OECD GOING DIGITAL TOOLKIT

POLICY NOTE

Bridging connectivity divides

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This Toolkit note was written by Alexia González Fanfalone, Maximilian Reisch, Miki Naito, Jaeho Lee and Verena Weber, under the supervision of Verena Weber. It builds on "Bridging connectivity divides", OECD Digital Economy Paper No. 315, which was reviewed by the Working Party on Communication Infrastructure and Services Policy and declassified by the Committee on Digital Economy Policy on 4 December 2020. The note was prepared for publication by the OECD Secretariat.

This Toolkit note is a contribution to the OECD Going Digital project, which aims to provide policy makers with the tools they need to help their economies and societies thrive in an increasingly digital and data-driven world.

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Bridging Connectivity Divides

Reliable and high-quality connectivity is fundamental for the digital transformation. Now more than ever, access to high-quality broadband services at affordable prices is essential to ensure that economic and social activities can continue in an increasingly remote manner. However, important disparities in terms of connectivity persist, aggravating the consequences of digital divides. As such, expanding connectivity to achieve an inclusive society is at the heart of policy agendas in OECD countries. However, more concretely, what are the innovative policies and regulatory measures that have proven to work best to ensure connectivity for all? This Toolkit note provides a "roadmap" to policymakers by identifying policies and regulation to effectively reduce connectivity divides. Such policies include promoting competition, fostering investment, and removing barriers to broadband deployment, as well as a set of tailored approaches that are particularly relevant to extending connectivity in rural and remote areas. The Annex of this note provides examples of related policy and regulatory approaches implemented by different OECD countries.

How can policies and regulatory measures help bridge connectivity divides? Reliable and high-quality connectivity is fundamental for the digital transformation as it facilitates interactions between people, organisations and machines. On many dimensions, great progress has been made to increase the number of connected people and start closing divides. However, one of the most challenging questions is how to ensure that everyone benefits from digital transformation and nobody is left behind, regardless of their gender, their income level, or where they live. In short, how to ensure connectivity for all.

To close connectivity divides, people not only need to have access to broadband services, but they need to be connected *well*, which means access the high-quality communication networks and services at affordable prices. Only then can everyone fully benefit from their use and the digital transformation.

As countries weather the COVID-19 health emergency, connectivity, more than ever, is essential to ensure that economic and social activities can continue in a remote manner. However, disparities in access to communication services, among and within countries, may accentuate the consequences of the health emergency. Therefore, policies aiming to reduce connectivity divides are of paramount importance as significant challenges remain. First, that of making improved broadband readily accessible in areas with low population densities and for disadvantaged groups, and second, continuing to upgrade these networks so users can take full advantage of the opportunities they offer (OECD, 2018[1]).

What innovative policies and regulation can best ensure connectivity for all? This policy note identifies key aspects policy makers should consider to address connectivity divides effectively, in particular competition, investment, barriers to infrastructure deployment and a set of policies that are particularly relevant to rural and remote areas. The Annex of this note provides examples of policy approaches for each of these aspects from different countries.

What is a connectivity divide?

The term "digital divide" is a broad concept commonly used to refer to different levels of access and use of information and communication technologies (ICTs) and, most often, to the gaps in access and use of Internet-based digital services. Broadband access, as a general-purpose technology, provides the physical means for using these services (OECD, 2018[1]).

Digital divides can vary in terms of geography (e.g. as urban and rural areas), by gender, by age, by skill level, by firm size, and in general, by different vulnerable groups in society, among others. Some aspects underpinning digital divides are, of course, common to most geographical areas such as income

disparities or lack of skills, while other aspects are accentuated by differences in geography due the distance to core broadband networks. The definition of "gap" or "divide" inherently means a comparison; therefore, there is an implicit reference group in mind (within or among countries) when assessing them (e.g. rural versus urban areas, small and medium enterprises (SMEs) versus large firms, developed versus emerging economies, etc.).

Box 1. What is a connectivity divide?

The term "connectivity divide" is used to refer to gaps in access and uptake of high-quality broadband services at affordable prices in areas with low population densities and for disadvantaged groups compared to the population as a whole.

The focus of this Toolkit Note is the *network layer*. Enhancing connectivity, understood as ubiquitous access to high quality and affordable communication services, is key to achieving an inclusive digital transformation. *Affordability* and *high quality* broadband services usually derive from competition in communication markets and policies that promote investment. In this sense, the term "connectivity divide" is used to refer to gaps in access and uptake of high-quality broadband services in areas with low population densities and for disadvantaged groups.

Being connected well

Assessing connectivity divides is a pre-requisite to tailor policies and regulatory measures aimed at maximising the benefits of access to and use of broadband services. To do so, it is not only important to measure the availability of broadband through indicators such as coverage, penetration, and uptake by firms and individuals, but also to measure the performance (i.e. quality) of the broadband connection within and across countries. Drawing on both elements of availability and quality will enable setting appropriate broadband objectives and expand access in underserved areas, which is a policy objective that ranks high on current policy agendas of OECD countries. The OECD Broadband Portal provides a range of key resources to measure connectivity, for example, links to national broadband maps, broadband subscription data by speed tiers, and broadband coverage.

The quality of broadband services

Broadband quality includes several aspects such as up- and download speeds, latency, packet loss, resilience, etc. (OECD, 2019[2]). While bandwidth speed is one metric to gauge overall performance, other measures of quality will become increasingly important for operators in the future such as improved network response (i.e. latency) and the need for critical applications to have fewer network errors (i.e. packet loss) (OECD, 2019[2]).

The OECD has laid the foundation for a harmonised measurement approach in 2012 for one dimension of broadband quality: download speeds by tiers (OECD, 2013[3]). Regulators collect information on the advertised download speed of subscriptions, which are compiled to show subscriptions broken down by speed tiers - a view of the "theoretical" speed of subscriptions. While overall broadband speeds have been uniformly increasing in OECD countries, important disparities still exist between urban and rural areas in terms of the quality of connections.

Albeit definitions of what constitutes a rural area vary among OECD countries, there are persistent gaps in the availability of fixed broadband services with a minimum speed of 30 Mbps between urban and rural areas. In 2019, only 59% of rural households in Europe had access to fixed broadband services at 30 Mbps compared to 86% of households in all areas overall. In Canada, 93% of overall households had access to such broadband in 2019, but that share was only 67% in rural areas. At the end of 2018, in the United States[1], the availability was 77.7% in rural areas, against 94.4% in total. The persistence of rural-urban connectivity divides raises questions about inclusiveness and equal opportunities in the digital age.

There is a potential gap between the speeds advertised to customers and those actually experienced by users. Therefore, measurement of actual or "real" broadband performance is crucial. In this sense, data-driven regulation (i.e. relying on the power of disclosing information to steer communication markets in the right direction), can prove useful to increase broadband access and performance in OECD countries. In particular, the transparency generated by data on network quality provides incentives for operators to "self-regulate" and invest in network improvements (see Annex for examples).

Going forward, in addition to broadband speeds, indicators such as resilience, robustness, latency and reliability will become increasingly important with the next evolution of broadband networks (i.e. 5G and high-capacity fixed networks). One clear trend of 5G is the need to bring cells closer to the user (network densification) to reduce latency and keep up with the pace of data transmission requirements (OECD, 2019[4]). In order to meet increasing customer demands on communication infrastructure, more fibre backhaul will need to be deployed. Therefore, measures of the underlying wholesale inputs directly influencing broadband performance, such as backhaul availability, will become increasingly relevant.

[1] For the United States, the speed threshold is 25 Mbps, as a percentage of population coverage rather than as a percentage of households covered.

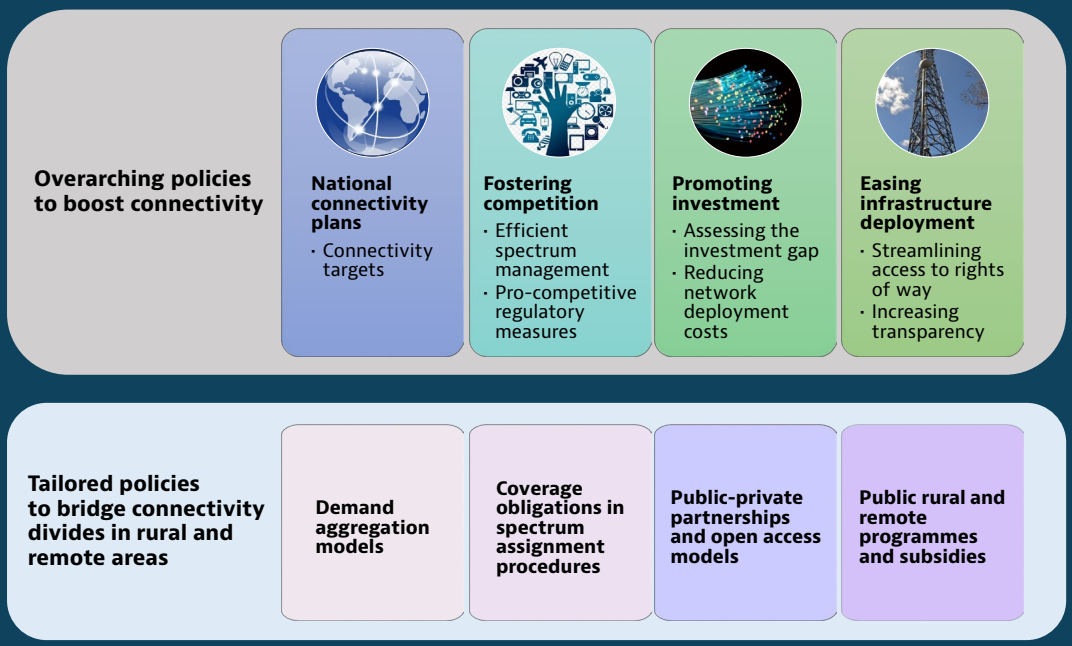
Affordability of communication services

The second relevant parameter to bridge connectivity divides is affordability, which can represent a major obstacle to broadband uptake. Affordability depends on people's available income as well as the pricing of the communication service. Assessing prices of communication services is thus also key for an inclusive digital transformation. Prices are both a measure of affordability and an important factor in understanding the competitive dynamics of communication markets (see Competition section below). While price plans are inherently complex (e.g. as regards bundles, usage patterns, promotional discounts), the OECD has made several advances in this area by providing a pricing methodology that incorporates usage baskets (i.e. low, medium and high usage) to compare prices of communication services across OECD countries.

Policy responses and regulatory measures to bridge connectivity divides

Policies and regulatory measures that improve connectivity and enhance access to communication infrastructures and services are key for an inclusive digital transformation. The section first discusses overarching policies to foster connectivity. In a second step, the section focuses on policies and regulatory measures that particularly foster broadband development and deployment in rural and remote areas (Figure 1).

Figure 1. Overview of policies to bridge connectivity divides



***Source*:** Authors.

Overarching policies and regulatory measures to expand connectivity

A growing number of OECD countries consider access to the Internet as a basic right for citizens (e.g. Colombia, Finland, France, Iceland, Ireland, Italy, Mexico, Norway, Poland, Slovenia, Sweden, Turkey and the United Kingdom). In addition, an increasing number of countries in the OECD have changed their legal frameworks to include broadband as part of their universal service framework. In 2008, Switzerland became the first country to do so, followed by Australia, Belgium, Canada, Colombia, Finland, Iceland, Israel, Korea, Poland, Slovenia, Spain, Sweden, Turkey, United Kingdom and the United States.

As such, expanding connectivity to achieve an inclusive society is at the heart of the policy agenda across OECD countries. National broadband plans and digital strategies, policies to foster competition, promote investment and ease infrastructure deployment are important tools used by OECD countries to spur the expansion of high-capacity communication networks.

Boosting connectivity through national broadband plans and digital strategies

The vast majority of OECD countries have established connectivity targets through national broadband plans or digital strategies, which set targets for coverage and speeds. Many plans increasingly aim for higher speeds (e.g. "Gigabit" and even 10 Gbps broadband connections).

The need to foster competition for an inclusive digital transformation

OECD's research for the past two decades has shown that the liberalisation of the communication sector has brought many benefits in terms of increasing the affordability, availability and quality of communication services.[2] Promoting competition enables users to benefit from greater choice from network service providers and spurs innovation in communication markets. It increases investment, lowers prices and drives up the overall quality of broadband offers, including to underserved populations. Therefore, policies and regulatory measures that foster competition can be a key driver for bridging connectivity divides.

The analysis of market structures and their effects on delivering efficient and inclusive communication services has been a key policy and regulatory issue. Prices, for example, depend greatly on the competitive conditions of the

[2] The OECD has undertaken 22 country reviews of telecommunication policy and regulation since 1999. These reviews provide an overview of the challenges and achievements in a country's telecommunication sector, and putting forward recommendations.

market in each country, and in some instances, they also depend on regulation for specific services at the wholesale level. In a sector with high fixed costs and barriers to entry, as is the case for the communication sector, the institutional and regulatory framework weighs heavily on the resulting market structure. As such, it has a direct influence on the affordability of communication services and the effects of competition on prices (OECD, forthcoming[5]).

Increased competition in communication markets has not only rendered communication services more affordable, but has also played a significant role in broadband development in OECD countries. As the cost structure of communication markets is conducive to barriers to entry in the market, *ex ante* pro-competitive regulation in wholesale markets is widely used to increase infrastructure and retail based competition. A determining factor that has driven communication prices down in most OECD countries is proper regulation that fosters competition.

Mexico provides a good example for the effects of competition in driving broadband development and fostering uptake of communication services. In 2012, Mexico had one of the highest telecommunication prices in the OECD.[3] The results published in the *OECD Telecommunication and Broadcasting Review of Mexico 2017* showed that regulatory reform in 2013 boosted competition, significantly lowered prices, and increased the quality of communication services (OECD, 2017[6]).

To promote competition OECD countries have implemented policies to lower barriers for investment and to increase regulatory certainty. These policies include simplifying licensing requirements, lifting foreign investment restrictions, ensuring effective and efficient interconnection among the different actors, simplifying and harmonising rights-of-way acquisition and encouraging network sharing and co-investment (OECD, 2018[1]).

Efficient spectrum management as a means to foster competition and drive deployment

Spectrum is an essential input for wireless communications. Therefore, its timely availability is critical for the next generation of wireless networks (OECD, 2019[4]). The use of market-based auction mechanisms for spectrum assignment is a best practice among OECD countries. Furthermore, the use of spectrum caps and coverage obligations in auctions has helped promote competition in OECD communication markets, while expanding network coverage (see more details on coverage obligations in the section below).

Four important elements in spectrum auction design affect the outcome: setting spectrum caps, designing the blocks, coverage obligations and

[3] In 2012, Mexico had one of the highest telecommunication prices in the OECD, both when measured at purchasing power parity or in United States dollar.

establishing the reserve prices. Spectrum auctions can shape competition dynamics as the design of blocks, together with spectrum caps, can determine how many players will prevail in markets in years to come. Thus, the design of the auctions becomes vital for the sector. When designing spectrum auctions, the different elements of the auction design should embody the objectives of enhancing competition in the market and providing incentives to expand coverage of mobile networks.

Pro-competitive wholesale access regulation seeking to foster connectivity

Regulatory frameworks are increasingly addressing the critical role of access to backhaul connectivity for the competitive dynamics in the market. For example, the European Electronic Communications Code (EECC), which include the possibility to intervene in backhaul markets, if competition problems are identified (European Commission, 2018[6]). The Australian Competition and Consumer Commission (ACCC) has declared certain Domestic Transmission Capacity Service routes (i.e. backbone and backhaul connectivity) as not sufficiently competitive, where providers of these regulated services must offer access to them under specified terms and conditions, including pricing (ACCC, 2019[7]).[4] In the United Kingdom, the government set out measures in the "Future Telecoms Infrastructure Review" (United Kingdom Department for Digital, Culture, Media and Sport, 2018[8]) to boost competition and to drive fibre rollout as the country considers it a priority for 5G, including measures such as "unrestricted access" to Openreach ducts and poles (i.e. the physical infrastructure subsidiary of BT Group) for both residential and business broadband use.

The importance of promoting investment

As the demands for reliable and fast connections are expected to continue to increase, policy makers should encourage investment in high-quality and affordable communication infrastructures and services. As more people and things go online, continued investment in communication networks is needed to ensure that connections and transfers of data between connected devices can take place quickly, both in fixed and mobile communication markets.

The use of fibre in fixed networks must be extended to support increases in speed and capacity across all next-generation technologies. In particular, expanding backhaul and backbone connectivity becomes essential. Fixed networks take on the 'heavy lifting' of the increasing demands on wireless networks, especially where radio spectrum is a scarce resource. Therefore,

[4] The ACCC has the ability to declare access to these services under Part XIC of the Competition and Consumer Act 2011.

investment in next generation communication networks such as fibre is critical. By bringing fibre physically closer to the end user, whether a business or a residence, Internet speed increases across all technologies, even when the final connections are made using co-axial cable or copper (OECD, 2019[9]). The COVID-19 health emergency has further shown that it will be essential to deploy more fibre deeper into networks and to gradually phase out xDSL technologies to allow for more symmetrical speeds (OECD, 2020[10]).

While most of the investment in broadband deployment usually comes from market participants, including for the deployment of private as well as publicly-owned networks (e.g. municipal networks or national wholesale networks), investment in the communication sector has been complemented by public funding in many OECD countries in the form of state aid. Authorities in OECD countries need to be cautious of the possibility of state aid hindering incentives by the private sector to deploy networks.

An enabling domestic environment plays a large role in attracting investments, and one way of providing incentives to invest is by reducing network deployment costs. Therefore, policies that make investments by communication operators easier and cheaper are key drivers of expanding and upgrading communication networks, and thus play a major role in bridging connectivity divides.

Co-investment to spur infrastructure deployment

An increasing number of OECD countries have adopted policies to reduce the costs of broadband deployment through measures of co-investment, or "joint deployment" of broadband networks. While there is still limited research on the effects of co-investment on competition in communication markets, co-investments can have pro-competitive and anti-competitive effects. When deciding about whether to allow and provide incentives for co-investment, the particular case at hand needs to be carefully analysed. Important factors to look at include the kind of operators that want to co-invest (e.g. incumbent versus challenger, large versus small firm), the geographical location of co-investment (e.g. rural areas versus larger cities) and the competitive situation in the market.

Promoting infrastructure sharing while safeguarding competition

Passive and active infrastructure sharing may also be a way to speed-up broadband deployment and increase the access to it. In all cases of infrastructure sharing, it is important to keep the public policy goal of fostering competition in markets in mind. Typically, passive infrastructure sharing raises less concerns than active infrastructure sharing. However, especially in rural and remote areas, active infrastructure sharing can also be viable way to not

only ensure that mobile coverage is extended, but also that different operators can compete with their offers in those areas.

Implementing "dig-once" policies

A number of OECD countries have focused on "dig-once" policies to leverage non-broadband infrastructure projects (e.g. road construction, railways, utilities and street light providers) to reduce the costs of broadband network deployment.

Easing infrastructure deployment

One key objective among OECD countries consists in removing barriers to infrastructure deployment and getting the regulatory measures "right". This becomes even more crucial with the next generation of both fixed and broadband networks as the deployment of next generation networks entail significant costs for operators and as wireless and fixed broadband networks become more complementary.

Streamlining access to rights of way

One effective way to ease infrastructure deployment and increase the speed of deployment is through establishing simplified permit granting procedures and reducing approval and construction times. Therefore, many OECD countries are aiming to streamline rights of way. The granting of public rights of way usually requires the active participation of public authorities, often at different levels of government in managing or authorising the civil works needed in constructing ducts or other infrastructure required for networks.[5] Streamlining rights of way for communication operators becomes increasingly important to deploy massive numbers of small cells for 5G and fibre backhaul to connect the cells (OECD, 2019[4]).

Making information available for operators and increasing the deployment efficiency

Increased access to information and public assets also plays a crucial role for broadband deployment. For example, a lot of the time in the deployment process in mobile infrastructure may be spent on the determination and acquisition of locations to build towers. To ease this process, countries can increase the transparency of and access to information about public assets.

[5] A public right of way permit is usually an agreement between the government and an applicant.

Tailored policies and regulation to bridge connectivity divides in rural and remote areas

Policies to promote competition and private investment, as well as independent and evidence-based regulation, have been tremendously effective in extending broadband coverage in OECD countries. In doing so, they reduce the size of the market segment that requires alternative approaches to meet public policy goals. In areas where market forces were not able to fulfil all policy objectives, such as in rural and remote areas, however, a range of further approaches are being used in OECD countries (OECD, 2018[1]).

Bridging connectivity divides is by no means an issue related solely to rural and remote areas. However, these areas generally have a unique set of issues associated with their distance to core network facilities (OECD, 2018[1]). Assisting rural and remote communities to bridge broadband access and uptake gaps is critical to strengthening their overall economic development and, in general, to harness an inclusive society.

Some initiatives to bridge connectivity divides in rural and remote areas, in addition to promoting market forces and reducing deployment costs, include demand aggregation models, using coverage obligations in spectrum auctions, subsidising national and rural broadband networks, as well as specific funds or carrying out competitive tenders to foster deployment in rural areas.

Demand aggregation (identification) models

Some OECD countries have used demand aggregation tools to foster broadband roll-out. Especially in areas where it is economically difficult to roll out broadband networks, demand aggregation (identification) models can be used to increase certainty for investors and operators. Demand aggregation coordinates and bundles consumer demand to increase the profitability of the network roll-out, increase certainty, and, depending on the area to cover achieve economies of scale. Community networks can also effectively conduct demand aggregation because of their intimate knowledge of local conditions.

Coverage obligations in spectrum assignment procedures

When designing spectrum assignment procedures in OECD countries, policy makers take into account policy objectives such as increasing coverage of communication networks and enhancing competition in mobile markets. Coverage obligations in auctions have proven an effective tool used in OECD countries to extend mobile broadband coverage in rural and remote areas. However, the extent of coverage obligations should not impede certain actors from bidding in the auction (OECD, 2019[11]).

In some cases, countries have included obligations to provide connectivity to specific premises, such as schools or highways, and to apply special rates,

provide free services for low-income citizens or to provide terminals for schools within spectrum licences. However, setting coverage obligations demands careful analysis. Lax coverage obligations may waste the opportunities to ensure mobile broadband access in areas where there are not enough economic incentives to deploy network infrastructure. On the other hand, obligations that provide for extensive geographical coverage in too short a time may impose an excessive burden on an operator. The usual practice is to impose the same obligations for all the MNOs in a country with similar licenses, while possibly allowing new entrants more time to fulfil obligations (OECD, 2018[1]).

Public-private partnerships and open access models

For many years, OECD countries followed the path of continued liberalisation of the communication sector with a focus on investments by the private sector and competition among private companies. More recently, some countries have started to provide public funding with a focus on remote and rural areas, and some even deploy national broadband networks once they determined that there is insufficient competition in certain areas. Public funding ranges from grants for public-private partnerships (PPPs) to funding entire national broadband networks. Not all funding and deployment cases have been successful.

Some of the PPP initiatives have been designed as open access networks, providing wholesale access capacity on fair and reasonable terms with a certain degree of transparency and non-discrimination. If elaborated well, this model enables more competition and innovation at the retail level, for example, by local or community networks, among others. If public funding is awarded to these networks (e.g. through preferential loans or subsidies), typically certain open access conditions can be imposed and companies need to comply with these conditions in exchange for public funds.

Municipal networks

Municipal networks are high-speed networks that have been fully or partially facilitated, built, operated or financed by local governments, public bodies, utilities, organisations, or co-operatives that have some type of public involvement (OECD, 2015[12]). Such networks are used in several OECD countries to promote fibre deployment in cities, smaller towns and surrounding regions. Implementing bottom-up models to finance and deploy high-speed networks has been an approach for assisting rural and remote areas to cope with continuously growing demand for higher broadband capacity. Municipal networks can extend the connectivity in regions where deployment by national communication companies is lacking or deemed unprofitable. In areas in which coverage is provided by national players, municipal networks are likely to spur competition.

Municipal networks can be a very good means to provide rural areas with Gigabit networks. Experience shows that networks which focus on the provision of dark fibre and relying on full open access models are particularly successful. These typically trigger innovation and competition at the retail level, in both the fixed and the mobile communication market.

Looking ahead, municipal fibre networks might ease the deployment of 5G in cities disposing of such a network. An important prerequisite for 5G is the deployment of fibre deeper into mobile backhaul networks and the connection of mobile cells with fibre. The existence of a fibre network in a municipality eases the connection of smaller antennas to fibre and reduces deployment costs. A further advantage is that the co-ordination between the municipal network and the municipal facilities (e.g. with respect to lampposts, bus stations, etc.) might be facilitated in case there is a common owner and a joint public interest.

Public rural and remote programmes and subsidies

In the majority of OECD countries, private investment is the largest source of investment in communication infrastructures. However, in some instances, governments may be better placed to take a longer-term and broader view of returns, and may choose to invest alongside private actors through PPPs to share the risks associated with the creation, development and operation of an infrastructure asset, especially in areas where positive business cases are hard to achieve.

Regarding public funds, as state aid may hinder network deployment incentives by the private sector (i.e. "crowding out"), the correct identification of which sparsely populated areas require subsidies is crucial.

Often, such public investment takes place through national broadband plans. The majority of OECD countries have included specific components in their plans related to the expansion of broadband in rural and remote areas (OECD, 2018[1]). Such national broadband strategies should address all of the key barriers to the expansion of high-speed networks. In addition to national broadband plans, the vast majority of OECD countries have specific programmes for expanding broadband access in rural and remote areas.

PPPs can also help bridge connectivity divides. They could also diminish reliance on public resources derived from taxation or universal service funds. As such, policy makers and regulators have increasingly used market mechanisms, such as using competitive tenders and reverse auctions, wherever possible to make the use of scarce public funds more effective in terms of meeting objectives in geographical areas that are underserved by broadband access. Colombia, Estonia, Greece, Hungary, Italy, Korea, Slovenia, the United Kingdom and the United States have used reverse auctions to this effect.

Annex. A selection of policy and regulatory approaches to bridge connectivity divides

Improving network quality and coverage through data-driven regulation

Data driven regulation in France and Korea

Responsible entity: France's Electronic Communications, Postal and Print media distribution Regulatory Authority (Arcep)

Description: Arcep, the communication regulator in France, is seeking to provide users with precise and personalised information (Arcep, 2020[13]). This could come from fixed and mobile broadband users (crowdsourcing) or be collected by the regulator from operators. Arcep's priority is to make data on coverage and quality of communication networks available to users. In this way, competition extends beyond prices to also include network quality. Since crowd-sourced quality measures of broadband depend on the user's connection at home, France moved to use more complex techniques in December 2018, such as Application Programming Interfaces, to be implemented in operators' set-top boxes to measure the quality of networks more accurately (OECD, 2020[14]).

Read more: *https://www.arcep.fr/la-regulation/grands-dossiers-thematiques-transverses/la-regulation-par-la-data.html*.

Responsible entity: Korea's National Information Society Agency (NIA)

Description: In a similar fashion, the Korean government, through the NIA, monitors the quality of broadband providers through "in the field" measurements, and renders the results publicly available on a yearly basis. The network quality evaluation by the NIA began 1999 with 2G mobile services. According to the NIA, the service quality evaluation has significantly contributed to broadband development, as operators increased network quality after each publication of the results. Furthermore, it has helped increase competition by providing users with objective quality information on communication services to choose providers accordingly (OECD, 2020[14]).

Read more: *https://berec.europa.eu/eng/events/berec_events_2020/244-berec-oecd-webinar-on-quality-of-services-and-quality-of-experience*.

Expanding connectivity through competition

Telecommunication reform boosting competition in Mexico

Responsible entity: Various Mexican governmental entities

Description: The constitutional reform of the Mexican telecommunication sector in 2013 created a strong, independent, and converged regulator for telecommunication and broadcasting, the Federal Institute of Telecommunications, with the necessary tools to foster competition in a sector that was marked by very high levels of concentration for more than twenty years. Another milestone was eliminating restrictions on foreign direct investment in all telecommunication and satellite communication services, which allowed new entrants to join these markets (e.g. AT&T), boosting competition and encouraging increased availability of advanced technologies and acquisition of specialised knowledge in these markets.

Tangible benefits include the increase of over 72 million additional mobile broadband subscriptions from 2012 to 2020. This allowed many people - especially from low-income households – to connect to the Internet for the first time. In addition, competition in the sector led to a sharp decline in mobile broadband prices, e.g. from around 70% to 84% for different OECD communication baskets over the 2013-20 period. Overall benefits include the elimination of national long distance calls, higher quality of communication services, and increased investment levels.

Read more:

http://www.ift.org.mx/que-es-el-ift/que-es-la-reforma-de-telecomunicaciones; http://www.ift.org.mx/node/2702; http://www.ift.org.mx/node/2662; https://www.oecd.org/about/impact/reforming-telecommunications-in-mexico.htm.

Reducing network deployment costs and easing infrastructure roll-out

Streamlining rights of way in the United States

Responsible entity: The United States Federal Communications Commission (FCC)

Description: In the United States, an example of regulatory action to streamline rights of way is the FCC Order, "*Accelerating Wireless and Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment,*" adopted on September 2018 (FCC, 2018[17]). The decision clarifies the FCC's views regarding the amount that municipalities may reasonably charge for small cell deployment given the practicalities of 5G deployment and the

importance of 5G to the United States. In offering guidelines for determining this value, the FCC cited the rules of twenty states that limit upfront pole fees to USD 500 for use of an existing pole, USD 1 000 for installation of a new pole, and recurring fees of USD 270 (OECD, 2019[4]).

Read more: *https://www.fcc.gov/document/fcc-facilitates-wireless-infrastructure-deployment-5g*.

Co-investment and "dig-once" policies in the European Union

Responsible entity: The European Commission

Description: Within the European Union (EU) zone, the European Electronic Communications Code (EECC) envisages creating incentives to co-investment as it provides for regulatory relief to operators entering in such agreements. Namely, the EECC establishes that an operator with Significant Market Power (SMP) will be able to propose commitments on offers for co-investment in new networks that consist of optical fibre elements up to the end-user premises or base station. If these commitments fulfil certain criteria on access for co-investors and third parties, and are made binding by the national regulatory authority, the operator with SMP would be exempted from *ex-ante* regulation. The co-investment offer has to be open to any willing co-investor while granting access to the network also to non-co-investment parties, under certain conditions.

EU Member States, as for the rest of the EECC, had a deadline to transpose these elements of the EECC into national law by the end of 2020. Furthermore, BEREC published in December 2020 guidelines to foster the consistent application of the criteria for assessing co-investments in very high capacity network elements (BEREC, 2020[18]).

Concerning "dig-once" policies, many European Union member states have transposed the European Union Broadband Cost Reduction Directive (2014/61/EU) into national law (e.g. Italy with Law 33/2016 and Greece with Law 4463/2017). The directive includes provisions that allow communication network operators to access other utility infrastructure.

Read more: *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972*.

Passive and active infrastructure sharing agreements in France

Responsible entity: France's Electronic Communications, Postal and Print media distribution Regulatory Authority (Arcep)

Description: In France, symmetric regulation on fibre imposes that the firm exploiting a fibre cable must provide reasonable open access to other firms on a non-discriminatory basis. For mobile networks, the four French operators are

obliged since 2018 to consult other operators before deploying towers and to share passive infrastructure in white areas. With regards to active infrastructure sharing, there is an obligation for radio access network (RAN) agreements and spectrum sharing in rural "white areas" in France, i.e. areas with limited mobile coverage (BEREC, 2019[19]).

Read more: *https://www.arcep.fr/la-regulation/grands-dossiers-reseaux-mobiles/le-partage-dinfrastructures-mobiles.html; https://www.arcep.fr/la-regulation/grands-dossiers-reseaux-fixes/la-fibre/le-cadre-reglementaire-de-la-fibre.html*.

Making information available to ease broadband deployment in Mexico and Belgium

Responsible entity: Mexico's Federal Telecommunications Institute (Instituto Federal de Telecomunicaciones, IFT)

Description: In Mexico, the National Telecommunication Infrastructure Information system (Sistema Nacional de Información de Infraestructura, SNII), approved and issued by board of the IFT, includes useful information pertaining to rights of way geared at allowing concessionaires to deploy communication infrastructure on public assets, such as buildings. This inventory aims at revealing the availability and status of this infrastructure to increase efficiency in deploying communication networks, lower the costs for infrastructure deployment, and increase coverage across the country.

Read more: *www.dof.gob.mx/nota_detalle.php?codigo=5576710&fecha=28/10/2019*.

Responsible entity: Belgium's Institute for Postal Services and Telecommunications (BIPT)

Description: With the aim to reduce deployment costs, Belgium created a central electronic counter in each region for applying for licences to roll out infrastructure and for granting licenses swiftly, promoting access to existing infrastructure. In addition, the country published guidelines and issued a "fibre ready" label for citizens that plan to build or renovate their residences. Based on the European Union Directive, it also seeks to optimise the co-ordination of roadworks and the distribution of costs among network operators (telecommunication companies, cable companies, power grid operators, water companies, transport, etc.) participating in the joint roadworks. In addition, Belgium encourages mobile site sharing (Act of 13 June 2005 on electronic communications). The implementation of site sharing is followed up by the non-profit making association Radio Infrastructure Site Sharing (RISS).

Read more: *http://www.riss.be/fr/index.php*.

Tailored policies and regulation to bridge connectivity divides in rural and remote areas

Demand aggregation in Germany

Responsible entity: Communication operators in Germany

Description: In Germany, demand aggregation is used to extend connectivity in particular in rural and remote areas. Before deploying fibre-to-the-home (FTTH) networks, firms aggregate demand and require that a certain percentage of households commits to use their broadband services for a certain period of time. They typically ask for a commitment of 30 to 40% of households before deploying networks. One of the most prominent companies in Germany using this model is *Deutsche Glasfaser*. The company reports that so far it has installed over 500 000 FTTH connections using this model (Deutsche Glasfaser, 2020[20]).

Read more: *https://www.deutsche-glasfaser.de/netzausbau/.*

Municipal Networks in Sweden

Responsible entity: Municipalities in Sweden, the Swedish Post and Telecom Authority (PTS), and the Swedish Broadband Forum

Description: A decisive factor in Sweden's high fibre take-up is that municipal networks have been widely deployed in the country since the liberalisation of the communication market (OECD, 2015[12]). Most Swedish municipal networks provide retail "operator" neutral network infrastructure based on fibre to the building or fibre to the home (FTTB/FTTH). That is, their business model relies on open networks where they act as physical infrastructure providers offering wholesale access to retailers on a non-discriminatory basis (OECD, 2018[21]). This has led to a notion of "open" municipal networks, which contrasts with other business models for backbone and backhaul provision of fibre that rely on completely vertically integrated telecommunication operators present both in wholesale and retail markets (OECD, 2015[12]).

In 2017 there were 156 municipal fibre networks present in 200 of the 290 Swedish municipalities, where most of them provided wholesale products such as "dark fibre" and Ethernet capacity (OECD, 2018[21]). The latter means that the passive network is separated from active network provisioning and services, which proponents say reduces the risk for conflict of interest, and promotes a competitive service and retail market (OECD, 2015[12]). Municipal wholesale networks, together with a new entrant in the fibre market (i.e. IP Only), have triggered higher investments in high-capacity fixed networks in Sweden.

The Swedish Broadband forum is a good example of how to ensure the coordination that has contributed positively to fibre expansion in Sweden (OECD, 2018[21]). The main functions of the forum include: i) promoting the collaboration between public and private players regarding mobile and fixed broadband expansion, ii) providing guidance about robust fibre networks to municipalities, iii) identifying relevant barriers to infrastructure deployment, iv) establishing measures to support broadband deployment in rural areas, and vi) acting as a secretariat for regional broadband coordinators.

Read more:

https://bredbandsforum.se/english/; https://bredbandsforum.se/bredbandskoordinatorer/; https://www.government.se/496173/contentassets/afe9f1cfeaac4e39abcdd3b82d9bee5d/sweden-completely-connected-by-2025-eng.pdf; https://www.ssnf.org/in-english/#:~:text=The%20Swedish%20Local%20Fibre%20Alliance,attracted%20about%20a%20hundred%20members.

Public funds and subsidies for rural and remote areas

Rural connectivity programme in New Zealand

Responsible entity: Ministry of Regional Economic Development and Ministry of Broadcasting, Communications and Digital Media

Description: New Zealand has established the Rural Broadband Initiative (Phase II) and the Mobile Black Spot Fund that are delivering improved broadband and mobile services to inhabitants in rural and remote areas. Over USD 296 million[1] in grant funding from the Telecommunications Development Levy has been allocated for the Rural Broadband Initiative in New Zealand to provide improved broadband to target around 10,000 rural households and businesses. The aim is to connect 99.8% of the population to broadband.

Read more:

https://www.mbie.govt.nz/science-and-technology/it-communications-and-broadband/fast-broadband/broadband-and-mobile-programmes/; https://www.crowninfrastructure.govt.nz/wp-content/uploads/2018/12/RBI2-MBSF-expansion-fact-sheet-18-Dec-2018-FINAL.pdf.

Reverse auctions to fund connectivity in rural and remote areas in the United States

Responsible entity: The United States Federal Communications Commission (FCC)

Description: Reverse auctions were used in the United States for the Rural Digital Opportunity Fund (RDOF). Through a two-phase reverse auction mechanism, the FCC will fund up to USD 20.4 billion over ten years to finance up high-speed broadband networks ("up to Gigabit speeds") in rural and remote areas (FCC, 2020[22]). The Phase I auction, which began on 29 October 2020, and ended on 25 November 2020, awarded up to USD 16 billion support to bring broadband to over five million homes and businesses in census blocks that were entirely unserved by voice and broadband with download speeds of at least 25 Mbps The funds were awarded by reverse auction in a process favouring faster download speeds, but also those willing to take the lowest amount of grant per customer.

Read more: *https://www.fcc.gov/auction/904/factsheet*.

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