

Broadband accessibility and quality connection in Europe by urban-rural typology including remoteness

Headlines

- In 2019, 97% of the EU households had access to fixed broadband, and 93% in rural areas. Despite recent improvements in high-speed broadband connectivity, less than 40% of rural households had access to fast broadband (> 30Mbps) compared to about 63% in urban ones.
- Whereas the accessibility to fixed broadband is pretty good in urban regions of the EU countries, rural and remote population living in Latvia, Romania, Slovakia, Spain, Hungary, Estonia, Finland, Poland and Lithuania are facing a disadvantaged situation.
- In some Member States, a high share of rural residents has access to high-speed broadband. In Denmark and the Netherlands, 85% of the population in remote and rural regions has such access. This share decreases to less than 20% for residents of rural and remote areas in Bulgaria, Ireland, Austria, Cyprus, Greece and Italy.
- The difference in EU average speed between fixed (30,305 kbps) and mobile (20,736 kbps) broadband connection varies across regional typologies: the highest average speed is recorded in cities, the lowest one in the rural and remote areas (approximately half of the speed).
- Cities show the highest speed in all Member states; in Malta and Denmark, average speed shows good values also in rural areas. Similarly, Sweden, the Netherlands, and Luxembourg provide high-speed connection to the remote and rural residents.
- In general European rural municipalities have low-speed broadband connection, however in Denmark, Sweden, Finland and The Netherlands also rural municipalities enjoy high-speed connection even far from cities.
- The poor or lack access to high-speed broadband might leave rural and remote areas behind, if they do not have the right infrastructure, capabilities and resources. The Digital Single Market Communication confirmed the importance of Internet connectivity.

Motivation

This policy brief has been elaborated based on the methods and findings in support of the EC Communication on a *Long-Term Vision for Rural Areas*¹. It aims to contribute an analytical Staff Working Document showing the situation and trends in rural areas. This document is built on the inter DG collaboration between DG for Agriculture and Rural Development, DG for Regional and Urban Policy, EUROSTAT and Joint Research Centre.

The main objective of the policy brief is to provide evidence on the level and quality of accessibility to broadband networks in the EU27. In particular, the analysis will identify important territorial disparities across urban and rural areas in relation to internet connection using different technologies. The main findings can support policies aiming at transforming challenges into opportunities, especially in remote areas, in the context of the digital transition and technological innovation.

Introduction

In 2019, more than 185 million EU households (96.6%) had access to at least one of the main fixed broadband networks in EU27 (DESI report, 2020). However, broadband coverage in rural areas, especially in remote regions, continue to be lower than national coverage (7.4 percentage points), with only nearly two thirds of the population having access to fast connection.

During the last years, fast broadband coverage has greatly improved in rural areas (from 9% in 2011 to nearly 59% in 2019), although closing the connectivity gap between urban and rural areas remains a challenge (DESI report, 2020). The lack of connectivity and accessibility to high-speed broadband reinforces the impact of distance, isolation and high transport costs, acting as a barrier for technological and market developments (EU broadband coverage, 2019).

In spite of recent improvements, the strategic objective of Digital Single Market for 2025 (European Commission, 2016) to ensuring that “all European households, rural or urban, have

¹ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12525-Long-term-vision-for-rural-areas>

access to Internet connectivity offering a downlink of at least 100 Mbps, upgradable to Gigabit speed” remains a challenge. The infrastructure required to reach this 2025 strategic objective is the Very High Capacity Networks (VHCN).

There is a call for a comprehensive range of actions to create a modern, lively and dynamic countryside that can attract young people and generate opportunities. In this respect, the Commission is promoting the development of ‘Smart Villages’ that provide digital and innovative solutions to agriculture and key sectors of the rural economy, as well as better services for rural citizens.

The Commission also works on several other fields to help Member States with faster roll-out of broadband networks. In 2017, the Commission launched a network of Broadband Competence Offices (BCOs) to support Member States and to advise local and regional authorities on how to develop broadband and deploy VHCN services, especially in rural and remote regions.

Data and methods

The analysis presented herein explores and quantitatively assesses the household accessibility to different type of broadband networks, and the quality of the broadband connection across rural and urban areas at different levels. It uses the most recent and finest spatial resolution data and statistical information available, reflecting the situation in 2019 and 2020 from two different sources:

- *Household accessibility* according to three categories indicating the availability of different types of broadband coverage. These categories cover: overall fixed-line broadband, next generation access (NGA) coverage achieving speeds of at least 30 Mbps, and a category of very high-capacity networks (VHCN), which include technologies currently capable of supporting gigabit speeds. Data is provided at NUTS3² level using the 2016 version (EU broadband coverage, 2019).
- *Broadband location and quality* are based on data provided by Speedtest® by Ookla®³ in order to test the speed and performance of internet connection. Data refer to the second trimester 2020 and it is available at local level for both fixed and mobile broadband connections.

² NUTS - Nomenclature of territorial units for statistics.

³ The data set contains records of hundreds of millions of measurement for the second quarter of the year 2020. Each record includes several attributes associated with each spatial unit. The attributes selected for this specific analysis are the average download speed (measured in kilobits per second) and the number of unique devices. They represent relevant parameters to evaluate the reliability of the broadband

This information is combined with urbanisation categories⁴, including remote areas⁵. The analysis distinguished two geographical levels for statistical and mapping purpose:

- 1) Local administrative units (LAU) and their corresponding degree of urbanisation categories, namely municipalities classified as: City; Town and Suburb, close to a city; Town and Suburb, remote; Rural area, close to a city; and Rural area, remote.
- 2) NUTS3 regions and their corresponding Urban-Rural typologies, namely regions classified as: Predominantly urban; Intermediate, close to a city; Intermediate, remote; Predominantly rural, close to a city; and Predominantly rural, remote.

The study is performed applying descriptive statistic and using spatial tools to analyse patterns of broadband networks across the EU. It shows the geographical distribution of broadband accessibility and quality aggregated at three different levels: country level, regional level and municipality level. Spatial patterns and quantitative results are graphically represented and mapped considering the distinction between urban and rural typologies, including remoteness. Data on broadband accessibility to households is defined as a regional share over the total households depending on the assigned Urban-Rural typology and the three different types of networks (overall fixed-line, NGA and VHCN). Concerning the broadband quality and location data, the big volume of recorded measurements made it necessary to employ geospatial computational tools⁶ to aggregate, homogenise, discriminate and visualise grid level data.

Results

EU households’ accessibility to broadband connection

In 2019, 96.6% of EU households had access to fixed broadband which represents more than 185 million households in EU27. However, the situation varies significantly when looking at high-speed networks, with only 84.3% and 49.6% of the households connected to NGA and VHCN networks respectively (Figure 1).

connection for specific activities (i.e., stable and fast connection for remote working).

⁴ As defined by DG Eurostat and DG for Regional and Urban Policy.

⁵ Remoteness is defined if the majority of the population in an area lives more than a 45-minute driving by car from the nearest city.

⁶ Tools employed include several Python packages for spatial analysis including geopandas, PySal, shapely and others.

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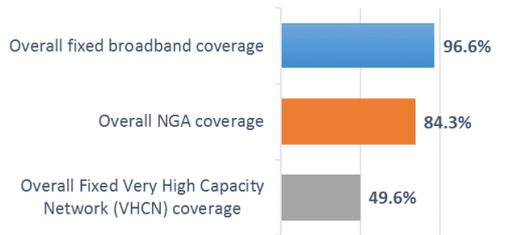
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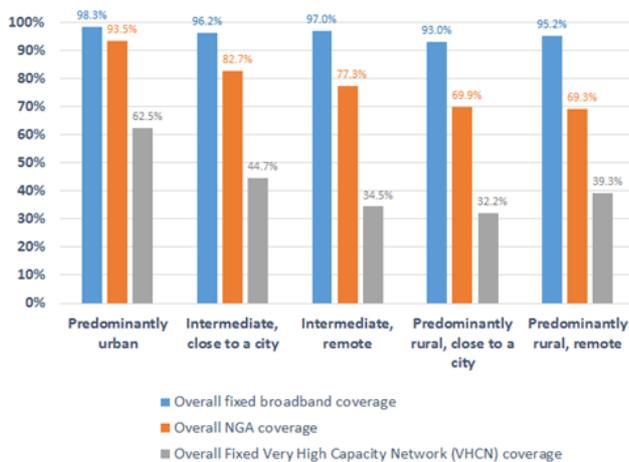
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Figure 1: Percentage of household accessibility to different broadband coverages in the EU, 2019



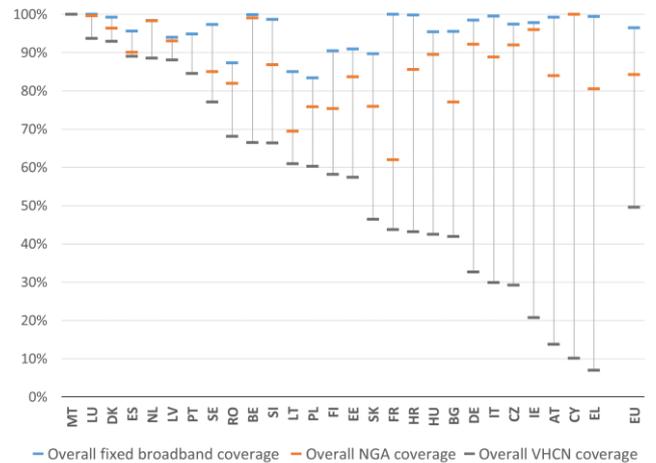
The overall fixed broadband is accessible by almost the majority of the EU households amongst different urban-rural typologies (Figure 2). However, rural and remote areas are disadvantaged compared to cities and regions close to a city (93% vs 98.3%). The access to high-speed broadband networks, both NGA and VHCN, by rural and remote households needs improvements to reduce the current digital gap. Comparing rural and remote regions to the more urbanised ones, differences in household accessibility are 3.3pp, 18pp and 20pp for the fixed broadband, NGA and VHCN, respectively. In particular, less than 40% of the EU households in rural remote areas have access to VHCN, compared to 62.5% of urban households.

Figure 2: Household accessibility to fixed broadband, NGA and VHCN coverage per urban-rural NUTS3 typologies in the EU, 2019



Several EU27 countries show complete broadband coverage, including Luxembourg, Cyprus, Malta and France. Cyprus and Malta are the only two countries to report complete coverage for NGA technologies. Belgium, Luxembourg, the Netherlands, Denmark and Ireland present NGA coverage at 95% and above. France currently ranks last for household accessibility to NGA network (62.1%). Access to the VHCN infrastructure varies more amongst EU27 countries. Malta, Luxembourg, Denmark, Spain, The Netherlands, Latvia and Poland show the highest coverage (> 80%), well above the EU average (49.6%). One important aspect to highlight is the variability within countries for different broadband networks: dispersion is very reduced in Malta, Luxembourg or Denmark, but significant differences can be noticed for Slovakia, France, Bulgaria, Germany, Austria and Greece (Figure 3).

Figure 3: Percentage of household accessibility to different broadband coverage in the EU countries, 2019



Across and within the EU countries, broadband coverage is lower in rural and remote areas than in urban regions and those close to a city (Figure 4). Most of the countries have fixed-broadband coverage above EU average in all the urbanisation categories, although Latvia, Romania, Slovakia, Spain, Hungary, Estonia, Finland, Poland and Lithuania show some disadvantages in rural and remote regions. Some Member States ensure broadband access to a high share of rural residents: in Denmark and the Netherlands, 85% of population in remote and rural regions has access to fast broadband. In Bulgaria, Ireland, Austria, Cyprus, Greece and Italy, this percentage is less than 20%.

Figure 5 shows the access to very high-speed broadband according to different NUTS3 typologies. Regions are classified using average speed per each typology, identifying areas above (dark colours) or below (light colours) the EU average. Scandinavian and Baltic countries, together with Poland, Romania, the Netherlands, Spain, Portugal and Malta, all show a very good access to VHC networks.

Figure 4: Percentage of households' accessibility to fixed broadband coverage in the EU, 2019.

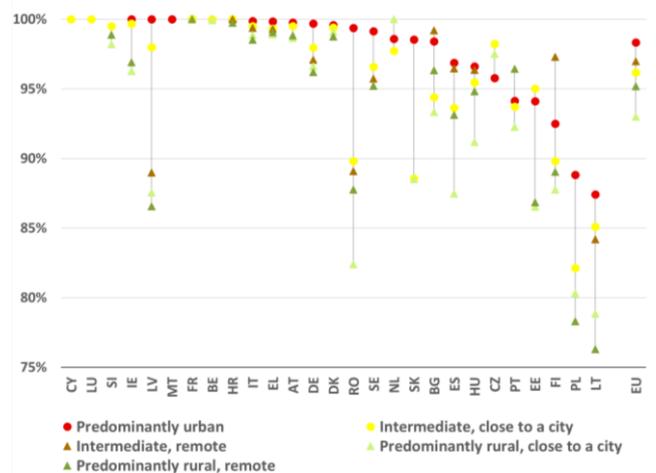


Figure 5: Percentage of households' accessibility to very-high-speed broadband (VHCN) coverage by urban-rural NUTS3 typologies, 2019.

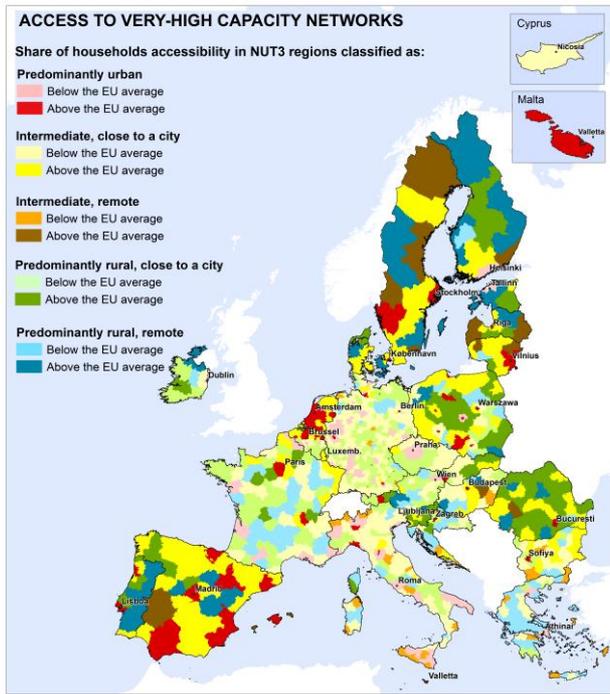
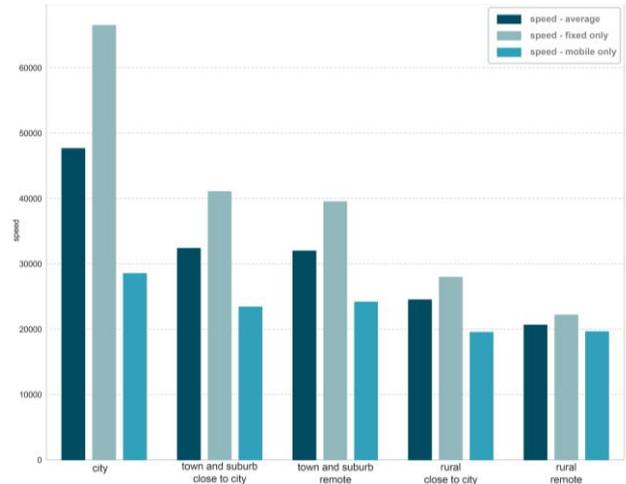


Figure 6: Average speed of overall, fixed and mobile broadband connection for the EU27 countries, measured in kilobits per second



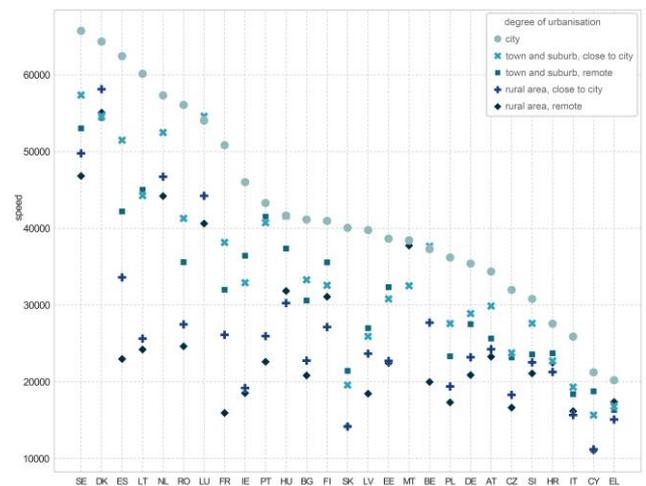
At country level, the highest speed is measured in cities in all Member States (Figure 7). However, Malta and Denmark show a comparable speed also in rural areas. Similarly, Sweden, the Netherlands, and Luxembourg present good broadband connections (above 40 Mb) in rural and remote regions. On the other side, some countries (Croatia, Italy, Cyprus, and Greece) show low-speed connections (below 30 Mb) across all urbanisation categories.

Broadband quality measurement at the local level

The broadband average, calculated in kilobits per second (kbps), is aggregated for the EU27 according to the five categories of the degree of urbanisation (Figure 6).

It can be noticed a significant difference in EU average speed between fixed (30,305 kbps) and mobile (20,736 kbps) broadband networks. Densely populated areas show the highest speed, whereas the lowest average speed is recorded in rural and remote regions. In particular, cities show the highest average speed connection (47,665 kbps) in comparison to the other urbanisation categories. Rural and remote residents have access to broadband network with the lowest speed (20,650 kbps) in most of the EU countries.

Figure 7: Average speed of broadband connection for the EU27 countries by degree of urbanisation, in kilobits per second.



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Overall, results show that cities have the highest speed in broadband network, revealing how areas already very connected in terms of roads and railways are also the most connected from the digital infrastructure (Figure 8). Results also reveal that rural municipalities are generally characterised by a low to a very low-speed broadband connection. However, this differs for municipalities located in Denmark, Sweden, Finland and the Netherlands, where the average speed is high even in rural areas far from cities. Moreover, the data availability for speed measurement sometimes is lacking or not sufficient to assess specific territories, for example, low-populated density areas classified as remote. This fact is particularly evident for some inner areas of Spain, France and Italy.

Figure 8: Average speed of broadband connection for the EU27 countries, in kilobits per second.

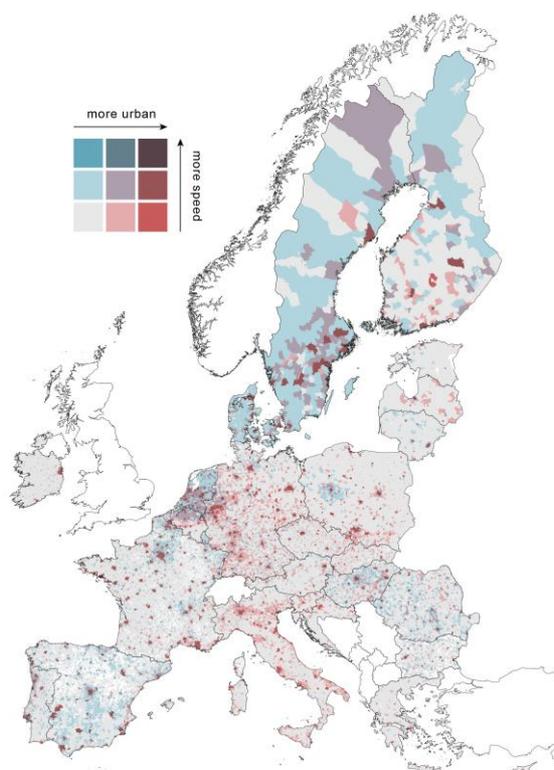
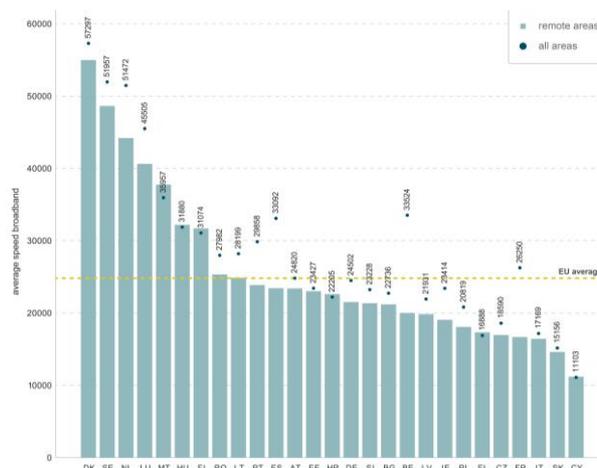


Figure 9 shows the average speed in remote areas compared to the overall country average speed. The highest gaps are in Belgium, France and Spain. Malta presents an interesting behaviour since remote areas have a higher speed than the country average. Denmark, Sweden and Finland show the highest speed in remote areas, with small differences in comparison to the country average speed. Countries showing the lowest speed connection are Greece, Czech Republic, France, Italy, Slovakia and Cyprus.

Figure 9: Average speed of broadband connection from LAU2 municipalities classified as remote regions compared to the country average for the EU27, in kilobits per second



Challenges

Despite recent improvements in high-speed connectivity, only 60% of houses in rural areas have access to fast broadband (> 30Mbps), while the access for the EU households is 84%. The gap is even bigger for VHCN coverage, with 20% of rural houses having access to such technology compared to 44% of all EU houses (EU broadband coverage, 2019).

The lack or poor access to high-speed broadband might leave rural and remote areas behind as they do not enjoy the right infrastructure (i.e. broadband), capabilities (i.e. digital skills) and resources (i.e. money). The development of mobile broadband infrastructure, in conjunction with other devices (smartphones and tablets), may represent a relevant way of accessing e-services for a broader population in remote areas.

In rural and remote areas, challenges are mostly related to the number and group of users, and the economic interest to deploy the service infrastructure. Remote areas are usually less populated than the rest of the country, with some population age groups more represented than others, such as the elderly population. As a specific group, women participation in the digital economy needs to be more active in areas of Internet use, user skills, digital jobs, careers and entrepreneurship to foster and enhance women inclusion in digitalisation (WiD Scoreboard, 2020). In the agricultural sector, it is a priority to create the right environment enabling farmers to make best use of digital technologies and their potential. At the moment, there is a gap between technologies offered by research and market and their take up by the agricultural sector and farmers.

These factors lead to market failure scenarios, with no or only small incentives for private providers to invest on broadband infrastructure that could supply high-speed connection to sparsely populated areas. To overcome these barriers, public authorities should attract private investment by planning and co-funding interventions to benefit rural population. Although the broadband supply is not the only driver for remote areas development, it is both a pre-condition and an essential service for better opportunities.

Opportunities

Since early 2018, the Commission is implementing an "Action plan for Rural Broadband", aiming to help broadband rollout in rural and remote areas. In addition to strengthening and increasing the number of BCOs, the introduction of a 'rural proof test' will give priority to broadband in rural areas in the reprogramming of the Structural Funds and the design of a common methodology for planning, reporting and control of investment in broadband. The digital strand of the Recovery and Resilience Plans of the Member States is a unique opportunity to secure the investments needed to fill the digital gap between rural and urban areas. Targeted EU policies on digitalisation might help to create new jobs, new ways to deliver services and new ways to move people and goods, strengthening rural economies and improving their attractiveness.

Access to broadband connection represents an important feature in any strategy aiming at developing territorial innovation, digitalisation and improving the well-being in rural and remote areas. It represents an essential infrastructure to support several domains such as work, education, health and innovation. High-speed broadband is currently and increasingly needed for access to education and information, e-health, recreational purposes, entrepreneurial and (agro)business activities. Fast and reliable broadband access can supply fundamental services in areas often characterised by poor access to public services, helping overcome the challenges caused by rural remoteness, enhancing connectivity and building bridges with other regions.

Advances in technology, especially the Internet infrastructure, are particularly relevant for rural regions. The access to high-speed connection may also represent an incentive for retaining inhabitants and help repopulate remote areas, giving people the possibility to perform their work from home, without commuting to more densely populated areas. Reliable Internet connectivity can overcome some of the core challenges including isolation, high transportation costs, high costs to delivery services and distance to market. The Covid-19 pandemic and the consequent measures show that many people can efficiently perform their working duties from home, both partially and completely.

References

Broadband coverage in Europe 2019. Mapping progress towards the coverage objectives of the Digital Agenda. DG Communications Networks, Content & Technology by: IHS Markit, OMDIA and Point Topic. Contract number: LC-01252443. Luxembourg: Publications Office of the European Union, 2020. ISBN: 978-92-76-20128-1,

DESI report 2020. Digital Economy and Society Index. Final report. A study prepared for the European Commission DG Communications Networks, Content & Technology by Tech4i2. ISBN 978-92-79-85699-0. DOI: 10.2759/745483.

European Commission (2016). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions: Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society — COM (2016) 587, Brussels.

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Women in Digital Scoreboard, 2019. European Commission. DG for Communications Networks, Content and Technology. Digital Single Market, Digital Economy & Skills.

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