity makes capital investments, commits to provide jobs, contributes technological expertise and assumes financial risk.

Another model refers to an arrangement where the local government enters into a long-term lease of a major asset, such as the passive infrastructure of a broadband network, to a private company, transferring the right and responsibilities for the leased asset to the private company. Under this framework, defined as a public service delegation, a private player deploys the broadband network with or without partial public subsidy, while assuming the risk. Table 9 presents some of the most common models of public-private partnership arrangements for telecommunications projects.

Table 9: Advantages and Disadvantages of Public-Private Partnership Financing Models

Model	Description	Advantages	Disadvantages
1. Debt-facilitation model	• Public entity facilitates access to tax-exempt financing • No commitment to use public funds	No public funds are placed at risk	• Potential misalignment of objectives between parties • Limited leverage of public party capabilities (RoW , facilities)
2. Debt-guarantee model	Government guarantees debt, secured by private party	Access to better financial terms of debt	Public funds are placed at risk
3. Public service delegation	• Private player deploys broadband network with or without partial public subsidy • Player has a concession to resell the passive or active layers to service providers	Risk is assumed by outside player	• Subsidy is needed to attract the concession holder • Lack of commitment of project sponsor might result in service failure

Source: Katz, R. (2014). Broadband Funding mechanisms. Working Paper. CAF Latin America Development Bank, September.

The public service delegation model is particularly attractive insofar that it shifts the deployment and operations risk away from the public sector. However, it is critical to ensure in this case a high level of commitment on the part of the private co-sponsor.

Notwithstanding their potential, the use of PPPs in tackling rural infrastructure deployment has been limited for several reasons[24]:

- **High complexity**, due to the interaction of several public and private players, potentially from different countries.
- **High costs**, requiring extensive legal expertise and monitoring due to the complex interaction of parties and the indexed nature of public repayments.
- **Need for an enabling environment** that can properly structure deals and monitor the work of the private parties and their remuneration.
- **Availability of bankable projects** to attract private parties and justify the transfer of risk.

Due to the costly and time-consuming procurement process (about two years from preparation of business case through financial close), PPP agreements are more suitable for large, expensive projects. This is even more relevant for countries that are new to PPP procurement. One way to ensure economic viability for PPP procurement is to establish thresholds of eligibility. In this approach, a minimum threshold is needed to:

- **From a public-sector view** – justify procurement cost incurred and maintain value for money.
- **From a private-sector view** – secure project financing; typically, this is not economical for banks/borrowers below certain amounts, and bidders would have to give full recourse to raise financing/justify transaction costs incurred by bidder.

[24] Source: Arthur D. Little (2020). *Successful Public-Private Partnerships*. Luxembourg.

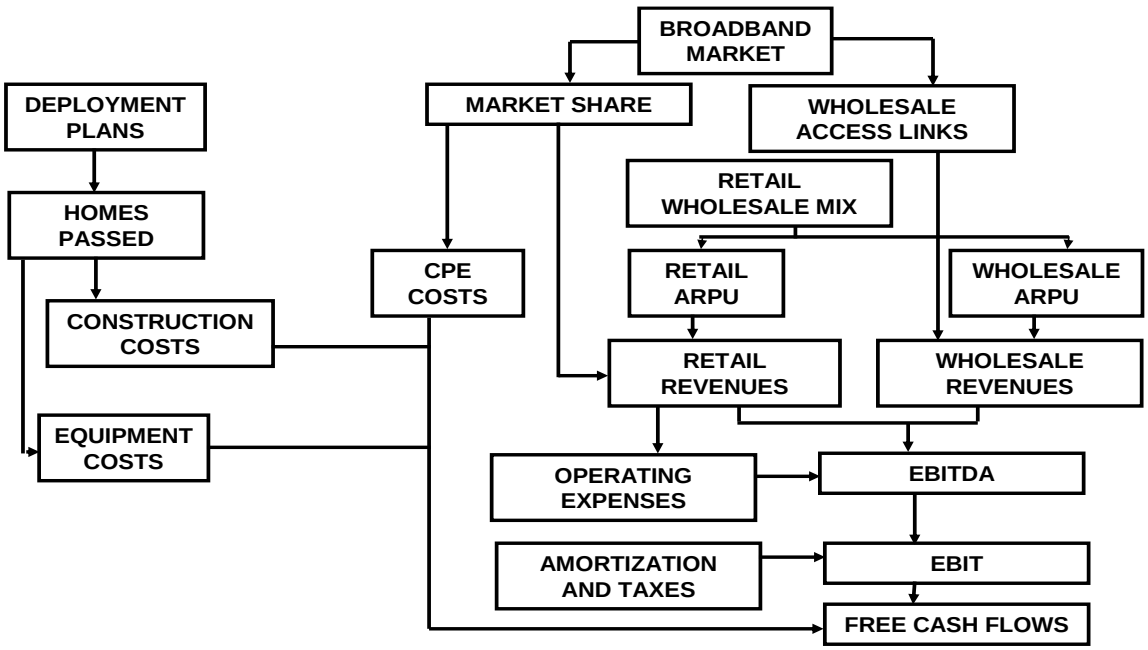
3.5 Policies and regulations to reduce the cost of network development inputs

The commercial deployment of fixed broadband network is constrained by a number of factors:

- The number of homes passed (a factor driven by population density)
- The number of subscribers (a variable driven by uptake which in turn is conditioned by affordability and other demand factors)
- Retail Average revenue per user (or price of a subscription)
- Wholesale Average revenue per user (if access is sold to other service providers)
- Equipment costs (driven by technology selected)

These factors can be laid out in the following conceptual structure of a business plan (see figure 6).

Figure 6. Conceptual Structure of a Broadband Business Plan



Source: Katz, R. (2008). Ultrabroadband Investment Models. Communications and Strategies, November

The commercial business plan to deploy a broadband network in a rural area is constrained by basic economics and market factors. The cost to pass a home in a rural setting (with a density of 63 homes per square mile) approximates USD 3,656.[25] In general terms, a positive Net Present Value is fulfilled if the adoption of homes passed ranges between 60 per cent and 70 per cent. Under these conditions, if uptake decreases and if revenues fall under USD60 per month, the NPV of the investment is negative.

[25] See Cartesian (2019). *All-Fiber Deployment Cost Study 2019: Report to Fiber Broadband Association* (September 10).

What can governments do to alleviate some of the constraints of the commercial business plan in order to generate incentives for broadband deployment? The determination of public incentives to stimulate deployment of telecommunications infrastructure in rural areas is based on an understanding of primary bottlenecks of the business plan and reducing some of the so-called "choke points":[26]

- Subsidize capital cost by offering loans with interest rates lower than the market rate and more extended tenor;
- Public sector co-invests with private sector if deployment takes place in rural areas;
- Offer grants through a universal service fund;
- Allow for tax exemptions for deployment taking place in rural and unserved areas;
- Reduce property taxes for facilities deployed in rural areas;
- Exempt sales taxes and import duties for equipment acquired for purposes of deploying networks in rural areas;
- Lower cost of right of way access;
- Promote aggregation of demand from public entities (schools, safety, health care) in order to create an "anchor tenant" effect;
- Promote synchronization of infrastructure development (e.g.: trenching) across infrastructure development parties;
- Streamline processes to obtain rights of way and tower deployment; and
- Provide access to cell deployment sites on public property (rooftops in public buildings).

Examples of some of these approaches have already been implemented in certain countries. For example, in Japan, while FTTH deployment is considered to be a responsibility of the private sector, the government provides two types of incentives for deployment. First, loans with interest rates lower than the market rate are made available to any carrier with a fiber network installation plan. Secondly, tax deductions are also assigned to carriers engaged in fiber deployment. In Europe, the Broadband Delivery program in the United Kingdom and the French National Very High Speed Plan focus only on capital funding only, without addressing ongoing subsidies for recurrent operational costs. In doing so, they comply with the European Commission's guidelines in terms of providing third party access, being technology neutral and using existing infrastructure. In Malaysia, the government allows for import duty exemptions for equipment acquired for deployment in rural areas. Similarly, in Brazil, the government introduced a reduction of import duties for small cell equipment.

A related but very important issue to alleviate the economic constraints of the business case is reducing the cost of spectrum access. In the words of a panelist, "I would suggest to governments, particularly in emerging markets, to look at spectrum in the light of a development issue not a fundraising vehicle".

Based on the understanding of the economic and financial drivers of an infrastructure deployment plan, such as the one provided in figure 5, it would be very advantageous for policy makers and regulators to model the impact of the list of initiatives presented above in

[26] Some of these initiatives are alluded to in World Economic Forum (2020). Accelerating Digital Inclusion in the New Normal, July.

order to understand their impact on the business case and facilitate deployment of private sector operators. Along these lines, one panelist mentioned that this exercise would facilitate understanding what are the inputs that have the greatest impact on the business case and, consequently develop a prioritization of initiatives to lower deployment costs. For example, in view of the panelist, "equipment represents a small portion of overall deployment costs. More importantly, labor cost, the costs associated with deploying assets like underground or the concrete base that a mobile cell site may sit on could be higher in absolute terms than network equipment, particularly in rural areas. In addition, there are other costs like power, backdoor connectivity, site rents and material, which are not driven by equipment costs. Thus, I don't really see the exemption of taxation or import duties in relation to equipment having significant impact on the business case for the deployment of the infrastructure in rural areas. On the other hand, taxation on profits could have a larger impact, although providing tax exemptions for service to be deployed in rural areas could be harder to implement in practice."

3.6 Auctions for subsidies

This concept for allocating funds to support network deployment in rural areas is based on the general idea that the operator with the lowest bid for subsidies in a reverse auction, will deploy the network and provide the service. The model has been used frequently in the past twenty years for allocating subsidies in the provision of universal service by a wide group of countries, including Australia, Chile, Colombia, India, Nepal, Peru and the United States.[27] The World Bank is currently conducting a reverse auction to deploy network or reconnect 2,000 villages in Ethiopia.

In general, reverse auctions have proven to be an effective approach for reducing expenditures on universal service as well as getting a firm understanding of the true costs of supplying service in a rural area. As an example, the average reserve price for deploying service in rural areas as recently conducted by the United States Rural Digital Opportunity Fund, Phase I was USD5,008 per household, while the average subsidy assigned was USD1,768 (35 per cent of the reserve price) On the other hand, reverse auctions are less effective in promoting competition. Incumbent operators tend to have a better advantage regarding true information on cost to serve and economies of scale in service provisioning. This allows them to win auctions, thereby extending their market position, while receiving a government subsidy.

[27] See a survey of approaches in Wallsten, S. (2008). *Reverse auctions and Universal Telecommunications Service: Lessons from Global Experiences*. Washington, DC: Technology Policy Institute (April).

4 RISKS TO DEVELOPMENT OF LOW-COST OPERATING MODELS TO TACKLE THE DIGITAL DIVIDE

While the business models and funding strategies outlined throughout this report represent positive contributions to tackle the digital divide, roundtable panelists mentioned that some risks still exist in the fulfillment of some of these options.

Competition patterns in the network infrastructure vendor space, which is now being reshaped by a variety of forces, may have an impact on the deployment costs. In the words of a panelist, "increased network vendor diversity has the ability to offer lower cost high impact infrastructure within the next three years that will alter network economics five years".

The challenges in the business cases in deploying innovative connectivity technologies (e.g.: Loon[28] or Oneweb) point to the issue that devising a 'silver-bullet' to resolve connectivity issues is probably impossible. In the opinion of a panelist, "you cannot imagine the digital divide problem and try to solve it from Silicon Valley or London. In my opinion, most of the solutions have lost touch with the business case and cultural reality in the less developed countries." The problem of digital divide is a mix of high capex (due to remote areas) and low ARPU (people don't have either the ability or the appetite to pay), which new technologies are not necessarily able to overcome. That being said, other technology-based ventures (e.g.: Starlink and Space X) are still undergoing deployment.

Addressing the digital divide requires "a 'ground-shot' rather than a 'moon-shot' approach. One really needs a holistic mindset and practical approach to solve this issue: co-development of fiber with other infrastructure to reduce costs; education and upskilling to enable the adopting population to appreciate and realize more value-adds from digital connectivity so they will pay more (and able to). These solutions sound less sexy, but they often work better."

[28] Loon was winded down after Google was not able to find a sustainable business model and partners for the project. Westgarth, A. (2021). *Saying goodbye to Loon*, January 21.

5 CONCLUSIONS

The roundtable provided an opportunity to dialog around the critical business model and financing issues required to approach and tackle the digital divide. As indicated at the beginning of the session, in light of the ongoing pandemic, this challenge remains front and center within the ICT sector. The roundtable was a very useful platform allowing the panelists to present their views which are indicated below:

- Innovative models to address the digital divide have existed prior to the pandemic. The pandemic has merely reinforced the need to accelerate these initiatives, scale them, or expand them to more geographies. The problem is scaling those tools, so they can benefit the millions, rather than the thousands.
- Digital divide business models require extensive cross-sector partnerships between a diverse set of organizations and sectors which might have with a varied set of vested interests, raising the potential for coordination failures.
- In that context, several opportunities exist that the ICT sector can implement previous verification of their compatibility with the radiocommunication regulatory framework:

    - On the related regulatory side, enable the deployment of alternative access and infrastructure providers to reduce deployment costs, reduce excise taxation on devices and digital services, wholesale access regulation, infrastructure sharing incentives.
    - In addition, regulators should build the necessary conditions to stimulate infrastructure sharing
    - Promote the development of rural e-services such as rural financing, e-commerce and media platforms as stimuli to drive the deployment of networks.

- On the financing side, recognize the role of DFIs as important in making this happen.
- In addition, tackling the network infrastructure related aspects of the digital divide requires crowding-in investment from a diversity of investors with different risk profiles from equity to senior debt. Those investors may be private equity, pension funds, development finance institutions, commercial banks, corporates. The issue to attract investors is to make the projects not only viable but also render the financial benefit proportionate to the risk.
- In addressing the project financing of the network infrastructure related aspects of the digital divide, the ICT sector has a lot to learn from other sectors such as renewal energy and water and sanitation that have been tackling the universal access challenge for a long time.