ITUPublications

International Telecommunication Union
Development Sector

Economic and fiscal incentives to accelerate digital transformation

9th ITU Economic Experts Roundtable: Outcome report

Economic and fiscal incentives to accelerate digital transformation

9th ITU Economic Experts Roundtable: Outcome report

November 2022

Acknowledgements

This 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 input from participants in the 9th ITU economic experts roundtable[1], organized by the International Telecommunication Union (ITU) on 10 May 2022, and from a survey sent to the roundtable panellists on research recently developed.

ITU would like to thank Dr Alison Gillwald, Executive Director, Research ICT Africa; Mr Paul Lam, Strategy Officer, Digital & Technology, Asian Infrastructure Investment Bank; Ms Carolina Limbatto, Partner Head of Latin America, Cullen International; Mr Carlo Maria Rossotto, Principal Investment Officer, Global Head Upstream Telecom, Media and Technology, International Finance Corporation; Mr Richard Webb, Director Infrastructure Networks, CCS Insight; Dr Sidy Diop, Partner Economic Advisory at Deloitte France; and Mr Ankur Rudra, Telecommunication Analyst, Asia Equity Research, JP Morgan for their invaluable contributions to, and participation in, the roundtable that was moderated by Ms Sofie Maddens, Head, Regulatory and Market Environment Division of the Telecommunication Development Bureau (BDT).

[1] 9th ECONOMIC EXPERTS' ROUNDTABLE "The economic and fiscal incentives in the digital economy" organized online (10 May 2022) – https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Events2022/EconomicRoundTable2022.aspx.

Disclaimers

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 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.

ISBN

978-92-61-37071-8 (Electronic version)
978-92-61-37081-7 (EPUB version)
978-92-61-37091-6 (MOBI version)

Please consider the environment before printing this report.

Table of contents

List of figures and tables

Figure

Tables

Foreword

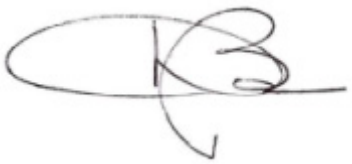
Ensuring affordable universal and meaningful connectivity for all is fundamental to accelerating progress towards the United Nations Sustainable Development Goals (SDGs). We have seen, during the COVID-19 pandemic, how digital technologies and services supported overall socio-economic resilience, while enabling those with a fast broadband connection to continue their daily activities as close to normally as possible.

The United Nations Secretary-General's *Our Common Agenda* report also highlights the potential of digitization to address the world's social and economic challenges and reiterates that carefully crafted regulatory approaches represent one of the most powerful tools to achieve this, through promoting investment in public goods and incentivizing sustainability.

The role of governments in implementing economic and fiscal incentives to accelerate the digital transformation of economies was the main theme of the ninth ITU Economic Experts Roundtable. This year's discussions underline the importance of innovative economic and fiscal incentives and instruments that can stimulate the deployment of digital infrastructure, especially in rural and isolated areas, as well as the introduction of advanced technologies.

In an increasingly digital age, one of the core priorities of governments should be to define an enabling environment that will accelerate the deployment of digital infrastructure in poorly-served areas. Those enabling conditions should include economic and fiscal incentives that can mitigate some of the cost constraints that negatively impact network deployment in these areas.

It is my hope that this outcome report will serve as a useful resource for ITU Member States and all ICT stakeholders as they tackle the creation and implementation of taxation policies that include appropriate incentives to foster digital transformation and promote equal digital affordable access, while supporting all industries and markets in all sectors.



Doreen Bogdan-Martin
BDT Director
International Telecommunication Union

Executive summary

The role of economic and fiscal incentives to accelerate the digital transformation of economies and societies was the main theme of the ninth ITU economic experts roundtable. The roundtable addressed the following questions:

1) What potential economic and fiscal incentives could be implemented to stimulate the deployment of digital infrastructure in rural and isolated areas?
2) What kind of economic incentives should be defined to ensure the introduction of advanced technologies such as 5G in support of the needs for the digital transformation of the economy?

Incentives to stimulate deployment of ICT infrastructure in rural and isolated areas

The first question was discussed within a trend of declining investment per capita in the telecommunication/ICT sector, particularly in developing countries. The negative trend in capital spending is affecting primarily rural and isolated areas, especially in developing countries, since during the pandemic investment continued to flow to urban areas that concentrate the population with higher affordability. In this context, the key public policy objective should be to define an enabling environment to accelerate the deployment of digital infrastructure in rural and isolated areas. These enabling conditions must consider economic and fiscal incentives that can mitigate some of the cost constraints that negatively impact the ICT network deployment in these rural and isolated areas.

The main responses from the roundtable panellists were structured around the need to mitigate some of the potential "choke points" of the commercial business case:

- Infrastructure sharing as a way of reducing the burden of capital expenses (Capex) and operational expenses (Opex): Network infrastructure sharing and co-sharing as well as co-development and co-investment can be advantageous under many circumstances. However, successful implementation of such measures needs to address several constraints. First, active sharing (which includes radio access network (RAN) sharing) and core network sharing is not easy to achieve, especially when network operators are competitors. Second, despite its economic benefits, infrastructure sharing can be a source of imbalance and market distortion and, if imposed from outside, can reduce rather than increase the incentives to build new infrastructure and adopt new technologies. The understanding of so-called potential "coordination failures" in the implementation of network sharing models is a pre-condition to determine the incentives to be deployed to promote industry development. These incentives are not driven by a "one size fits all" approach. Some market structures will be more prone to reaching the coordination entailed by network sharing than others.

- Reducing taxes as an approach to increasing the available capital to be invested: Numerous empirical studies have shown taxation to have a negative impact on the deployment of ICT infrastructure.[1] In light of these empirical findings, potential options to be considered in the fiscal space to provide incentives for network deployment in rural areas include reducing telecommunication/ICT regulatory fees, designing tax frameworks and incentives at the sub-national level to address the specific needs of rural deployment, reducing/eliminating equipment and consumer device import duties, removing sector specific taxes and reducing spectrum licence payments.
- Exploring new business opportunities to increase revenues: Labelled by one panellist as the "downstream rural e-services model", this option is based on promoting rural financial services, e-commerce, and media platforms as services that drive demand first, which would then stimulate telecommunication/ICT operators and services providers to deploy networks.
- A different alternative for focusing on the demand side is to dramatically change the supply side business model: In the words of a panellist, rather than trying to "fine-tune" the current model by promoting, sharing or reducing taxes, an alternative approach could be one that is based on implementing different operating models with lower service economics (for example, community networks, micro-telcos, Wi-Fi based mobile Internet service providers (ISP)) that are more suited to addressing the demand of rural areas.
- Rebalance the fiscal framework to address asymmetries between impositions on infrastructure service providers and over-the-top (OTT) or digital platforms: In particular, universal service fund (USF) contributions could potentially be shifted to demand players that rely on networks to deliver their services (e.g. digital platforms) to share in the burden of contribution.

Incentives required to ensure the introduction of advanced ICT technologies

While the next generation of mobile connectivity around 5G is conceived as an exponential increase in the quality of the value of connectivity, the total investment compared with the annual capex projection underlines the level of effort that network operators would have to face if they were to deploy 5G networks on a national scale. This is the nature of the challenge facing developing countries in terms of deployment of advanced ICT infrastructure, which raises again the need for implementing economic and fiscal incentives.

The five main recommendations in this domain were:

1. Regulators should acknowledge that to stimulate the deployment of 5G they should accept a low reserve price at auctions in exchange for a higher coverage rate, while easing barriers to deployment via lowering access to and cost of mid-band spectrum. This would allow operators to accelerate new technologies (e.g. 5G) deployment by reducing up-front (pre-service) costs and redirect more capex to network roll-out. This, in turn would allow faster scale-up of infrastructure coverage and capacity, higher performance capabilities and faster monetization of use cases, especially in industrial sectors.
2. One way of reducing spectrum licence costs is to impose coverage obligations in licence awards within a "beauty contest" hybrid auction framework. This may allow licence applicants to trade licence fees for coverage obligations.

---

[1] See Matheson, M. T., & Petit, P. (2017). Taxing telecommunications in developing countries. International Monetary Fund; Koutroumpis, P., Lekatsas, A., Giaglis, G., & Kourouthanasis, P. (2011). Between a rock and a hard place: Recession and telecoms taxation. *Telecommunications Policy*, 35(7), 681-688. Arawomo, O., & Apanisile, J. F. (2018). Determinants of foreign direct investment in the Nigerian telecommunication sector. *Modern Economy*, 9(05), 907. GSMA (2016). *Digital Inclusion and Mobile Sector Taxation in Colombia. Reforming sector-specific taxes and regulatory fees to drive affordability and investment*. Deloitte. Katz, R. & Callorda, F. (2019). *Assessment of the economic impact of taxation on communications investment in the United States*. A report to the Broadband Tax Institute. Telecom Advisory Services. ITU (2021). *The impact of policies, regulation, and institutions on ICT sector performance*.

3. Policy-makers and telecommunication/ICT regulators can also facilitate deployment of 5G through several initiatives: (i) provide financial and fiscal stimuli by subsidizing the purchasing of 5G devices and connectivity fees; (ii) set up funds for 5G trial services; (iii) promote research and development (R&D) on 5G use cases and innovation; and (iv) reduce deployment barriers of physical infrastructure and encourage infrastructure sharing.
4. Along these lines, policy-makers and regulators should play the role of orchestrators of incentives to facilitate 5G network deployment, simultaneously acting upon cost restructuring through sharing, including industry consolidation and promoting network joint ventures, while implementing tax incentives in support of 5G equipment purchasing and applications development.
5. Economic and fiscal incentives may not be enough to facilitate the deployment of 5G technology. It was noted by a panellist that, as networks migrate from 4G to 5G, telecommunication/ICT operators are transitioning their operating model, blending infrastructure within cloud-based architectures to drive operational savings. This entails a dramatic shift in operating model, a *sine qua non* condition of ultimate success.

List of acronyms and abbreviations

ARPU	Average revenue per user
ASEAN	Association of Southeast Asian Nations
CAPEX	Capital expenditure
FTTH	Fibre-to-the-home
GSR	Global Symposium for Regulators
ICT	Information and communication technology
IFC	International Finance Corporation
ISP	Internet service provider
ITU	International Telecommunication Union
NPV	Net present value
LTE	Long-term evolution
OECD	Organisation for Economic Co-operation and Development
OPEX	Operational expenses
OTT	Over-the-top
PPP	Public-private partnership
RAN	Radio access network
ROI	Return of the investment
R&D	Research and development
USF	Universal service fund
VAT	Value added tax
WSIS	World Summit on the Information Society

1 Introduction

The United Nations Secretary-General's report on "Our Common Agenda" released in September 2021 highlighted the potential of digitization to address some of the world's social, and economic challenges. The report advocates for a multi-stakeholder understanding between Member States, the private sector and civil society to address some of the challenges in building equality in the access to digital technologies. At the same time, the report recognizes that "taxation is one of the most powerful tools […], critical to investing in public goods and incentivizing sustainability". It also noted that "a reformed international tax system is needed to respond to the realities of growing cross-border trade and investment and an increasingly digitalized economy while also addressing existing shortcomings in fair and effective taxation of businesses and reducing harmful tax competition".

The 9th ITU Economic Experts Roundtable was dedicated to the role of economic and fiscal incentives to accelerate the digital transformation of economies and societies. The rising global challenges resulting from the COVID-19 pandemic have put this imperative at the centre of telecommunication/ICT industry discussions. Yet, the development of a framework that addresses the conflicting imperatives of different stakeholders is a non-trivial task.

When thinking about incentives, fiscal reform remains a critical lever. Decisions regarding taxation and financial contributions are driven by public policies guided by normative goals (e.g. how much revenue should the government collect to pay for services and what type of services should be provided to its citizens?) and the cost/ benefit equation incurred to meet those objectives. While the benefits of taxes relate to general policies (e.g. raising revenues to support the public administration) or specific objectives (e.g. support the development of broadband in schools), economic theory also shows that, in general terms, taxation affects market equilibrium by shifting the demand and supply curves by raising prices with the consequent reduction in the quantity of goods. Along these lines, the impact of taxation on the digital transformation of the economy is a multi-pronged debate that needs to be structured around not only the benefits it generates, but also the costs in lost surplus it may imply. That said, tax reform is only one of the potential incentives to accelerate digital transformation. As discussed during the roundtable, infrastructure sharing, and demand side stimulation remain two additional levers that impact the digital economy.

Considering the importance of this matter to enable better ICT network coverage, affordable digital connectivity for sustainable development and accelerated digital transformation, the 9th economic experts roundtable was organized specially within the World Summit on the Information Society (WSIS) Forum framework,[1] specifically under Action Line C6 on Enabling Environment.

The need to create a suite of enablers to decrease ICT infrastructure deployment costs, such as streamlining relevant regulation and addressing excessive sector taxation, was already raised during previous ITU economic expert roundtables.[2] This time, discussion on the need to outline an appropriate set of economic and fiscal incentives focused on the trade-offs between the need

[1] World Summit on the Information Society (WSIS) - https://www.itu.int/net4/wsis/forum/2022/

[2] Specifically on the 7th and 8th ECONOMIC EXPERTS' ROUNDTABLES (https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Events.aspx)

to raise funds for the delivery of public services and to encourage the deployment of digital infrastructure, while addressing any potential fiscal asymmetries and imbalances across sectors (ICT compared to other industries) and sub-sectors of the digital economy (telecommunication/ICT compared to OTT or digital platforms). In sum, the purpose of the roundtable was to explore the creation of a framework of incentives that promotes equal affordable access to digital technologies, does not hamper capital spending and network deployment and reduces symmetries across the digital ecosystem, while ensuring that governments receive the financial sources needed to deliver public services focusing on the following main questions:

1) What potential economic and fiscal incentives could be implemented to stimulate the deployment of digital infrastructure in rural and isolated areas?
2) What kind of economic incentives should be defined to ensure the introduction of advanced technologies such as 5G to support the digital transformation of the economy?

In addition to the roundtable discussions, the economic experts responded to a survey distributed ahead of the meeting (see survey template in Annex). This report provides a summary of the responses to the survey, complemented with comments and opinions made during the discussions and supported by references to recent research on the topic.

The second section of this report is dedicated to analysing the incentives to be implemented to stimulate deployment of ICT infrastructure in rural and isolated areas. It begins by reviewing the investment models required for deploying fixed and mobile networks and analysing drivers and potential "choke" points for a positive return. On this basis, this section reviews potential incentives recommended by the economic experts to alleviate the constraints of a network investment in rural areas, which includes points raised on infrastructure sharing, taxation reform, demand side initiatives, and rebalancing fiscal asymmetries among digital ecosystem players. Each group of incentives was also assessed in terms of benefits, options, and implementation issues.

The third section addresses the economic and fiscal incentives to accelerate the introduction and deployment of advanced telecommunication technologies, such as 5G. It outlines the potential investment required to deploy 5G in some developing countries, and reflecting the sizable capital required for this technology to be deployed. The section also presents recommendations by the economic experts to mitigate the cost of this effort.

2 Incentives to be implemented to stimulate deployment of ICT infrastructure in rural areas

In large part, driven by the contraction triggered by COVID-19, worldwide investment in ICT network infrastructure declined in 2020, and exhibited a modest rebound in 2021 (see table 1).

Table 1: Annual investment in telecommunication infrastructure per capita (in USD)

	2018 (USD)	2019 (USD)	2020 (USD)	2021 (USD)
World	51.96	51.3	51.7	52.3
Sub-Sahara Africa	9.94	8.5	7.6	7.4
Latin America and the Caribbean	34.03	36.4	33.7	35.2
North America	298.11	345.6	338.1	352.3
Asia-Pacific	31.71	26.2	28.0	27.8
Western Europe	121.72	121.6	121.6	121.1
Eastern Europe	37.59	38.8	40.5	40.5
Arab States	38.82	39.7	43.6	43.0

Year-on-Year decline

Sources: ITU; GSMA Intelligence; Telecom Advisory Services analysis

As shown in Table 1, developing countries have been most affected by a negative trend in investment. For instance, investment in telecommunication/ICT infrastructure in sub-Sahara Africa has consistently declined since 2018, while in the Latin American region, the 2020 decline appears to have been reversed in 2021, and in the Asia-Pacific region, the negative trend resumed in 2021.

As discussed in previous roundtables[3], while not shown in the aggregate metrics, it is well known that the negative trend in capital spending is affecting primarily rural and isolated areas in developing countries, since even during the pandemic investment continued to flow to urban areas. In this context, the issue of ensuring that investment is channelled to rural and isolated areas has become a critical imperative, especially considering the pervasive digital exclusion that became apparent during the pandemic. Obviously, since governments of advanced economies have the resources to compensate for this shortfall and invest in rural areas to remedy the

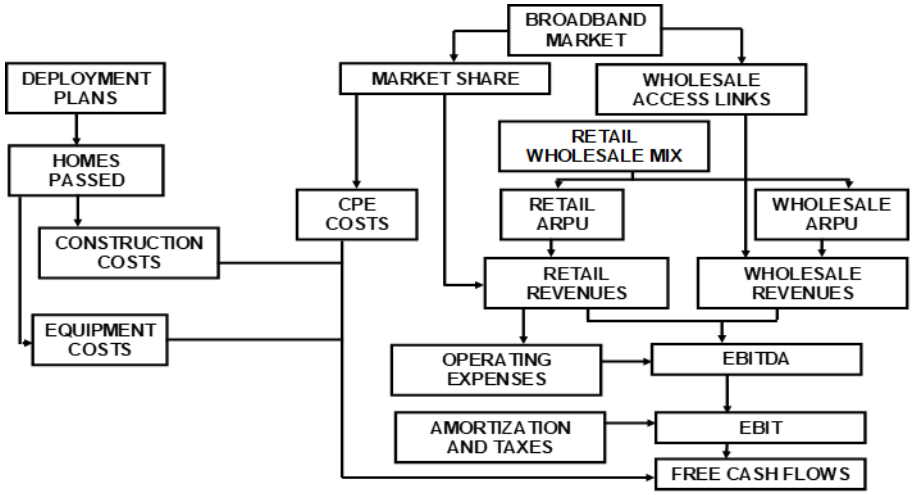
[3] Information available at the ITU portal on the economic impact of broadband, digitization and ICT regulation (https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Economic-Contribution.aspx))

digital divide[4], the key issue for developing countries is how to implement the right economic and fiscal incentives to ensure that the private sector continues deploying infrastructure and providing affordable access in rural and isolated areas. This section begins by stating the nature of the problem in quantitative terms and then reports the economic experts' perspectives and recommendations to address this problem.

2.1 Network deployment economics in rural and isolated areas

To start discussing the issue of incentives for the deployment of ICT infrastructure in rural and isolated areas, the drivers and constraints of network deployment economics need to be understood. Such a model should generate a good understanding of all commercial and financial variables needed to assess the viability of a business case. The example in Figure 1 provides a view of a fibre-optic investment model in the distribution network (fibre-to-the-home (FTTH)).

Figure 1: FTTH investment model



Source: "Ultrabroadband investment models". Communications and Strategies (November 2008).

In the case of FTTH, capital expenditures include construction costs for fibre-optic deployment, network equipment costs, and customer premise equipment costs. In turn, operating expenses are conditioned by share of homes passed. Revenues represent the sum of average revenue per user (ARPU) and, if applicable, wholesale fees for reselling the facility to other network operators. Finally, free cashflows, and consequently the return of the investment (ROI) as measured by net present value (NPV), will be affected by amortization and taxes.

Assuming a deployment plan of 5 600 000 homes passed, and with 25 per cent of homes connected, the business case turns cash positive in three years, with a NPV positive (even without considering its terminal value). However, if the number of homes connected drops below 20 per cent, the NPV turns negative.[5] As expected, population density is a critical variable driving a positive return on the investment. A study by Cartesian (2019), where real FTTH deployment costs for the United States were used to develop a logarithmic model, indicated that cost per

[4] Notice the USD 42.25 billion Broadband Equity Access and Deployment programme recently approved in the United States.

[5] It should be noted that a decline in equipment pricing would somewhat affect the profitability thresholds, but the intrinsic dynamics of the model remain valid.

home passed in rural areas can range between USD 3 000 and USD 6 000.[6] However, additional studies indicate that other variables are also critical in driving a positive FTTH business case, including:

- number of homes connected: uptake must always be higher than 25 per cent (a variable which in turn is conditioned by affordability and other demand factors, particularly important in rural areas);
- ICT service pricing: retail average revenue per user must be higher than USD 60 (also a function of affordability);
- operating expenses;
- amortization and taxes.

Similar business cases have been modelled for mobile networks although in this case the variables driving a positive business case include, in addition to the above, other factors such as the cost of spectrum access. A commercial business plan to deploy broadband networks in a rural area is constrained by basic economics and market factors. In general terms, a positive NPV of the business case is fulfilled if service adoption ranges between 30 per cent and 50 per cent.[7] Under these conditions, if uptake decreases and, consequently, revenues fall, the NPV of the investment is again negative. In this context, the key objective is to define an enabling environment to accelerate the deployment of digital infrastructure in rural areas. This enabling context must consider economic and financial incentives that can mitigate some of the cost constraints that can potentially negatively impact ICT investment in a rural and isolated area.

2.2 Why are economic incentives important in driving network deployment in rural and isolated areas?

The understanding of broadband network investment model dynamics presented above framed the discussion of economic incentives. The economic experts' responses were structured around the opportunity to mitigate some of the drivers of the business case discussed above, and included:

- sharing infrastructure as a way of reducing the capex and opex burden;
- reducing taxes as an approach to increasing the available capital to be invested;
- exploring new business opportunities in the search to redefine the average revenue per user (ARPU);
- rebalancing the fiscal framework to address asymmetries between impositions on infrastructure service providers and digital platforms.

Infrastructure sharing to contribute to reduce the capex and opex burden

Infrastructure sharing in telecommunication/ICT is defined as the use of infrastructure or resources by more than one telecommunication operator/service provider through a cooperative or commercial arrangement, or the concurrent use of an existing infrastructure to reduce investment and operating expenses. The infrastructure sharing concept can be applied in fixed and mobile networks through several options. In the mobile segment, sharing decisions range from sites and towers to other network elements such as the radio access network (RAN)

---

6 Cartesian (2019). *All-Fiber Deployment Cost Study 2019*.

7 *Telecommunications Industry in the Post-COVID 19 World: A report of the 7th ITU economic experts roundtable*. Geneva: International Telecommunication Union (www.itu.int/en/ITU-D/Regulatory-Market/Pages/EconomicRoundTable2021.aspx).

and spectrum. In the fixed segment, sharing could include ducts, power supply, electric posts, local loop access, and backhauling.

Numerous studies have already provided an estimate of economic benefits of infrastructure sharing. Based on Tognisse, I., the investment required to extend a mobile network includes cell tower costs (on average, between USD 150 000 and USD 250 000, depending on the location), base station equipment (baseband processors, transceivers, power supplies, amplifiers for a cost between USD 20 000 and USD 50 000), installation of the equipment (approximately USD 25 000), and interconnection to the core network (USD 5 000).[8] In this context, it is estimated that site and tower sharing across multiple operators yields a capex benefit of over 40 per cent.[9]

Another approach to drive a reduction in capex through infrastructure sharing is co-development through promoting collaboration between telecommunication/ICT operators and service providers and other network industries (such as electric utilities) to achieve joint deployment and operation of shared infrastructure.

While strictly in economic terms, network sharing and co-development can be advantageous under many circumstances, its successful development needs to address several constraints. First, active sharing (which includes radio access network sharing) and core network sharing is complex to achieve, especially when network operators are competitors. Second, despite the economic benefits, infrastructure sharing can be a source of imbalance and market distortion and, if imposed from outside, can reduce rather than increase the incentives to build new infrastructure and adopt new technologies. For example, municipal jurisdictions can become a 'choke' point in terms of processing authorizations or imposing high contributions from tower companies. In many countries, local authorities and municipalities have the constitutional autonomy to provide permits for infrastructure deployment and charge a contribution. Interestingly enough, in other infrastructure areas (for example, ports), the national authorities are increasingly gaining jurisdictional leverage over local governments. The concept at play in this case is "vertical policy coherence". Under this term, a national imperative, such as addressing the digital divide or deploy 5G for industry development reasons, overrides local government considerations.

Moreover, even if the deployment hurdle is solved, other negative externalities might come into play. For example, ICT national regulatory authorities (NRAs) might leave network operators to decide on their own whether to share infrastructure or force them to do so in the interest of furthering deployment in rural areas. Infrastructure sharing does not come as a natural strategy to operators who can be at various stages of network roll-out and may, therefore, have different attitudes to value network infrastructure as a competitive advantage. In principle, if an operator has invested heavily in a national network, it will likely be unwilling to offer competitors access to that advantage[10]. Under some competitive market conditions, operators might, on their own, arrange socially optimal and financially viable solutions. In contrast, owners of infrastructure that confers dominant positions will be reluctant to share it. For example, the competitive differentiator inherent in network investment and deployment is expected to increase with 5G.

---

8 Kweku., J. "Analysis of Co- Location of Telecommunication Infrastructure in Ghana". In: *Proc. - 2019 Int. Conf. Comput. Model. Appl. ICCMA 2019* (2019), pp. 72–80. DOI: 10.1109/ICCMA.2019.00019.

9 Tognisse, I. *et al*. (2021). "Infrastructure sharing model to connect the unconnected in rural areas". *ITU Journal on Future and Evolving Technologies*, Volume 2 (2021), Issue 2, 6 December.

10 This concept has been studied 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.

However, 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 a rethinking of new business models for infrastructure sharing.

The analysis of so-called potential "coordination failures" in the implementation of network sharing models is a pre-condition to determine the incentives to be deployed to promote industry development. These incentives are not driven by a "one size fits all" approach. Some market structures will be more prone to reaching the coordination entailed by network sharing than others. Furthermore, coordination will be more feasible under some models than others. Under these circumstances, governments can help to provide the incentives for sharing infrastructure. If these are addressed properly, infrastructure sharing yields an increase in overall connectivity. For example, Houngbonon *et al*. (2021) demonstrated that a comparison of market outcomes for 56 low- and middle-income countries with and without a successful tower business (as emblematic of a thriving infrastructure sharing model) is generally positive. Even if one recognizes that markets with tower businesses are typically richer and often have more sophisticated regulatory environments, the availability of quality mobile connectivity, proxied by population coverage of 4G and median download speed, is higher in markets with the tower business model than in markets without it. Moreover, 4G population coverage is 10 percentage points higher and median download speed is 2.2 Mbit/s higher, while affordability of mobile connectivity, measured by the cost of a medium basket of mobile broadband plan, is better.[11]

Reduction of taxes to increase available investment capital

By affecting the bottom line of the network deployment business case, taxes impose a constraint on the financial model. In general terms, levies always raise the pre-tax return on capital invested. Most research literature has found that taxation regimes play an important role in driving capital flows, when controlling for economic development, unemployment, and currency fluctuations[12]. Accordingly, when a firm must make an investment decision, taxation plays a significant role. Taxes affect both the incentives of a company to make investments and reduce the supply of funds available to finance them. In fact, several empirical studies indicate that, all things being equal, marginal, and average tax rates have a negative effect on investment decisions.[13]

In all fairness, taxes are just one of the many factors driving capital investment decisions. Beatty *et al*. (1997) showed that high net equity financing activity (access to low-cost funds) and high stock returns (market signalling) are also important variables in explaining high future net capital

---

[11] Houngbonon, G; Rossotto, C., and Strusani, D. (2021). *Enabling a competitive mobile sector in emerging markets through the development of tower companies*. EMCompass Note 104 (June); Washington, DC: International Financial Corporations.

[12] See Slemrod, J. (1990). Tax effects on Foreign Direct Investment in the United States: evidence from a cross-country comparison, in A. Razin and J. Slemrod eds. *Taxation in the Global Economy*, Chicago: University of Chicago Press, 79-117; Devereux, M. & Freeman, H. (1995). The impact of tax on foreign direct investment: empirical evidence and the implications for tax integration schemes, *International Tax and Public Finance,* 2: 85-106; Billington, N. (1999). The location of foreign direct investment: an empirical analysis, *Applied Economics,* 31: 65-76.

[13] Auerbach, A.J. (2005). *Taxation and capital spending*. Paper prepared for the Academic Consultants Meeting of the Board of Governors of the Federal Reserve System. University of California and NBER, September; Devereux, M. P., & Griffith, R. (2003). Evaluating tax policy for location decisions. *International tax and public finance*, 10(2), 107-126; Heckemeyer, J. H., & Overesch, M. (2017). Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics/Revue Canadienne d'économique*, 50(4), 965-994; Talpos, I. and Vancu, I. (2009). Corporate Income Taxation Effects on Investment Decisions in the European Union, *Annales Universitatis Apulensis Series Oeconomica*, 11 (1): 513-518.

expenditures[14]. Similarly, as expected, high net income and low dividend pay-outs are important predictors. Nevertheless, when controlling for these factors, the authors also determined that, for instance, changes in the tax code in the United States had a real effect on the investment behaviour of firms based in the United States[15].

The mechanisms by which taxes affect technology investment (particularly telecommunication/ICT) are complex. In general terms, Devereux (2006) considers that taxation first affects two decisions: in which business to invest (e.g. mobile, broadband, and other) and in which geographic location to invest (e.g. a specific country)[16]. In addition, taxes also influence a continuous choice: once a business and locations are agreed upon based on taxation attractiveness, businesses see levies affecting their capital expenditure allocation process. In other words, taxes will influence how much investment will favour certain locations to the detriment of others.

It should be noted that changes in tax regimes do not affect investment decisions instantaneously. Investment decisions are partially driven by variables that only change gradually (e.g. changes in the cost of capital). As a result, a modification of taxation regimes (e.g. a change in the sales tax rate affecting the initial purchasing of network equipment) might affect the incentives to invest immediately but translate in investment decisions only gradually[17]. An implication of the evidence that indicates that corporate investment behaviour lags changes in tax regimes is that countries that constantly change tax policies introduce another layer of complexity for firms planning future investment. In other words, by the time the firm is ready to adjust to the tax regime imposed in past years, a new change imposed by the government modifies the underlying premise of future investment. This situation, which is rather common in the telecommunication industry, makes it very complex for network operators to plan future capital investments.

In general terms, the impact of taxation on corporate behaviour tends to vary according to the economic cycle and evidence shows that in periods of economic expansion, the negative impact of taxation on investment affects primarily the supply of funds and not the incentives to invest[18]. Lintner states that,

"So long as profit positions are not unacceptably low and the necessary funds are available, very substantial amounts of new investment will be undertaken even where there is no very clear enough evidence that the individual investment moves will add enough to net profit to make them worthwhile".

---

[14] Beatty, R., Riffe, S., Welch, I. (1997). "How Firms make capital expenditures decisions: financial signals, internal cash flows, income taxes and the Tax Reform Act of 1986". *Review of Quantitative Finance and Accounting*, 9 (1997): 227-250.

[15] In 1986, the U.S. Congress passed the Tax Reform Act (TRA) to simplify the income tax code, broaden the tax base and eliminate many tax shelters and other preferences. The act raised overall revenue by USD54.9 billion in the first fiscal year after enactment. As of 2014, the Tax Reform Act of 1986 was the most recent major simplification of the tax code, drastically reducing the number of deductions and the number of tax brackets (for the individual income tax) to three.

[16] Devereux, M (2006). *The impact of taxation on the location of capital, firms, and profit: a survey of empirical evidence*. Oxford University Centre of Business Taxation. Working paper WP 07/02.

[17] See (Auerbach, 2005). *Taxation and capital spending*. Paper prepared for the Academic Consultants Meeting of the Board of Governors of the Federal Reserve System. University of California and NBER, September 2005.

[18] Lintner, J. (1954), *Corporate Income Taxes: Their Effect on Investment*. Proceedings of the Academy of Political Science, Vol. 25, No. 4, The American Economy, Keystone of World Prosperity (January 1954), pp. 14-26.

The incentives mentioned include maintaining or improving a competitive position or increasing market share. Conversely, in periods of economic downturn, the effects of taxes on investment incentives would be relatively more important, and the availability of funds becomes less important in influencing investment decisions[19]. Therefore, in the context of post-pandemic conditions, when telecommunication/ICT investment per capita is declining in developing countries[20], taxation becomes a critical factor to consider in determining incentives that address the rural digital divide.

The telecommunication/ICT sector is subject to general and sector-specific levies (see Table 2).

Table 2: Fiscal obligations affecting the telecommunication/ICT sector

Segment	Fiscal obligation	Nature
Taxes on telecommunication operators	Profit tax	General
	Labour taxes	General
	VAT for equipment	General
	Import duties for equipment	General
	Regulatory fees	Sector-specific
	Universal service contribution	Sector-specific
	Spectrum licence fees	Sector-specific
	Others (municipal, other sector specific taxes)	General or sector-specific
Taxes on consumers of telecommunication goods or services	VAT on services	General
	Import duties for smartphones	General
	Other specific taxes	Sector-specific

General taxes affect every sector of a country's economy, typical examples include income tax (such as tax on operator profits); value added tax (VAT), which is imposed on the operator when purchasing equipment; and labour and social contributions, which are paid by enterprises for each employee, such as social security obligations. In some countries, operators are also required to pay custom duties for the import of electronic equipment, software and network components.

Taxes on telecommunication/ICT operators: Among industry-specific contributions, several examples apply to the telecommunication sector: regulatory fees are collected to partially finance the activities of the NRA; and a portion of the contributions imposed on operators is usually collected by a universal service fund (USF) to address issues such as the digital divide. These funds are usually used to fund network deployment in geographic areas where market supply is scarce (or non-existent), and to stimulate demand through aid or subsidies to disadvantaged populations. In addition, spectrum frequency licence allocations or renewals can include one-off

[19] See also Fazzari, S; Hubbard, G; and Petersen, B. (1988). "Financing constraints and corporate investment", *Brookings papers on economic activity*.

[20] See ITU (2021). *The economic impact of broadband and digitization through the COVID-19 pandemic: Econometric modelling*. Geneva: International telecommunication Union.

payments, although in some cases, they can include recurring payments. These are typically justified to fund the regulatory administrative expenses associated with the management of the spectrum. In addition, there are other sector-specific contributions that are applied in some countries, such as service activation taxes and numbering fees. Beyond contributions imposed at the national level, network deployment can also be subject to municipal fees, which can be one-off or recurring, such as for the use of public spaces, property taxes, rental costs, and environmental fees.

Taxes on consumers of telecommunication/ICT goods or services: This category refers to taxes applicable to consumers. End consumers are subject to VAT on payments for services to which they subscribe. This is a general tax, although some countries charge an expanded VAT or an additional sales tax for the acquisition of certain telecommunication services. In addition, in some countries consumers must pay VAT and custom duties for the acquisition of imported devices such as smartphones. Beyond the taxes mentioned above, certain countries have introduced other sector specific obligations affecting the acquisition or use of telecommunication services. Examples of this are service connection fees (for example, a certain percentage of the connection cost), or excise taxes (such as a specific amount per minute of voice or per level of data consumption). The application of such taxes differs in magnitude and scope depending on the country.

Numerous empirical studies have shown taxation to have an impact on the deployment of ICT infrastructure. For instance, the incidence of some specific taxes in the telecommunication market for a sample of countries (Bangladesh, Brazil, Malaysia, Mexico, and South Africa), simulating scenarios for the period 2009-2014 was studied by Katz *et al*. They focused on specific contributions such as VAT for services and handsets, finding that a reduction in taxation in the studied countries could potentially reduce the total cost of mobile ownership, increase service penetration, and increase GDP.[21] In turn, Zamil and Hossen (2012) analysed the case of Bangladesh, covering the period from 1997 to 2008, and documenting the potential gains in terms of sector development from a tax reduction.[22] Andrianaivo and Kpodar (2011)[23], and Calandro *et al*. (2013)[24] outlined the risk of African governments imposing high taxes and fees that will constrain the development of the telecommunication/ICT sector. Similarly, Arawomo and Apanisile (2018) performed a study focused on Nigeria, covering the period 1986-2014, suggesting that the government should offer incentives such as tax holidays, import duties exemptions and subsidies to foreign firms to develop the telecommunication sector.[25] For the Americas region, Katz and Callorda (2019) provided empirical evidence on the impact of taxation on network investment across the United States. According to this research, a decrease of 1 percentage point in the average weighted state and local sales tax rate affecting initial equipment purchases (from 4.58% to 3.58%) would increase investment by 1.97 per cent over the current level of capex.[26]

---

[21] Katz, R., Flores-Roux, E., & Mariscal, J. (2010). The impact of taxation on the development of the Mobile broadband sector. GSMA and Telecom Advisory Services LCC.

[22] Zamil, F., & Hossen, M. M. (2012). Problems and prospects of telecommunication sector of Bangladesh: A critical review. *The International Institute for Science, Technology and Education*, 4(1), 16-25.

[23] Andrianaivo, M., & Kpodar, K. R. (2011). ICT, financial inclusion, and growth: Evidence from African countries. IMF Working Papers, 2011(073).

[24] Calandro, E., Gillwald, A.; Moyo, M. & Stork, C. (2013). Comparative ICT sector performance review.

[25] Arawomo, O., & Apanisile, J. F. (2018). Determinants of foreign direct investment in the Nigerian telecommunication sector. *Modern Economy*, 9(05), 907.

[26] Katz, R., and Callorda, F. (2019). *Assessment of the Economic Impact of Taxation on Communications Investment in The United States: A report to the Broadband Tax Institute*. New York: Telecom Advisory Services.

A panellist at the roundtable mentioned research conducted in Burkina Faso, and the Republic of Congo that demonstrate the benefit of tax reduction on the deployment of networks. More specifically, a decrease of one percentage point in taxation of telecommunication operators in the Republic of Congo would yield an increase of between 5 and 6 percentage points on mobile coverage. A similar analysis for Burkina Faso indicates that one percentage tax reduction would increase coverage by 1.4 per cent.

A complementary economic incentive mentioned during the roundtable discussion is the need to reduce spectrum licence fees. Authors who have analysed the role of spectrum management in pricing or adoption include: Zaber and Sirbu (2012)[27], Kuroda and Forero (2017)[28], Hazlett and Muñoz (2009)[29], Park *et al*. (2011)[30], and Bauer (2003).[31]

In light of these empirical findings, options in the fiscal space that provide incentives for network deployment in rural and isolated areas include:

- Reduce regulatory fees to a maximum of 0.1 per cent of operator gross revenue, supported by the premise that they should only serve to recover the administrative costs of regulation.[32]
- Design tax frameworks that consider different needs at the sub-national level rather than addressing them nationally. While there is some agreement that the telecommunication services industry should be taxed at the same effective rate as other sectors, fiscal authorities should consider implementing specific tailored incentives to stimulate investment in rural and isolated areas. In the words of a panellist: "*Unless fiscal authorities implement fiscal incentives to stimulate network deployment in rural areas of developing countries, a persistent digital divide will continue to exist*".
- Eliminate sector-specific taxes to reduce the asymmetric treatment between the telecommunication industry and other sectors of the economy. Katz and Jung (2022) have estimated that each point of reduction in the regulatory fee rate (for example, from 2% to 1%) generates an increase in investment of 1.6 per cent.
- Eliminate import duties on telecommunication/ICT equipment and software to reduce investment costs. Katz and Jung (2022) estimated that the elimination of equipment import tariffs generates an increase in investment of 14.7 per cent.[33] For example, several countries in the Americas region are exploring approaches to reduce import duties and VAT on network equipment. In Brazil, fiscal authorities provide an incentive to reduce taxes for those telecommunication operators that acquire equipment produced in the country.

---

27 Zaber, M., & Sirbu, M. (2012). Impact of spectrum management policy on the penetration of 3G technology. *Telecommunications Policy*, 36(9), 762-782.

28 Kuroda, T., & Forero, M. (2017). The effects of spectrum allocation mechanisms on market outcomes: Auctions vs beauty contests. *Telecommunications Policy*, *41*(5-6), 341-354.

29 Hazlett, T. W., & Muñoz, R. E. (2009). A welfare analysis of spectrum allocation policies. The *RAND Journal of Economics*, 40(3), 424-454.

30 Park, M., Lee, S. W., & Choi, Y. J. (2011). Does spectrum auctioning harm consumers? Lessons from 3G licensing. *Information Economics and Policy*, 23(1), 118-126.

31 Bauer, J. (2003). "Impact of license fees on the prices of mobile voice service." *Telecommunications Policy*, 27(5-6), 417-434.

32 Regulatory fees are those impositions required to finance the activities of the National Regulatory Agency (NRA). While operators in some countries are not required to pay a recurrent fee, annual payments are imposed in most cases. When these payments are based on a fixed amount, the purpose is exclusively to finance the administrative costs associated to sector regulation. In contrast, other countries choose to establish the fee as a percentage of the operator's gross income, typically at a rate of 1 per cent or higher (rather than a fixed amount to recover costs). While this option is easier to calculate and collect, it results in a larger transfer of resources from the industry to the government.

33 This model was developed for 108 countries for the period from 2009 to 2018, the total sample being 368 observations.

- Implement targeted approaches for investment of universal service funds (USFs). For instance, to reduce USF contributions, Argentina and Colombia allow operators to use part of the contribution directly on national connectivity projects.
- Eliminate import duties on smartphones to improve access and affordability of ICT good. A study by Henn and Gnutzmann-Mkrtchyan (2015) has demonstrated that participation in the Information Technology Agreement that supports the reduction in ICT equipment and devices tariffs has contributed to developing telecommunication/ICT sector and boosting trade in developed and developing economies alike through the reduction of trade costs and by improving the investment climate associated with the reduction of tariffs.[34] For example, as mentioned by a panellist, several initiatives in the Americas region are focused on reducing taxes on consumer devices. In Colombia for instance, consumer telecommunication devices are exempted from VAT.
- Reduce spectrum licence payments. Research by Bahia and Castells (2019) has indicated that a 1 per cent reduction in spectrum payments is associated with a 0.45 per cent increase in 4G coverage in developing countries.[35]
- To complement these initiatives, a panellist raised the need for governments to provide tax rebates, both direct and indirect including subsidies, and subsidized loans for network rollout. For example, a subsidy scheme to provide network connectivity in remote villages has been implemented. For example, Malaysia approved tax allowances on expenditure on last-mile broadband equipment as an incentive for operators to roll out their networks.[36]

Exploring new business opportunities

Tax exemptions can be used to stimulate ICT infrastructure deployment in rural areas. This lever can improve the financial profile of an investment but if the profitability gap continues to exist after implementing the tax reduction, rural investment will not follow, and other options need to be explored.

As discussed above, one variable that could improve the network deployment investment model is to increase revenues, or as one panellist said, "*shift the emphasis from supply to demand*". This demand stimulation option was raised with the understanding that, as expected, it could run in the face of reduced service affordability, a characteristic endemic to rural areas. A roundtable panellist suggested the need to explore "*innovative ways to think about cross-subsidization of deployment through the identification of new business models and opportunities to generate revenues*". In other words, in addition to thinking about how to close the return-on-investment gap by sharing infrastructure and reducing taxes, network operators could turn the problem on its head and start to look at new business opportunities that could increase revenues.

Labelled by one panellist the "*downstream rural e-services*" model, this option is based on promoting rural financial services, e-commerce, and media platforms as services that drive demand first, which would then stimulate telecommunication services providers to deploy networks. As another panellist suggested, "*demand stimulation would result in other revenue streams that would be open for taxation*." However, for this to happen, the digital ecosystem would have to be developed enough to have the capacity of developing demand in anticipation of network deployment. This has been the case in China as a result of the pioneering work of some platforms such as, for example, Alibaba, Tencent, and Tik Tok.

---

[34] Henn, Christian & Gnutzmann-Mkrtchyan, Arevik, 2015. *The layers of the IT Agreement's trade impact*, WTO Staff Working Papers ERSD-2015-01, World Trade Organization (WTO), Economic Research and Statistics Division.

[35] Bahia, K., & Castells, P. (2021). The impact of spectrum assignment policies on consumer welfare. *Telecommunications Policy*, 102228.

[36] Katz, R. and Berry, T. (2014). *Driving demand of Broadband Networks and Services*. London: Springer, p. 141

A different alternative for focusing on the demand side is to dramatically change the supply side business model. Rather than trying to "fine-tune" the current model by promoting sharing or reducing taxes, suggested a panellist, an alternative approach could be based on different operating models with lower service economics (for example, community networks, microtelcos, Wi-Fi-based mobile Internet service providers) that are more suited to addressing the demand of rural areas. In the words of one panellist, "*We need to completely review that predominantly national exclusive licensing frameworks and expensive business models (and taxation regimes) with the current blunt incentives and penalties and think about creating more enabling frameworks, for multiple players to enter markets providing different niche, community, microcell, regional (dynamic spectrum licensing for rural areas).*"

One approach could be to allow large operators to bid for high demand spectrum but achieve significant price discounts for certain types of infrastructure sharing (e.g. Ofcom) with the positive outcomes of reducing overall costs (reduced revenues from auction but massive positive multipliers in take up and services) and potential innovation that can drive the digital and data economy and produce multiple systemic revenue streams for the state.

Rebalance the fiscal framework to address asymmetries

On a related matter, the option exists to redefine the contribution mechanism of universal service funds. A recent proposal developed by the United States FCC Commissioner Brendan Carr[37] and linked to the funding mechanism of universal service funds (USFs) stands out. The traditional model, according to Commissioner Carr, is obsolete. He argues that the dominant telecommunication network is no longer telephony, but the Internet, which leads to the need to rethink how to finance high-speed networks in unprofitable environments. Carr proposes to include internet platforms as potential contributors. The argument is that, just five companies - Netflix, YouTube, Amazon Prime, Disney+ and Microsoft - account for 75 per cent of rural broadband Internet traffic in the United States (Layton and Potgieter, 2021[38]), and most of the investments are to add capacity and adapt networks to support such streaming services.

This proposal is similar to one raised by a panellist: "*Currently in many African countries, the outcomes of skewed and misdirected tax structures is that the most profitable big tech platforms pay nothing, the infrastructure providers often pay very high taxes (though they remain very profitable in many markets where they are dominant), which are passed on the end users making the price of services unaffordable for the majority of the population and then in some countries end users further face regressive social networking and mobile money taxes (and the platforms themselves don't pay a cent). This has impacted negative on universal service goals, with many of the poorest being push of the networks or their usage reduces dramatically, which has meant that the data service providers in many African countries the infrastructure operators, revenues have decreased, making them even less profitable and in fact reducing the contribution to the tax base for state formation*".

---

[37] Carr, Brendan (2021). "Ending Big Tech's Free Ride". *Newsweek* (May). Available at: https://www.newsweek.com/ending-big-techs-free-ride-opinion-1593696

[38] Layton, R., & Potgieter, P. H. (2021). *Rural Broadband and the Unrecovered Cost of Streaming Video Entertainment*. Forthcoming, ITS Gotenberg June.

2.3 Options for implementation of incentives for deploying networks in rural and isolated areas

Going forward, several incentives exist that could prove useful in promoting the deployment of networks in rural and isolated areas:

- Promote active and passive infrastructure sharing across fixed and mobile network operators.
- Incentivize co-development with other network industries (e.g. utilities) by promoting collaboration in deployment and operation of shared infrastructure.
- Reduce sector specific taxation: governments should consider the development of tax frameworks at the sub-national level to reduce the burden and stimulate deployment in isolated areas.
- Enact sales tax and import duty exemptions for network equipment.
- Reduce spectrum licence fees, if possible.
- Explore new business opportunities around to increase "downstream rural e-services", to improve revenues.
- Rethink the rural operating model by searching for much lower cost options (for example, community networks, microtelcos, Wi-Fi based mobile Internet service providers).
- Rebalance the fiscal framework to address asymmetries between impositions on infrastructure service providers and digital platforms.

3 Economic and fiscal incentives required to ensure the introduction of advance information and communication technologies

3.1 The imperatives of 5G[39]

The next generation of mobile connectivity around 5G is conceived as an exponential increase in the quality of the proposed value of connectivity. The services associated with 5G technology offer greater coverage by providing consistent quality levels both inside and outside buildings, in populated areas, industrial zones and along transportation corridors. Similarly, coverage would be extended to rural and isolated areas, providing signal coverage for devices with very low energy consumption. This includes the ability to provide service for a high density of Internet of Things (IoT) terminals. Furthermore, the unit cost of data traffic would be significantly lower than that of 4G networks. This functionality is offered at a high quality in different geographies, although the latency and speed of the services are adapted to particular applications, use cases and market segments.

These characteristics define an advanced network that is composed of a high density of access points[40] and that operates in high, mid and low bands, as well as millimetre wave bands, potentially complemented with non-licensed spectrum. The network allows the interconnection of several different radio technologies that have the interoperability necessary to allow for uninterrupted communication sessions. Finally, 5G mobile infrastructure offers the ability to allocate portions of the network using the virtualization of network functions (*"network slicing"*) and *software defined networks*.

The economics of 5G have been estimated for full coverage in three settings, urban, suburban, and rural, primarily in advanced economies (see Table 3).

---

39 The ITU Radiocommunication Sector (ITU-R) has developed the IMT-2020 (5G) specifications including other broadband technologies that also comprise enhancements to previous mobile broadband scenarios and extends application of 5G technology to use cases involving ultra-reliable, low latency communications, and massive machine-type communications, as described in the IMT Vision included in Recommendation ITU-R M.2083-0 (09/2015) available at: https://www.itu.int/rec/R-REC-M.2083. More information on ITU-R Working Party 5D (WP 5D), IMT Systems is available at: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/Pages/default.aspx.

40 In dense areas, the number of sites will range between 200 and 2 500 per km^2, whereas in suburban spaces it will reach 400 sites per km^2, and in rural areas it will be approximately 100 per km^2. Download speeds can reach 300 Mbit/s in high density areas, and 1 Gbit/s inside buildings. Latency in high density areas is 10 minutes, although certain critical applications may receive 1 minute latency.

Table 3: United Kingdom: 5G cost (without spectrum acquisition costs)

	Town/City (millions)	Population distribution (%)	5G capex (USD billions) (*)	5G capex (%)	Capex per Population (USD)
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

(*) Cost scenario assumes no sharing scenario with a country-wide delivery of 50 Mbit/s

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

Using capital investment per population as a starting point (which does not include spectrum acquisition costs), total deployment costs for 5G networks have been estimated for selected Americas region countries[41]. Additionally, the total 5G investment was compared with the annual capex projection to underline the level of effort that operators would have to make if they were to deploy 5G networks on a national scale (see Table 4).

Table 4: Selected Americas region countries: 5G cost (without spectrum acquisition costs)

Country	Investment required (USD billions)	Annual capex (USD billions)				
		2021	2022	2023	2024	2025
Argentina	9.09	0.384	0.407	0.505	0.575	0.608
Brazil	48.41	3.588	3.933	4.255	4.348	4.235
Chile	5.18	0.999	1.054	1.115	1.140	1.144
Colombia	12.62	0.893	0.902	0.931	0.907	0.888
Mexico	37.41	1.830	1.951	2.144	2.353	2.329
Peru	7.36	0.845	0.873	0.935	1.029	1.045

Source: The value of digital transformation through expansive mobile in Latin America. Katz, R. and Cabello, S. (2019).

The comparison of the five-year capex forecast with the investment required to deploy national 5G infrastructure (under no sharing assumption) provides an indication of the challenge facing the deployment of advanced networks especially in developing countries. Analysis suggests that it could take at least ten years to raise the investment required to cover the sum of all capex (and a potential extrapolation beyond 2025) to deploy 5G in any of the selected Americas region countries under a non-shared network scenario. This is the nature of the challenge facing developing countries in terms of deployment of advanced ICT infrastructure, thereby raising the need for implementing economic and financial incentives.

[41] The projected costs in this case are based on calculations for the deployment of the extended version of 5G networks. The required capital for rural deployment in Americas region countries was adjusted based on the difference in GDP between selected Americas region countries and the United Kingdom.

3.2 Spectrum management incentives

According to one panellist, governments should acknowledge that to stimulate the deployment of 5G they should accept a low reserve price at auctions in exchange for a higher coverage rate and less barriers to deployment by easing access to and lowering the cost of mid-band spectrum. This would allow network operators to accelerate 5G deployment by reducing up-front (pre-service) costs and redirect more capex to network roll-out. This, in turn would allow faster scale-up of infrastructure coverage and capacity, higher performance capabilities and faster monetization of use cases, especially in industrial sectors.

One way of reducing spectrum licence costs is to impose coverage obligations in licence awards in a "beauty contest" hybrid auction framework. This allows licence applicants to trade licence fees (in some cases up to 40 per cent) for coverage obligations. This approach was already used in 4G but is being applied to 5G in countries such as Chile and Brazil.

3.3 The role of government as a facilitator of incentives

Governments can play an important role in facilitating the deployment of 5G through several initiatives:

- provide financial stimuli by subsidizing the purchasing of 5G devices and connectivity fees for enterprises, to encourage implementation of 5G in use cases (e.g. China);
- set up funds for trial services;
- promote R&D on 5G use cases and innovation;
- reduce deployment barriers to physical infrastructure.

Some governments are also implementing a policy framework to combine taxation system proposals, infrastructure sharing, and further spectrum allocations. More importantly, governments are perceived as playing the role of orchestrators of incentives to facilitate 5G network deployment. In ASEAN[42] countries, for example, regulators are enabling 5G rollout by restructuring cost through sharing and industry consolidation and promoting network joint ventures. In Japan, companies involved in 5G deployment can deduct the cost of equipment purchasing from income tax. In Taiwan, Province of China, and Hong Kong, Special Administrative Region of China, operators receive subsidies in support of 5G applications development.

3.4 Impact of economic and financial incentives for advanced technology deployment

The impact of 5G deployment is structured around productivity effects in economic sectors and, potentially, new use cases for consumers. It is widely expected that adoption of 5G, fibre-optic rollouts and cloud services can drive economic growth and potentially kick start new industries and create new business models and employment. However, according to a panellist "*heavy capital expenditure burden and the lack of scale visible consumer use cases is keeping service providers hesitant from launching new services, except from conventional fixed mobile access*".

Reducing the capex burden with asset sharing and tax reductions will encourage quicker deployment. A reduction of 5G licence costs will certainly have an impact on the ability and possibility of telecommunication/ICT operators to deploy advanced networks. Along these lines,

[42] https://asean.org/

a decreasing revenue for the government resulting from reduced spectrum licence incomes could be partly compensated by the spill over of technology on the operations of key industries.

That being said, one panellist reminded the roundtable that economic and financial incentives are not enough to facilitate the deployment of 5G technology, and as technologies migrate from 4G to 5G, operators are transitioning their operating model and blending infrastructure within cloud-based architectures to drive operational savings.

Based on the last Global Symposium for Regulators (GSR-21) best practice guidelines, the role of government is to clear the way for investment and support a different competitive market for future broadband and digital services. For this, it is important to implement sound tax policy strategy to foster the digital economy, including tax incentives or tax deductibility for new investments in infrastructure, tangible and intangible assets such as ICT equipment and software, and remove sector specific taxes on digital services, devices and equipment[43].

[43] GSR-21 Best Practice Guidelines on Regulatory uplift for financing digital infrastructure, access and use, available at https://www.itu.int/en/ITU-D/Conferences/GSR/2021/Documents/GSR-21_Best-Practice-Guidelines_FINAL_E_V2.pdf

4 Conclusions: implications for policy-makers and regulators

It is highly appropriate to conclude this roundtable report with the words of one panellist,

> *"I really urge today's discussion to think about the economic and the incentives as well as the fiscal policies are not just about the tax and subsidies but more importantly how can we think about innovative arrangements to collect and to spend the same amount of budget. And how can we improve the efficiency of spending the budget by enabling cross subsidization and cross departmental collaborations".*

In other words, beyond the specific recommendations outlined in this report, government policy-makers and regulators need to think about economic and fiscal incentives for deployment of ICT networks in a holistic manner, aiming to address the overall objectives of maximizing digital transformation of economies and societies. In that context, collaboration across government agencies is critical.

Annex

ITU economic experts roundtable survey

As anticipated in the concept note, the purpose of the upcoming roundtable is to take stock further on potential economic and fiscal approaches to address, in a balanced way, the trade-offs between government need to raise funds for the delivery of public services and provide required incentives for deployment of digital infrastructure. (a) How can (or should) we address potential asymmetries in economic incentives to be implemented across all sectors of the digital economy? (b) What are the implications for the digital ecosystem of the G20 endorsement of the OECD deal of a global minimum corporate tax of 15 per cent? (c) What could be the potential fiscal incentives to stimulate the deployment of digital infrastructure in rural and isolated areas? (d) What kind of economic incentives should be defined to ensure the introduction of advanced technologies such as 5G, optical fibre, and cloud-services?

In preparation for the roundtable, we would appreciate it if you could answer a short survey. As usual, the compiled responses will help frame the session discussion. In addition to the survey response, we would appreciate it if you can share with us any relevant piece of research you or your organization has produced on the topic.

An effective tax policy must consider a series of factors to balance, ranging from the governments' own fiscal needs, to avoiding inefficiencies and distortions that negatively affect the performance of the markets. Economic theory suggests increasing taxing to goods that produce a negative externality to society (such as tobacco, alcohol, or gambling), while on the other hand, minimize fiscal obligations for those goods and services that are supposed to generate positive spill-overs and the intention of public authorities is to stimulate their consumption.

In your opinion:

Q1: What do you believe the key principles driving the tax structure in telecommunications should be?

Example (only for reference, since you might not agree with it)

Description of the topic	• Excessive taxation and impositions on the telecommunication industry is having a negative impact on deployment of networks, particularly in remote and rural areas with low return of investment.
Trends and/or issues on the spot	• While there is some agreement that the telecommunication services industry should be taxed at the same effective rate as other sectors, fiscal authorities should consider implementing specific incentives to stimulate investment in rural and isolated areas.
Economic impact	• Tax exemption for investment of telecommunication networks in rural areas will stimulate deployment of networks, and consequently a reduction of digital divide.
Long term outlook	• Unless such incentives are implemented, considering governments' limited resources in developing countries, we might be expecting a persistent digital divide.

(continued)

Preferred quotation: (if you have one)	• "Unless fiscal authorities implement fiscal incentives to stimulate network deployment in rural areas of developing countries, a persistent digital divide will continue to exist."

#1: XXXXXX

Description of the topic	•
Trends and/or issues on the spot	•
Economic impact	•
Outlook for 2022	•
Preferred quotation: (if you have one)	•

#2: XXXXXX

Description of the topic	•
Trends and/or issues on the spot	•
Economic impact	•
Outlook for 2022	•
Preferred quotation: (if you have one)	•

Q2: What kind of fiscal incentives could be implemented to stimulate deployment of ICT infrastructure in rural and isolated areas?

Q3: Do you believe the global minimum corporate tax of 15 per cent endorsed by the G20 will address some of the fiscal asymmetries existing within the digital ecosystem (e.g. between OTT and telecommunication operators)?

Q4: What kind of incentives should be defined to ensure the introduction of advanced technologies such as 5G, optical fibre, and cloud-services in support of the needs for digital transformation of the economy?

Office of the Director
International Telecommunication Union (ITU)
Telecommunication Development Bureau (BDT)
Place des Nations
CH-1211 Geneva 20
Switzerland

Email: bdtdirector@itu.int
Tel.: +41 22 730 5035/5435
Fax: +41 22 730 5484

Office of Deputy Director and Regional Presence
Field Operations Coordination Department (DDR)
Place des Nations
CH-1211 Geneva 20
Switzerland

Email: bdtdeputydir@itu.int
Tel.: +41 22 730 5131
Fax: +41 22 730 5484

Digital Networks and Society (DNS)
Email: bdt-dns@itu.int
Tel.: +41 22 730 5421
Fax: +41 22 730 5484

Digital Knowledge Hub Department (DKH)
Email: bdt-dkh@itu.int
Tel.: +41 22 730 5900
Fax: +41 22 730 5484

Partnerships for Digital Development Department (PDD)
Email: bdt-pdd@itu.int
Tel.: +41 22 730 5447
Fax: +41 22 730 5484

Africa

Ethiopia
International Telecommunication Union (ITU) Regional Office
Gambia Road
Leghar Ethio Telecom Bldg. 3rd floor
P.O. Box 60 005
Addis Ababa
Ethiopia

Email: itu-ro-africa@itu.int
Tel.: +251 11 551 4977
Tel.: +251 11 551 4855
Tel.: +251 11 551 8328
Fax: +251 11 551 7299

Cameroon
Union internationale des télécommunications (UIT)
Bureau de zone
Immeuble CAMPOST, 3e étage
Boulevard du 20 mai
Boîte postale 11017
Yaoundé
Cameroon

Email: itu-yaounde@itu.int
Tel.: + 237 22 22 9292
Tel.: + 237 22 22 9291
Fax: + 237 22 22 9297

Senegal
Union internationale des télécommunications (UIT)
Bureau de zone
8, Route des Almadies
Immeuble Rokhaya, 3e étage
Boîte postale 29471
Dakar - Yoff
Senegal

Email: itu-dakar@itu.int
Tel.: +221 33 859 7010
Tel.: +221 33 859 7021
Fax: +221 33 868 6386

Zimbabwe
International Telecommunication Union (ITU) Area Office
TelOne Centre for Learning
Corner Samora Machel and Hampton Road
P.O. Box BE 792
Belvedere Harare
Zimbabwe

Email: itu-harare@itu.int
Tel.: +263 4 77 5939
Tel.: +263 4 77 5941
Fax: +263 4 77 1257

Americas

Brazil
União Internacional de Telecomunicações (UIT)
Escritório Regional
SAUS Quadra 6 Ed. Luis Eduardo Magalhães,
Bloco "E", 10º andar, Ala Sul (Anatel)
CEP 70070-940 Brasilia - DF
Brazil

Email: itubrasilia@itu.int
Tel.: +55 61 2312 2730-1
Tel.: +55 61 2312 2733-5
Fax: +55 61 2312 2738

Barbados
International Telecommunication Union (ITU) Area Office
United Nations House
Marine Gardens
Hastings, Christ Church
P.O. Box 1047
Bridgetown
Barbados

Email: itubridgetown@itu.int
Tel.: +1 246 431 0343
Fax: +1 246 437 7403

Chile
Unión Internacional de Telecomunicaciones (UIT)
Oficina de Representación de Área
Merced 753, Piso 4
Santiago de Chile
Chile

Email: itusantiago@itu.int
Tel.: +56 2 632 6134/6147
Fax: +56 2 632 6154

Honduras
Unión Internacional de Telecomunicaciones (UIT)
Oficina de Representación de Área
Colonia Altos de Miramontes
Calle principal, Edificio No. 1583
Frente a Santos y Cía
Apartado Postal 976
Tegucigalpa
Honduras

Email: itutegucigalpa@itu.int
Tel.: +504 2235 5470
Fax: +504 2235 5471

Arab States

Egypt
International Telecommunication Union (ITU) Regional Office
Smart Village, Building B 147,
3rd floor
Km 28 Cairo
Alexandria Desert Road
Giza Governorate
Cairo
Egypt

Email: itu-ro-arabstates@itu.int
Tel.: +202 3537 1777
Fax: +202 3537 1888

Asia-Pacific

Thailand
International Telecommunication Union (ITU) Regional Office
4th floor NBTC Region 1 Building
101 Chaengwattana Road
Laksi,
Bangkok 10210,
Thailand

Mailing address:
P.O. Box 178, Laksi Post Office
Laksi, Bangkok 10210, Thailand

Email: itu-ro-asiapacific@itu.int
Tel.: +66 2 574 9326 – 8
+66 2 575 0055

Indonesia
International Telecommunication Union (ITU) Area Office
Sapta Pesona Building
13th floor
Jl. Merdan Merdeka Barat No. 17
Jakarta 10110
Indonesia

Email: itu-ro-asiapacific@itu.int
Tel.: +62 21 381 3572
Tel.: +62 21 380 2322/2324
Fax: +62 21 389 5521

CIS

Russian Federation
International Telecommunication Union (ITU) Regional Office
4, Building 1
Sergiy Radonezhsky Str.
Moscow 105120
Russian Federation

Email: itumoscow@itu.int
Tel.: +7 495 926 6070

Europe

Switzerland
International Telecommunication Union (ITU) Office for Europe
Place des Nations
CH-1211 Geneva 20
Switzerland
Email: eurregion@itu.int
Tel.: +41 22 730 5467
Fax: +41 22 730 5484

International Telecommunication Union
Telecommunication Development Bureau
Place des Nations
CH-1211 Geneva 20
Switzerland

ISBN: 978-92-61-37071-8

Published in Switzerland
Geneva, 2022

Photo credits: Shutterstock