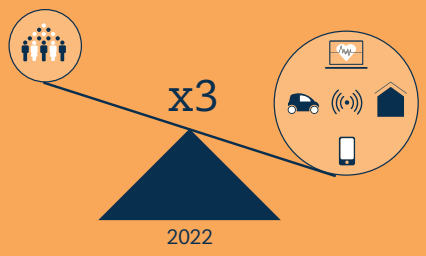
Chapter 2

ENHANCING ACCESS

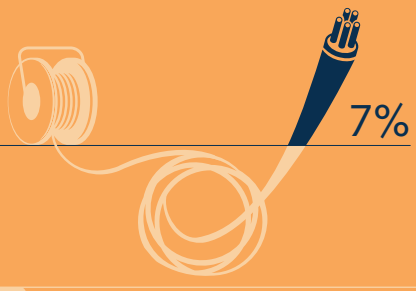
ACCESS

By 2022, **three devices per person** will be connected around the globe.



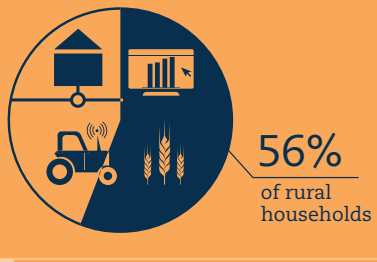
Prepare for a massive increase of connected people, devices and demand on networks.

Only 7% of people accross the OECD have a **fibre broadband subscription**.



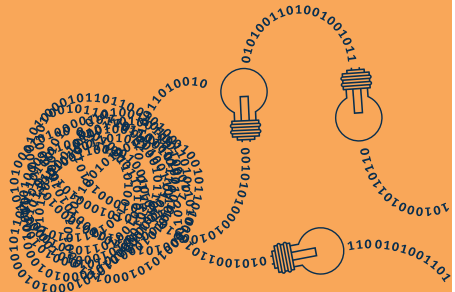
Invest in broadband infrastructure, especially fibre, to unlock digital technologies' potential.

56% **of rural households have access to fast fixed broadband**, in comparison to over 85% of households in urban and other areas.



Improve access in rural and remote areas to connect everyone and everything.

Access to data drives innovation, new products, organisational models and markets.



Enhance access to and sharing of data to unleash its potential, balancing benefits and risk.

ENHANCING ACCESS: WHAT MATTERS MOST FOR POLICY?

Invest in broadband to prepare for ever more people, things and technologies going online

- Demand for connectivity remains strong in the OECD, with over 100 million new mobile broadband subscriptions in 2017 and a doubling of data downloaded per subscription. Looking ahead, an estimated three devices per person will be online worldwide by 2022.
- Meeting such demand requires ongoing investment in fixed networks, including fibre. At the end of 2017, only 7% of inhabitants across the OECD had access to a fibre broadband subscription.

Promote competition and remove barriers to investment to boost connectivity

- Competition among network operators drives investment. Although markets vary, some countries with more mobile network operators (MNOs) (e.g. four rather than three) have experienced competitive and innovative services as a result. Other mechanisms, like passive infrastructure sharing and co-investment, can help expand coverage, depending on local market conditions.
- Internet exchange points (IXPs), efficient allocation of spectrum, and new generation Internet protocol (IP) addresses are critical to attracting investment.
- Simplifying administrative procedures facilitates the roll-out of key infrastructures, such as towers and masts.

Expand access in rural and remote places to connect everyone

- While rural areas are increasingly connected to broadband, much of this access is not high-quality. In all OECD countries, rural areas lag behind urban and other areas in their access to fixed broadband access with a minimum download speed of 30 megabits per second (Mbps), a speed needed to use advanced connected devices and services.
- Governments may invest directly in high-speed fixed networks or incentivise private investment, including by competitive tendering, tax exemptions, low-interest loans or lower spectrum fees. Satellite broadband technologies also hold promise.

Enhance access to data to unleash its potential

- Enhancing access to data requires balancing its benefits with the risks, taking into account legitimate private, national, and public interests.
- Approaches to foster access to data include contractual agreements, restricted data sharing arrangements, data portability and open government data initiatives.
- It is important to encourage the provision of data through coherent incentive mechanisms and sustainable business models while acknowledging the limitations of data markets and the risks of mandatory access regimes.

Communications infrastructures and services underpin the use of digital technologies, and facilitate interactions between connected people, organisations and machines. They serve as the basis for an open, interconnected and distributed Internet that enables the global free flow of information (OECD, 2011[1]). High-quality access to communication networks and services at competitive prices is fundamental to digital transformation. Data are emerging as similarly vital. Data are a driver of economic activity and a general-purpose input of production in many contexts, but these benefits are predicated on data availability and accessibility. Enhancing access to and the sharing of data is thus important, although such decisions should be balanced with considerations of data privacy and security, among others.

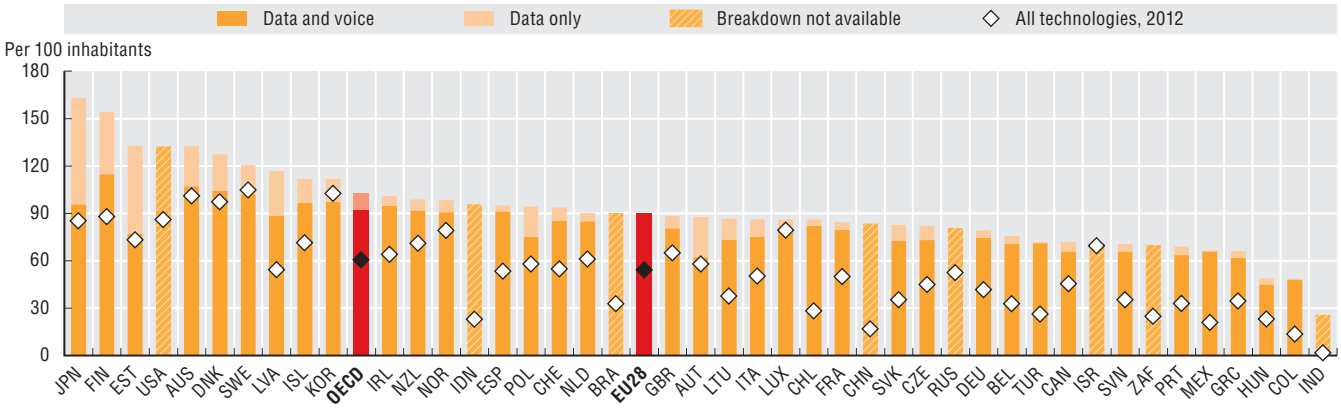
Prepare for more people and things going online than ever before

Increasing connections rely on the Internet's openness, in particular its distributed and interconnected nature, while respecting applicable legal and institutional frameworks (OECD, 2016[2]). While there are legitimate reasons for setting certain boundaries, drifting away from a general preference for Internet openness is economically and socially costly.

Pathways to the Internet continue to increase, while other modes of communication, such as traditional fixed telephone lines, have been in decline since the 1990s. In 2017 alone, the total number of fixed and mobile broadband subscriptions across the OECD grew by 95 million. This growth was driven by an increased uptake of mobile broadband subscriptions, reflecting continued growth in the use of connected devices like smartphones and tablets. In December 2017, mobile broadband subscriptions rose to 1.377 billion for a population of 1.344 billion people across the OECD, rising above 100 subscriptions per 100 inhabitants for the first time (Figure 2.1). This represents an increase of 79 million mobile broadband subscriptions since December 2016, with the fastest growth experienced by Chile (15%), Poland (15%), Greece (13%) and Latvia (13%).

2.1. There are more mobile broadband subscriptions than people in the OECD

Mobile broadband subscriptions, per 100 inhabitants, by package type, December 2017



Source: OECD (2019[3]), *Measuring the Digital Transformation*, *https://dx.doi.org/10.1787/9789264311992-en*, based on OECD[4], *Broadband Portal*, *www.oecd.org/sti/broadband/broadband-statistics*; ITU[11], World Telecommunication ICT Indicators Database, *http://handle.itu.int/11.1002/pub_series/dataset/64cb0e71-en*; European Union[12], Digital Scoreboard, *https://ec.europa.eu/digital-single-market/en/digital-scoreboard* (accessed September 2018).

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The use of connected devices, and their demands on communication networks, also grew dramatically over the same period. Between 2015 and 2017, mobile data usage more than doubled in two-thirds of the countries for which data were available. For example, over this period in Finland, data downloaded per mobile broadband subscription per month doubled, from 7.23 Gigabytes (GB) to almost 16 GB. This gain was particularly dramatic in comparison to the OECD average, which was just 3 GB per month per mobile subscription.

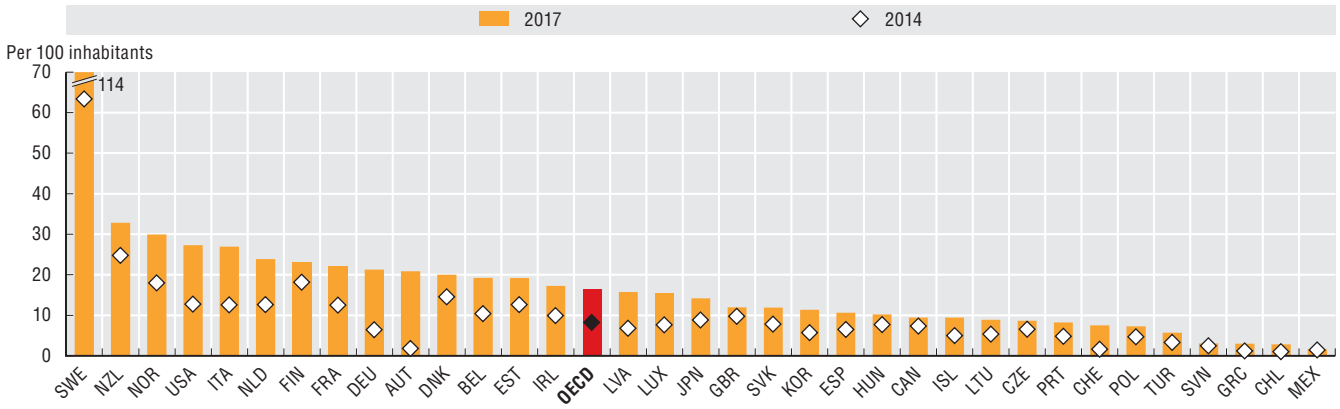
Connected objects, not just people, will be a key characteristic of the digital future. The Internet of Things (IoT) enables digital technologies to expand further across economies and societies, including in sectors such as agriculture, education, health, transportation, manufacturing and energy systems

(see Chapter 1). One estimate suggests that the IoT will include up to 20 billion devices worldwide by 2022 (more than three objects per person), representing global growth of more than 400% over five years (CISCO, 2018[5]).

Machine-to-machine (M2M) interactions capture a subset of the IoT that communicates using wired and wireless networks. M2M subscriptions refer to the SIM card subscriptions used in some connected machines and devices, such as in connected vehicles and smart metres (OECD, 2018[6]). The number of M2M subscriptions across the OECD almost doubled between 2014 and 2017 (Figure 2.2). Beyond the OECD, the People's Republic of China accounted for 61% of worldwide M2M SIM card subscriptions in September 2018 (OECD, 2019[3]).

2.2. Connected devices are on the rise

M2M SIM cards, per 100 inhabitants, 2017



Note: See Chapter notes.[1]

Source: OECD (2019[3]), *Measuring the Digital Transformation*, *https://dx.doi.org/10.1787/9789264311992-en*, based on OECD[4], *Broadband Portal*, *www.oecd/sti/broadband/oecd/broadbandportal.htm* (accessed September 2018).

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As more people and things connect, new demands will be placed on networks. Many connected devices, including those that are powered by emerging digital technologies like artificial intelligence (AI), will require real-time transmission of huge amounts of data. For example, autonomous cars are expected to generate up to 4 000 GB of data per day by 2020, equivalent to approximately 2 700 average Internet users (Waring, 2016[7]).

Similarly, as connected devices become widespread in critical sectors such as health or energy, the safe and reliable functioning of related systems will depend on the reliability of communication networks. In particular, these applications may require time-sensitive upload and download of data, with rapid transmission of data between two devices in the network. As demands for reliable and fast connection are expected to increase, policy makers must invest in high-quality communication infrastructures and services.

Invest in broadband to empower future technologies

As more people and things go online, continued investment in communication networks is necessary to ensure that connections and transfers of data between connected devices can take place quickly. Indeed, high-speed broadband uptake underpins the adoption of some technologies, like cloud computing (see Chapter 3) (Sorbe et al., 2019[8]). In particular, it is becoming increasingly critical to deploy fibre further into fixed networks to support increases in speed and capacity across all next-generation technologies, including 5G networks (see Chapter 1).

5G networks are intended to support enhanced mobile broadband; intelligent devices with fully automatic data generation, exchange and processing; and critical communications and applications (ultra-reliable communications with very rapid upload and download of data). 5G holds many promises,

including 100 times the current data-transfer capacity at 10 times the current network speed. 5G networks will be able to process more connections, enabling more devices to go online without the need for wired connections (OECD, forthcoming[9]).

But even as more connections are made wirelessly, the speed and rate of download of these connections ultimately depends on the capacity of fixed networks, which take on the "heavy lifting" of the increasing demands on wireless networks. In 2016, about 60% of data uploaded and downloaded on devices such as smartphones used fixed networks through Wi-Fi or small, low-power cellular base stations (OECD, 2018[6]; CISCO, 2017[5]). Alternative access paths and the offloading of data reduces the amount of data that needs to be transferred across cellular bands, freeing capacity to improve cellular access for other users. As a result, fixed and wireless networks act as both compliments and substitutes.

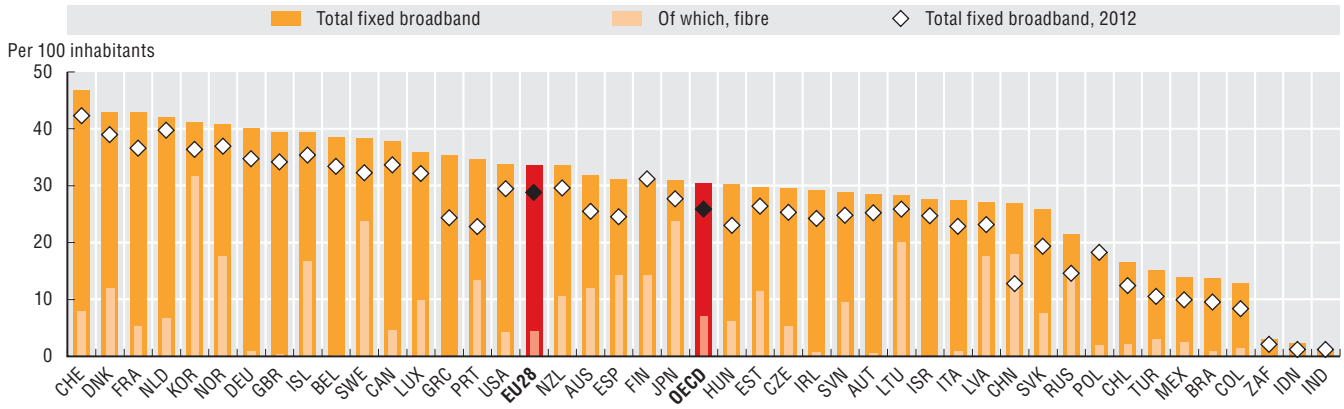
Backbone facilities, or the core network infrastructures that underpin other fixed networks, have been made up almost entirely of fibre optic networks (OECD, 2017[10]). But investment in fibre backhaul is increasingly important, namely the intermediate connections between communication network backbones and wireless towers, or end users. In particular, taking fibre backhaul closer to the end user, whether a business or a residence, is important for increasing Internet speed across all technologies, including for final connections using co-axial cable or copper.

Cable broadband networks are also being upgraded to provide higher speed services through the adoption of new standards and, like xDSL, through the deployment of fibre in these networks. Various types of xDSL remain the prevalent technology in communication networks across the OECD, with 41% of fixed broadband subscriptions, but they are slowly being replaced by fibre, which now accounts for 23% of fixed broadband subscriptions (up 15% in 2017).

At the end of 2017, only 7% of inhabitants across the OECD had access to a fibre broadband subscription. However, the average share of fibre masks significant cross-country differences (Figure 2.3). Japan and Korea are the only OECD countries where fibre subscriptions account for more than 75% of total fixed broadband subscriptions; they are also two of the few OECD countries with operators that offered 10 GB download speeds for residential services in 2018. In contrast, Austria, Belgium, Germany, Greece, Italy, Ireland and the United Kingdom recorded less than 10% of fibre in fixed broadband subscriptions in December 2017.

2.3. Investing in fibre backhaul can increase speeds across all technologies

Fixed broadband subscriptions, per 100 inhabitants, by technology, December 2017



Source: OECD (2019[3]), *Measuring the Digital Transformation*, *https://dx.doi.org/10.1787/9789264311992-en*, based on OECD[4], *Broadband Portal*, *www.oecd.org/sti/broadband/broadband-statistics*; ITU[11], *World Telecommunication ICT Indicators Database*, *http://handle.itu.int/11.1002/pub_series/dataset/64cb0e71-en*; European Union[12], *Digital Scoreboard*, *https://ec.europa.eu/digital-single-market/en/digital-scoreboard* (accessed September 2018).

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Many countries are catching up. Ireland experienced an astonishing 420% growth of fibre subscriptions in the year to December 2017, while Australia and Colombia also had growth rates over 100%. However, the average growth in fibre subscriptions across the OECD in the year to December 2017 was just 14.6%. While this low average partially reflects lower growth in countries with already high shares of fibre

penetration, including Japan, Latvia and Lithuania, the low average indicates a lack of sufficient growth in fibre to support projected capacity demands (OECD, 2018[4]).

The emergence of 5G networks also represents an impetus for investment in next-generation network deployment. While technical and industry standards have not been fully realised, many expect that deploying 5G networks will require smaller cell sites, complementing traditional large cell towers. Such cells will need to be connected to backhaul, again underlining the need for increased investment in next-generation communications infrastructures.

Widespread trials of 5G are currently underway, enabling the technology to evolve and new business cases to emerge, including in the area of fixed wireless services. In the United States, commercial operators have proposed offers of fixed wireless 5G access while operators in Japan and Korea have proposed offers of commercial mobile 5G services by 2019. Some countries have also implemented dedicated plans and strategies associated with the roll-out of 5G networks (OECD, forthcoming[9]).

While the technology and business cases are still rapidly evolving, it is likely that some of the traditional telecommunication regulatory issues will become even more relevant for the successful deployment of this new generation of wireless technologies. For example, telecommunication operators often have to secure "rights of way" to dig up streets; lay cables; and install masts, antennae and other infrastructure (European Commission, 2018[13]). Streamlining such rights of way may become increasingly important to deploy massive numbers of small cells for 5G and backhaul to connect the cells.

Similarly, all wireless connections depend on the use of the electromagnetic spectrum. The efficient allocation of the spectrum into radio frequency bands is also essential for the development of 5G wireless networks. Other issues, including access to backhaul and backbone facilities, and new forms of infrastructure sharing, may also become more important (OECD, forthcoming[9]).

Promote competition and remove barriers to investment to boost connectivity

In the past, communication networks across the OECD were typically stand-alone endeavours, with separate firms and business models operating on independent fixed, wireless and broadcasting networks. These services have increasingly converged on IP-based networks or the Internet. This means that market players are able to offer combinations of telephony, broadband Internet access, wireless services and television.

As convergence continues, policy makers must promote competition to ensure that users benefit from greater choice from network and service providers, either through bundled or simple voice, data and video offers. Promoting competition can positively influence investment and pricing decisions and can drive up the overall quality and speed of broadband offers, including to underserved populations. Sharing network components, for example through passive infrastructure sharing, can also sometimes reduce costs. It is a critical decision for each country to determine the balance between end-to-end infrastructure competition and the joint provisioning of facilities by rivals to support greater retail competition.

Convergence is contributing to increased merger and acquisition activity between cable network operators and MNOs across the OECD, as players aim to offer bundled services and compete against rivals (OECD, 2017[10]). Some suggest that concentration in the wireless telecommunication networks has increased (Werden and Froeb, 2018[14]). On the other hand, new MNOs have regularly entered markets in countries such as France and Italy in recent years, with the result of lowering prices and increasing innovation.

Similarly, in the near future, new players are poised to enter OECD markets, such as Digi.Mobi in Hungary, Rakuten in Japan, and TPG in Singapore. Moreover, in some countries it is the mobile players that are providing greater competition through the use of wholesale fixed networks (e.g. Salt's 10 GB offer in Switzerland or Verizon's plans for 5G fixed wireless in the United States over its own facilities). Both of these developments underscore the importance of deeper deployment of fibre networks to support any technology to promote competition.

Broadband has emerged as modular general-purpose networks that support a variety of traffic types, applications and devices, including transformative technologies like cloud computing and the IoT. The emerging range of over-the-top applications include those that provide voice and video services that may directly compete with the service offerings of network operators, particularly those with significant broadcasting interests. In light of the changing relationship between innovation, competition and investment in a converging market, policy makers should aim to promote frameworks that foster investment in broadband networks, protect consumers, promote competition and enable opportunities for all (OECD, 2016[2]).

Policy makers should exercise caution with potential mergers that would reduce the number of MNOs in a given market considering available studies regarding the price and non-price effects of such mergers. This is because experience has shown that countries with a larger number of MNOs, for example those going from three to four operators, are likely to offer more competitive and innovative services (OECD, 2014[15]), although local conditions vary. Further, proposed remedies should be assessed in terms of whether they effectively ensure competition. Some countries have opted for behavioural remedies such as obtaining commitments from merging parties, while others have facilitated the presence of mobile virtual network operators. Still others have applied structural remedies (e.g. divestment) when other options have been deemed as not effective enough to promote competition. Policy makers should also promote sufficient competition in international mobile roaming (Bourassa et al., 2016[16]).

Infrastructure sharing is another way to promote competition in telecommunication markets, particularly where markets are characterised by a dominant player. Such policies typically relate to access to passive infrastructure deployed by other actors, whether for operators deploying fibre to gain access to the infrastructure of public utilities (e.g. railways, energy companies and municipal facilities), or for new entrants seeking access to passive infrastructure owned by other operators themselves (e.g. dark fibre, ducts and masts). In Spain, passive infrastructure sharing has helped to increase deployment of fibre closer to the end user (OECD, 2017[10]).

Infrastructure-sharing provisions like these could reduce costs for network and services providers while enabling the development of new and innovative services for end users (OECD, 2017[10]). As 5G networks are deployed, many expect that infrastructure sharing will become increasingly important to accommodate transmission sites (namely, cell towers or other sites where electronic communications equipment can be placed), which are expected to increase one hundred fold to achieve the lower latency standards of 5G while using a shorter wave spectrum (OECD, forthcoming[9]).

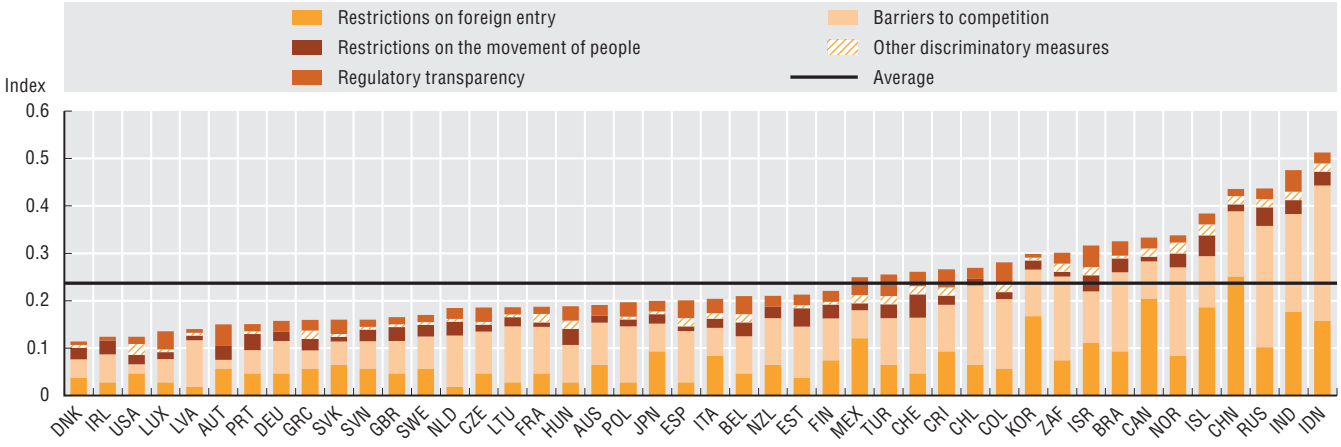
Co-investment arrangements, whereby two or more operators co-invest in network deployment could, in some circumstances, spur coverage and increase competition. Such arrangements have emerged in countries like the Netherlands, Portugal, Spain and Switzerland as a means of sharing risk and overcoming financing constraints. However, the impacts of such arrangements and the ideal conditions for network access for third parties depend on local market conditions and factors such as the number of operators and the areas of co-investment, and the overall effect is unclear at this stage (Godlovitch and Neumann, 2017[17]).

Other barriers to investment can include a lack of technical enablers. First, it is important to ensure the development of, access to and use of IXPs, to better enable the local exchange of traffic, unburden interregional links and stimulate investment in local networks. Second, it is important to ensure efficient allocation of spectrum, a scarce natural resource that is increasingly important with the large amounts of data transmitted over wireless networks. Third, as the pool of existing unassigned IP addresses is close to exhaustion, the relatively slow uptake of the new generation of IP addresses (IPv6)[2] could limit the connection of more devices and machines (Perset, 2010[18]), although some Internet service providers have developed short-term solutions for IPv4 reuse. Other administrative barriers to investment can include licensing requirements and overly complex rights of way permissions to install towers or masts.

International services trade barriers also reduce investment in the telecommunications sector, with restrictions on foreign entry and barriers to competition being the most prevalent (Figure 2.4). Reforms in recent years to reduce such barriers have been mixed. Compared to 2014, restrictions on trade in telecommunications services went up in about a third of the countries surveyed in 2017, a third reduced restrictions and a third were unchanged (OECD, 2017[19]).

2.4. Barriers to entry and competition are the most common telecommunication services trade restrictions

OECD Telecommunication Services Trade Restrictiveness Index, 2017



Notes: The Services Trade Restrictiveness Indices take values between zero and one, with one being the most restrictive. StatLink contains more data. See Chapter notes.[3]

Source: OECD (2019[3]), *Measuring the Digital Transformation*, *https://dx.doi.org/10.1787/9789264311992-en*, based on OECD, *Services Trade Restrictiveness Index*, *http://oe.cd/stri-db* (accessed September 2018).

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Pro-competitive reforms in the telecommunication sector are associated with a substantial reduction in trade costs for business services. In 2017, however, the largest overall increase in services restrictiveness for the 22 sectors analysed was in the telecommunications sector (OECD, 2018[20]). This was primarily due to increased restrictions on foreign investment and operations in the sector, including increases in residential and nationality requirements for board members of telecommunications operators.

The country with the greatest change from 2014 is Mexico, which recently introduced a range of pro-competitive reforms in the telecommunication and broadcasting sectors, including lowering barriers to foreign direct investment. While the Mexican telecommunication market structure did not greatly change, these reforms drove increased connectivity, lower prices and better quality services, including an increase of over 50 million mobile broadband subscriptions (OECD, 2017[21]).

Expand access in rural and remote areas to connect everyone

Ensuring adequate access to communications infrastructures across all geographic areas is essential to ensuring that all citizens can benefit from the opportunities of digital transformation. However, entrenched divides in broadband connection across geography persist across the OECD. The rural-urban divide not only includes access to broadband, but also access to broadband that is of sufficient quality. The persistence of this divide raises questions about inclusiveness and opportunity in the digital age.

While the share of households with broadband access has been consistently increasing across the OECD to near complete penetration rates, these gains have not been evenly shared across households. Across a majority of OECD countries, the share of households with broadband connections in rural areas is less than the share in urban and other areas. However, encouragingly, the gap between these two shares has declined in almost all OECD countries since 2010. In some countries, like Luxembourg, the share of households in rural areas with broadband access has now exceeded the share in urban areas.

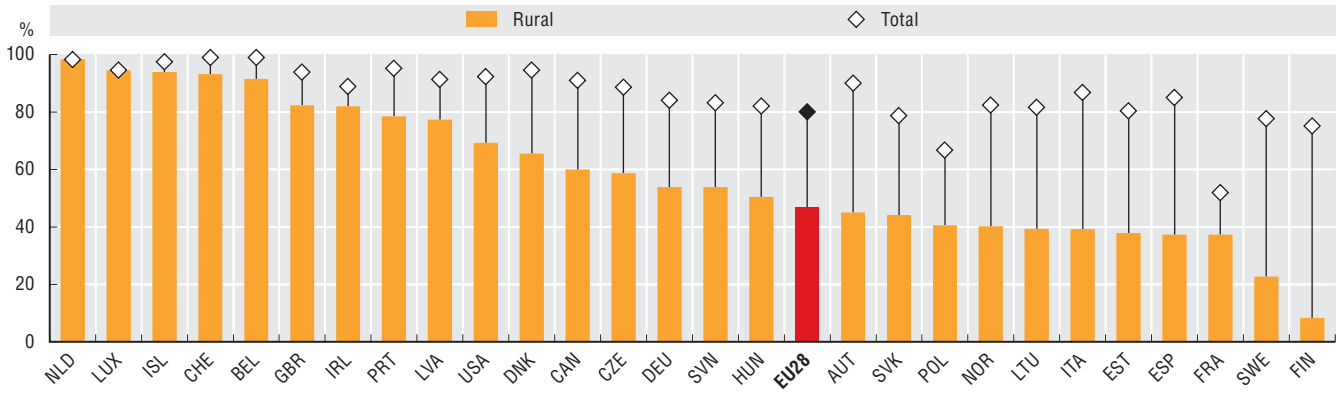
Nevertheless, access does not capture the quality of broadband connections, which must be high in all places to realise the potential of digital transformation. Quality access is a multi-dimensional concept that involves connection speed, the time taken to transfer data between users or devices and fewer errors in data transfer. In their choice of operator, some consumers may also value trust in a particular operator, or a preference for a particular mode of access (OECD, forthcoming[22]).

All OECD countries, with the exception of Japan, have set national targets for broadband availability, which are typically established in terms of the speed of service and the percentage of coverage. The vast majority of such targets aim for the majority of the population (usually nearly 90%) to have access at download rates of more than 20 Mbps, or approximately the speed necessary to stream a movie in ultra high-definition quality or support advanced tele-medicine applications (OECD, 2018[23]).

By including a speed dimension into metrics of access, gaps in access across geography become more significant. In 2016, just 56% of rural households had access to fixed broadband with a minimum speed of 30 Mbps, in comparison to over 85% of households in other areas (Figure 2.5). Measures of fixed broadband coverage with a minimum speed of 30 Mbps in rural areas can contrast sharply with overall broadband access data measured by surveys that do not take into account minimum speeds or technology categories. Finland is a case in point, where while almost 90% of households in rural areas had access to broadband in 2017, just 8.3% of Finnish rural households had access to fixed broadband with a minimum speed of 30 Mbps. In Finland, mobile technologies such as 4G are key to providing broadband coverage, particularly in rural areas.

2.5. Rural areas lag behind urban and other areas in broadband access at sufficient speeds

Households in areas where fixed broadband with a contracted speed of 30 Mbps or more is available, as a percentage of households in the total and rural categories, June 2017



Note: See Chapter notes.[4]

Source: OECD (2019[3]), *Measuring the Digital Transformation*, *https://dx.doi.org/10.1787/9789264311992-en*, based on OECD calculations based on CRTC, *Communications Monitoring Report, 2017* (Canada); EC, *Study on Broadband Coverage in Europe 2017* (European Union); FCC, *2018 Broadband Deployment Report* (United States).

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Addressing geographical digital divides is challenging because backbone networks are typically located closer to densely populated areas. Areas with low population density may be prone to natural monopolies, as commercial operators may assess that there is insufficient demand to invest. In some countries, a lack of basic infrastructure, including electricity, roads and ports, can present further challenges to high-speed infrastructure development in rural and remote areas.

In the majority of OECD countries, private investment is the largest source of investment in communications 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 public-private partnerships to share the risks associated with the creation, development and operation of an infrastructure asset.

Often, such investment takes place through national broadband plans. In September 2016, the United Nation's Broadband Commission for Sustainable Development reported that over 80% of countries have established or are planning to introduce national broadband plans or digital strategies. These are generally set in terms of speed of service offered and percentage of coverage, penetration and specific focus groups, and should ideally include measurable targets to address the policy challenges associated with ensuring competition and investment. The majority of OECD countries have included specific components related to the expansion of broadband in rural and remote areas in their broadband

plans (OECD, 2018[23]). Such national broadband strategies should address all of the key barriers to the deployment of high-speed networks and services, and should be revisited and reviewed regularly.

Many national broadband plans include strategies for public infrastructure investment; governments may choose to solve critical bottlenecks to private operation in rural areas by investing in high-speed backbones or backhaul infrastructure (OECD, 2017[24]), albeit often with the proviso of implementing open access policies so as to not encourage monopoly power in underserved areas (OECD, 2017[25]).

Given scarce public resources and the potential to crowd-out commercial roll-out of high-speed networks, another option is to promote private investment through a variety of incentives to reduce the cost of investment and network deployment in rural areas. These can include competitive tendering for partial tax exemption, changes to spectrum license arrangements, or loans at a reduced interest rate (OECD, 2018[23]), although competing objectives should be considered before policy changes are made. Many countries across the OECD have adopted universal service frameworks, while innovative hybrid approaches using satellite broadband technologies also have potential for improving access in rural and remote areas (OECD, 2017[25]).

Enhance access to data to unleash its potential

Communication infrastructures and services underpin digital transformation. However, the data that flow through these digital networks are also emerging as foundational. Such data are a source of economic value, and their effective and innovative use and reuse can spur economic and social benefits. However, these benefits are predicated on the availability and accessibility of data. Enhancing access to data for a variety of actors may therefore be a useful consideration for policy makers.

Value creation from data can be leveraged, for example by fostering data reuse. Overall, the available evidence shows that enhanced access and sharing can benefit data users as well as data providers (and suppliers), provided their respective legitimate interests and rights are taken into account. However, data are not homogenous, and their value depends on their context. Data on traffic flow differs in their use cases to data that could personally identify the user, and their treatment should differ accordingly.

Allowing access to and sharing of data requires a certain degree of openness, which can be thought of as a continuum of different degrees, ranging from closed (access only by the data controller) to discriminatory (access by stakeholders) to open (access by the public). In principle, all types of data can be shared or accessed for reuse, but not under the same conditions; there is no single optimal level of data "openness". Ultimately, the optimal level of openness for any given dataset depends on its characteristics, including with respect to its domain, security considerations and the relevant legal and cultural environment.

Opening access to data can bring important benefits to economies, societies and governments. For example, when publicly funded organisations make their data available, they improve transparency and accountability of institutions, and can help anti-corruption efforts (OECD, 2017[26]), while also empowering users to make more informed personal decisions (OECD, 2018[27]). The OECD has identified the benefits of opening access to scientific data, particularly when the research is publicly funded (OECD, 2007[28]), in view of its benefits for enabling collaboration, dissemination, reproduction and application of the results of scientific endeavours. But openness can carry risks, and it is important for data governance frameworks to strike an appropriate balance between the social benefits of greater access to and reuse of data, and public policy concerns such as privacy and intellectual property rights (IPRs), among others.

Enhancing access to data involves efforts to enable individuals and organisations to share their data more widely, and many approaches, including market-based approaches, exist (G7, 2017[29]). Pricing models are similarly varied and can include completely free, at marginal cost, and on commercial terms. However, the value of data depends on the context of their use and the information and knowledge that can be extracted (OECD, 2015[30]), which can challenge some forms of market-based pricing.

Open data efforts are perhaps the best known approach and the most extreme form of data openness, whereby all users enjoy non-discriminatory access (OECD, forthcoming[31]). Meanwhile, efforts to make public sector data collection freely available, often known as "open government data" initiatives, have the potential to spur innovation and new business models (see Chapter 4). For example, recent efforts

from the municipal transport authority of London to release consistent, up-to-date information have been estimated to yield savings up to GBP 130 million per year for customers, road users, the city of London and the municipal transport authority itself (Deloitte, 2017[32]).

In contrast to open data initiatives, other approaches to enhancing access to data include sharing data with fewer or specific users or organisations. For example, many firms actively commercialise proprietary data, which they may gain access to through contractual agreements with other firms. Similarly, market-based approaches for encouraging data access and sharing, like data markets and platforms that provide additional services, can enable the collection and commercialisation of data.

Similarly, "data portability mechanisms" enable users to access data they have given to an organisation in a commonly used, machine-readable and structured format, or to transmit those data to a chosen third-party. Other restricted forms of data sharing also exist, including partnerships for data sharing between organisations and initiatives to open data for social good.

While enhancing access to and sharing of data can drive value creation, there are also many challenges and legitimate concerns to such initiatives. Like many other aspects of digital transformation, the benefits of enhanced access to data may not be excludable; namely, those that increase access to their data may not capture all of the economic and societal benefits, or the costs of capturing those benefits may be high. Where gains cannot be captured by the data holder, there may be disincentives to increase access. This is particularly true where there are high costs to facilitating access, including with respect to the collection, cleaning and curation of data. Data are also increasingly recognised as a source of value, and organisations may be tempted to try to limit access to valuable data assets. However, the cost of enhancing access to data should be considered, so as not to disincentivise data collection and analysis. Contractual mechanisms through commercial agreements may help to address these challenges, which are not unique to issues related to the enhanced access to and sharing of data.

Finally, there may be legitimate restrictions of the flow and/or reuse of data, including private interests of individuals and organisations as well as national security and public interests (see Chapters 7 and 8) (OECD, forthcoming[31]). For example, incentives may be misaligned between actors, and some kinds of mechanisms for enhancing access may heighten digital security risk or the violation of privacy and IPRs. In turn, some kinds of data cannot be legally shared across borders, while uncertainties about the nature and the IPRs associated with particular kinds of data may skew incentives and decision making.

As digital transformation continues apace, data will continue to be created exponentially as more people and devices become interconnected. Similarly, as production becomes more knowledge-intensive, demand for data will also increase. Finally, many emerging digital technologies, AI, rely on access to data (OECD, forthcoming[33]). Balancing the risks and opportunities of enhancing access to and sharing of data will continue to be a policy priority going forward.

Notes

Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1. Figure 2.2: Data on M2M subscriptions are collected separately from other mobile subscriptions (e.g. subscriptions for users of smartphones, watches and tablets). Such data notes the country from which a mobile network operator or mobile virtual network operator allocates the SIM to the end user, and may not reflect the penetration of the IoT within each home country (e.g. a SIM card embedded in a vehicle may be sold and used outside that country). For Hungary, Latvia and Mexico, data refers to 2015 instead of 2014. For Switzerland, 2017 data are based on OECD estimates.
2. One potential challenge for the future of the Internet is its ability to scale to connect tens of billions of devices and machines, and a key aspect of that scalability is the use of the Internet Protocol (IP). The Internet Protocol specifies how communications take place between one device and another through an addressing system. There are two versions of the Internet Protocol in use, one which is largely exhausted in terms of the distribution of unassigned addresses (IPv4) and another that is plentiful but has had a slower than desirable rate of adoption (IPv6).
3. Figure 2.4: The Services Trade Restrictiveness Indices are calculated on the basis of the STRI regulatory database which records measures on a most-favoured-nation basis. Preferential trade agreements are not taken into account.
4. Figure 2.5: Rural areas: For EU countries, rural areas are those with a population density less than 100 per square kilometre. For Canada, rural areas are those with a population density less than 400 per square kilometre. For the United States, rural areas are those with a population density less than 1 000 per square mile or 386 people per square kilometre.
   Fixed broadband coverage: For EU countries, coverage of NGA technologies (VDSL, FTTP, DOCSIS 3.0) capable of delivering at least 30 Mbps download was used. For the United States, coverage of fixed terrestrial broadband capable of delivering 25 Mbps download and 3 Mbps upload services was used; data refer to 2016.

References

Bourassa, F. et al. (2016), "Developments in international mobile roaming", *OECD Digital Economy Papers*, No. 249, OECD Publishing, Paris, *https://dx.doi.org/10.1787/5jm0lsq78vmx-en*. [16]

CISCO (2018), "Visual networking index: Forecast and trends", *https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white-paper-c11-741490.html* (accessed 25 February 2019). [5]

Deloitte (2017), *Assessing the Value of Tfl's Open Data and Digital Partnerships*, Deloitte, London, *http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf* (accessed 2 March 2018). [32]

European Commission (2018), *Digital Single Market: Rights of Way*, *https://ec.europa.eu/digital-single-market/en/rights-way* (accessed 10 October 2018). [13]

European Union (2018), *Digital Scoreboard*, *https://ec.europa.eu/digital-single-market/en/digital-scoreboard* (accessed September 2018). [12]

G7 (2017), *G7 ICT and Industry Ministers' Declaration: Making the Next Production Revolution Inclusive, Open and Secure*, *http://www.g8.utoronto.ca/ict/2017-ict-declaration.html*. [29]

Godlovitch, I. and K. Neumann (2017), *Co-investment and Incentive-based Regulation*, proceedings of the 28th European Regional Conference of the International Telecommunications Society (ITS): "Competition and Regulation in the Information Age", Passau, Germany, *http://hdl.handle.net/10419/169463*. [17]

ITU (2019), *ICT Indicators (Edition 2018)* (database), *http://handle.itu.int/11.1002/pub_series/dataset/64cb0e71-en* (accessed 2 October 2018). [11]

OECD (2019), *Measuring the Digital Transformation: A Roadmap for the Future*, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264311992-en*. [3]

OECD (2018), "Bridging the rural digital divide", *OECD Digital Economy Papers*, No. 265, OECD Publishing, Paris, *https://dx.doi.org/10.1787/852bd3b9-en*. [23]

OECD (2018), *Broadband Portal*, OECD, Paris, *www.oecd.org/sti/broadband/broadband-statistics* (accessed 15 December 2018). [4]

OECD (2018), "IoT measurement and applications", *OECD Digital Economy Papers*, No. 271, OECD Publishing, Paris, *https://dx.doi.org/10.1787/35209dbf-en*. [6]

OECD (2018), *OECD Services Trade Restrictiveness Index: Policy Trends up to 2018*, OECD, Paris, *http://www.oecd.org/trade/services-trade/STRI-Policy-trends-up-to-2018.pdf*. [20]

OECD (2018), *Open Government Data Report: Enhancing Policy Maturity for Sustainable Impact*, OECD Digital Government Studies, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264305847-en*. [27]

OECD (2017), *Compendium of Good Practices on the Use of Open Data for Anti-corruption: Towards Data-driven Public Sector Integrity and Civic Auditing*, OECD, Paris, *http://www.oecd.org/corruption/g20-oecd-compendium-open-data-anti-corruption.htm*. [26]

OECD (2017), *Key Issues for Digital Transformation in the G20*, OECD, Paris, *https://www.oecd.org/g20/key-issues-for-digital-transformation-in-the-g20.pdf*. [24]

OECD (2017), *OECD Digital Economy Outlook 2017*, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264276284-en*. [10]

OECD (2017), *OECD Telecommunication and Broadcasting Review of Mexico 2017*, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264278011-en*. [21]

OECD (2017), *Services Trade Restrictiveness Index Sector Brief: Telecommunications Sector Brief*, OECD, Paris, *http://www.oecd.org/tad/services-trade/STRI_telecommunications.pdf*. [19]

OECD (2017), "The evolving role of satellite networks in rural and remote broadband access", *OECD Digital Economy Papers*, No. 264, OECD Publishing, Paris, *https://dx.doi.org/10.1787/7610090d-en*. [25]

OECD (2016), *The OECD Ministerial Declaration on the Digital Economy: Innovation, Growth and Social Prosperity*, OECD, Paris, *https://www.oecd.org/internet/Digital-Economy-Ministerial-Declaration-2016.pdf*. [2]

OECD (2015), *Data-driven Innovation: Big Data for Growth and Well-being*, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264229358-en*. [30]

OECD (2014), "Wireless market structures and network sharing", *OECD Digital Economy Papers*, No. 243, OECD Publishing, Paris, *https://dx.doi.org/10.1787/5jxt46dzl9r2-en*. [15]

OECD (2011), *OECD Recommendation of the Council on Principles for Internet Policy making*, OECD, Paris, *https://www.oecd.org/internet/ieconomy/oecd-principles-for-internet-policy-making.pdf*. [1]

OECD (2007), *OECD Principles and Guidelines for Access to Research Data from Public Funding*, OECD Publishing, Paris, *https://dx.doi.org/10.1787/9789264034020-en-fr*. [28]

OECD (forthcoming), *Artificial Intelligence in Society*, OECD Publishing, Paris. [33]

OECD (forthcoming), *Enhanced Access to Data: Reconciling Risks and Benefits of Data Sharing and Re-use*, OECD Publishing, Paris. [31]

OECD (forthcoming), *The Operators of the Future: Facilitators of Digital Transformations of Economies and Societies?*, OECD Publishing, Paris. [22]

OECD (forthcoming), "The road to 5G networks: Experience to date and future developments", *OECD Digital Economy Policy Paper*, OECD Publishing, Paris. [9]

Perset, K. (2010), "Internet addressing: Measuring deployment of IPV6: Measuring deployment of IPV6", *OECD Digital Economy Papers*, No. 172, OECD Publishing, Paris, *https://dx.doi.org/10.1787/5kmh79zp2t8w-en*. [18]

Sorbe, S. et al. (2019), "Digital dividend: Policies to harness the productivity potential of digital technologies", *OECD Economic Policy Papers*, No. 26, OECD Publishing, Paris, *https://doi.org/10.1787/273176bc-en*. [8]

Waring, J. (2016), *Intel CEO: 5G Crucial to Manage Coming M2M Data Flood*, *http://www.mobileworldlive.com/asia/asia-news/intel-ceo-says-coming-m2m-data-floodrequires-5g/* (accessed 25 September 2017). [7]

Werden, G. and L. Froeb (2018), "Don't panic: A guide to claims of increasing concentration", *Antitrust Magazine* Fall, *http://dx.doi.org/10.2139/ssrn.3156912*. [14]

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