

# A future-proof network for the EU: Full fibre and 5G

## SUMMARY

Advanced digital network infrastructure and digital services will be key in shaping the competitiveness of many European Union (EU) sectors – among them manufacturing, energy and healthcare – in the near future. Furthermore, these infrastructure and services are at the core of the twin digital and green transition that seeks to leverage the synergies between technological advancements and environmental sustainability. It is therefore necessary to ensure that the EU's networks are up to the task, including in terms of transmission speed. Having high-performing fixed and mobile networks with a higher transmission speed can have a positive effect on economic development as well, by boosting the gross domestic product.

In its Digital Decade strategy, the European Commission put forward its vision for new strategic connectivity targets for 2030, such as preparing the EU for the roll-out of the next generation of broadband infrastructure with gigabit speeds. This briefing aims to provide an overview of full fibre and 5G mobile networks as part of the EU's Digital Decade goal to accelerate deployment and investment in future-proof infrastructures. In this context, it discusses the current state of full fibre and 5G mobile technology in the EU, including the challenges of attracting private investment, and explores new business models for network deployment.

With 7 years left to reach the 2030 connectivity targets, it is paramount to understand where the EU stands in terms of future-proof network deployment, address the challenges and identify the opportunities that would help the EU telecom sector to thrive.



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## Introduction

There is currently a [global tech race](#) for online platforms, artificial intelligence, data, cloud, [quantum](#) and the [metaverse](#). In this regard, Thierry Breton, European Commissioner for the Internal Market, made it [clear](#) that the EU must ensure that its networks can give it the competitive edge it needs, including in terms of transmission speed. The EU has set non-binding 'digital decade' [targets](#) that are to be reached by 2030. These include providing all EU households with access to a fixed gigabit network (with a capacity of 1 Gigabit per second, or Gbps) and ensuring that all populated areas are covered by next-generation wireless high-speed networks with performance at least equivalent to that of 5G. Technological neutrality is one of the [key principles](#) of the EU regulatory [framework](#) for electronic communications. In essence, this means that '[a]ll technologies and transmission systems able to contribute to the achievement of the gigabit connectivity, including the current and upcoming advancements of fibre, satellite, 5G or any other future ecosystem and next generation Wi-Fi should be treated equally, where they have equivalent network performance'.<sup>1</sup>

In its February 2024 [white paper](#) on How to master Europe's digital infrastructure needs? (known as the Telecom white paper), the Commission voices support for a deadline for the migration from the legacy copper network to a newly deployed fibre one, and recommends that the migration for 80 % of subscribers be accomplished by 2028 and for the remaining 20 % by 2030. It furthermore recommends increasing the EU's competences for spectrum management, for instance, by allowing the EU to engage in both spectrum planning for future use cases and coordination of auction timing, to successfully complete 5G roll-out and ensure a future timely 6G deployment.

In April 2024, Enrico Letta, former Italian Prime Minister and Jacques Delors Institute President, completed his [report](#), Much more than a market – speed, security, solidarity, requested by [both](#) the European Council and the Commission. The report recognises that 'liberalisation policies backed by pro-competitive regulation at the European level' in the EU telecom sector have worked best in terms of new entrants challenging former incumbents, low retail prices for consumers, and progression in fibre and 5G roll-out (albeit slowly). Nonetheless, the report draws attention to the fragmentation of the market, resulting from the fact that each EU Member State has its own rules governing its national electronic communications market, and that there are more than 100 operators across the EU. This fragmentation, the report argues, 'hinders the scale and growth of pan-European operators, limiting their ability to invest, innovate, and compete with their global counterparts'. Therefore, according to the report, markets should remain open and competitive, yet some level of consolidation within national markets or strategic alliances between market players (e.g. pro-competitive sharing of investment in key network elements) might be needed to meet the scale of investment necessary for building future-proof EU telecoms infrastructure.

This briefing aims to give an overview of full fibre and 5G mobile networks as part of the EU's [goal](#) to accelerate deployment and investment in future-proof infrastructures.

## What is full fibre and 5G mobile technology? Where does the EU stand?

The term full fibre refers to **fibre-to-the-premises** (FTTP) [consisting](#) of fibre optic cables laid all the way to i) buildings (fibre-to-the-building, FTTB) or to ii) homes (fibre-to-the-home, FTTH). Full fibre can reach ultra-fast speed – more than 1Gbps for download and upload – and it is very reliable, stable and symmetric. The term 5G refers to the fifth generation of mobile communication regardless of the spectrum band used. 5G technology, enabling significant improvements in terms of speed and latency (measure of the responsiveness of a network) compared to 4G, is also [expected](#) to enable an array of new innovative services that will transform sectors such as manufacturing, energy and health, bringing them into the era of the internet of things.

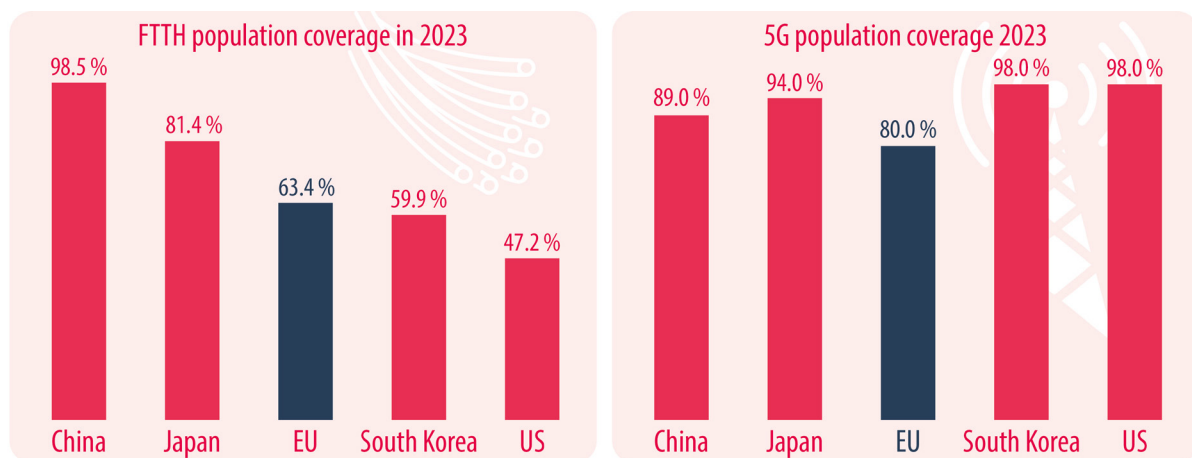
The European Commission's first [report](#) on the state of the Digital Decade shows that the EU needs to do more to achieve the digital decade connectivity targets. In terms of fixed access, full fibre

networks (FTTP), which are critical for delivering gigabit connectivity, have reached 56 % of households. While 5G basic coverage is already available to 81 % of the EU population, the deployment of [5G stand-alone networks](#), also known as 'full' 5G because it supports many of the most exciting new features and innovative uses, is [estimated](#) to be significantly less than 20 % of populated areas in the EU.<sup>2</sup> This limited 5G stand-alone deployment could, among others, be related to the early stage of 3.4-3.8 GHz band deployment, as this band – supporting higher speeds and capacity – currently only covers 41 % of the EU population.

Although international comparisons are difficult to make due to different indicators, market contexts and regulatory environments, data comparing the EU and the United States (US) seems to show that the EU is ahead in the deployment of **full fibre networks** (FTTP), particularly when considering FTTH deployment, but still behind in overall basic 5G coverage. The latest [report](#) of the US Federal Communications Commission (FCC) shows that by the end of 2021, the EU and the US had nearly the same percentage of full fibre coverage (44.8 % in the EU-26 compared to 44.7 % in the US).<sup>3</sup> Data from the end of 2022 shows that EU full fibre [coverage](#) increased to 56 % while the US [reached](#) 48.8 % (for comparison, Japan and South Korea each reached 99.7 %). It should be noted that full fibre coverage [varies](#) among the EU-27, with 14 Member States already exceeding 70 % coverage and 22 Member States exceeding 50 %. The State of Digital Communications 2024 [report](#), published by the European Telecommunications Networks Operators' Association (ETNO), forecasts that by the end of 2023, [FTTH coverage](#) (excluding FTTB) will have reached 63.4 % of the EU and 47.2 % of the US population (Figure 1).<sup>4</sup>

Nonetheless, there is a gap in overall **5G coverage** between the two regions. The US [has achieved](#) 98 % of 5G population coverage while the EU reached 81 % ([up](#) from 66 % the year before). South Korea (98 %), Japan (94 %) and China (89 %) are also ahead of the EU in overall 5G coverage (Figure 1). Within the EU, the situation [varies](#) a lot depending on the Member State, with 5G coverage in the largest Member States being relatively similar to the US (e.g. 10 Member States have already reached coverage above 90 %).<sup>5</sup> Additionally, in the use of full 5G (or 5G stand-alone) – which ensures high reliability and low latency for industrial use cases – and new Radio Access Network (RAN) technologies, the EU currently [outperforms](#) North America in some respects. The 5G Observatory published a [comparison](#) of the current status of 5G commercial launches in international markets. In its above-mentioned Telecom white paper, the Commission observes: 'Overall, and without taking into account population density and quality of connectivity, the EU has similar fixed and mobile coverage than the US but lags significantly behind other parts of the world in particular on fibre coverage and 5G stand-alone.'

Figure 1 – FTTH and 5G population coverage in 2023



Source: ETNO, [State of Digital Communications 2024](#) report.

## Investment challenges

Achieving the Digital Decade connectivity targets – all EU households covered by a fixed gigabit network and all populated areas covered by 5G – will require substantial investment from the private sector, as well as public funding, including from EU programmes.

A [study](#) commissioned by the European Commission estimates that around €114 billion of investment is still needed to reach the 2030 fixed connectivity targets through the deployment of full fibre networks (FTTP) as the technology of choice. An additional investment of around €33.5 billion is estimated to deploy full 5G to all populated areas by 2030. Therefore, around €148 billion seems to be needed to achieve the Digital Decade connectivity targets with full fibre and 5G networks.<sup>6</sup> The study also points to the need for public subsidies of €42.7 billion to achieve those targets, with €40 billion for full fibre and €2.7 billion for full 5G deployment. It should be noted that total investment and subsidy levels could be significantly reduced if i) fixed and mobile roll-out were combined or ii) [5G fixed wireless access](#) (FWA), instead of full fibre, were deployed in the most rural areas.<sup>7</sup> The study underlines that EU funds for investment in connectivity are unlikely to fully address the connectivity gap and will need to be supplemented by national and regional funds for connectivity as well (i.e. the study has not included such funds in its calculations). The EU has made just over €23 billion in [grants available](#) to support progress towards the 2030 connectivity targets (Gigabit and 5G coverage) under EU programmes for the 2021-2027 programming period.<sup>8</sup>

Table 1 – Estimated investment needed to reach the EU connectivity targets by 2030

	Technology	Total investment (private and public)	Public funding (as part of the total investment)
Fixed gigabit connectivity	Fibre-to-the-Premise (FTTP)	€114 bn	€40 bn
	5G Fixed Wireless Access (FWA) in areas with less than 30 inhabitants/km <sup>2</sup>	€108 bn	€29 bn
5G or 5G-equivalent wireless connectivity	Basic 5G (upgraded 4G base stations)	€11.5 bn	“Minimal”
	Full 5G (standalone 5G networks)	€33.5 bn	€2.7 bn
Fixed and wireless connectivity	Joint deployment of FTTP and full 5G	€120 bn	€33 bn

Source: Table drawn up by Cullen International based on data from a [study](#) by WIK-Consult.

ETNO continues to emphasise that the EU telecom sector lags behind its global peers, such as the US, in terms of both [revenue](#) and investment. According to ETNO, the [total fixed capital investment](#) in fibre and 5G per capita adjusted to GDP was €109 billion in the EU, compared to €174 billion in the US. Concerns regarding the long-term growth in revenues of the EU telecom sector and its ability to invest and innovate have also been shared by the [Commission](#) and by Enrico Letta's abovementioned report on the future of the single market. A [study](#) by the Belgian Institute for Postal Services and Telecommunications (BIPT) on the profitability of a sample of publicly listed telecom operators highlights, in line with the abovementioned findings, that EU telecom operators are lagging behind from an international perspective. However, the study also reveals that profit margins and return on capital (ROC) have remained stable in the European telecom sector over the past decade, with no noticeable a gap or decrease.

## New business models for full fibre network deployment

When it comes to full fibre networks, [new models](#) for fibre deployment have emerged. These [models](#) differ from the business model of [vertically integrated](#) telecom operators, who typically own both the passive and active infrastructure (wholesale services) and also provide services directly to end users (retail services). These new business models have also [attracted](#) the interest of public utilities, equity firms, infrastructure and pension funds. These investors see in fibre deployment the potential to achieve stable returns, contribute to future growth in service demand, and monetise existing network assets beyond the context of telecoms. This briefing will focus on wholesale-only network models, on separation of telecom networks, and on co-investment models in particular.

In a [wholesale-only network model](#), operators build full fibre physical infrastructure and offer access to all interested market operators while not offering retail services themselves. Since wholesale-only operators do not own legacy infrastructure (e.g. copper) and do not have their own retail operations, their primary goal is to invest in the latest technologies (e.g. FTTP) and make access available to all market participants on equal terms (e.g. wholesale-only operators have fewer incentives to discriminate against access seekers). Operators [pursuing](#) wholesale-only models might not be traditional telecommunications operators but also municipalities, public and/or private financial investors attracted by long-term investments with predictable cash flows. Sweden is one of the pioneers of municipal wholesale-only fibre networks (e.g. [Stokab](#)) and remains one of Europe's leader in fibre deployment. The wholesale-only operator [Open Fiber](#) is a joint venture of Cassa Depositi e Prestiti (60%), a state-owned financial institution, and Macquarie (40%), an Australian equity fund, [investing](#) in FTTH deployment in Italy. Wholesale-only operators might also enjoy State aid for the construction of networks in the country's most rural areas.<sup>9</sup>

Certain [models of separation](#) of vertically integrated telecom operators, such as legal and structural separation, have also attracted new investors interested in full fibre deployment. According to an EU [expert](#): 'A pure telecommunications network, without involvement with retail, appears similar to an utility business (such as energy, gas, transport, water) characterized by reasonable and certain returns of investments, defined in the long term'. An equity fund, [Morgan Stanley Infrastructure Partner](#), bought a 49.99% stake in the Portuguese telecom incumbent's (MEO) wholesale operations to create Altice Portugal FTTH, which was [transformed](#) into [Fastfiber](#) in April 2020. Fastfiber now comprises all of MEO's fibre assets in Portugal. In Italy, the US investment fund Kohlberg Kravis Roberts & Co. L.P. ([KKR](#)) bought a 37.5% share in the legally separated company [FiberCop](#), which is a part of the incumbent telecom's operations. The mission of FiberCop is to develop a full fibre network covering [60%](#) of premises by 2026. Recently, KKR's [offer](#) to acquire TIM's fixed network assets (NetCo), including FiberCop, has been [approved](#). The [closing](#) of the operation, which should lead to a structural separation, is expected by July 2024.<sup>10</sup>

### Malaysia's national 5G wholesale network

Malaysia established its 5G nationwide mobile network back in 2021, adopting a distinctive approach that has led the country to [become](#) one of the top performing 5G markets globally. The roll-out of 5G is being implemented through a [single state-owned](#) 5G network entity called Digital Nasional Berhad (DNB), providing equal access to access seekers on a wholesale basis.

The DNB network deployment is expected to reach 80% coverage in populated areas, including rural ones, by 2024. The entire 5G network roll-out is estimated to cost MYR16.5 billion (€3.2 billion) over the next 10 years. Interestingly, the total cost for the 5G deployment will be financed exclusively by the private sector.

Malaysia's government [plans](#) to roll out a second 5G network, [enabling](#) industry players to venture into the remaining 20% of areas not covered by the DNB and attract interest from foreign investors.

Source: Digital Nasional [website](#).

[Co-investment](#) in full fibre network deployment refers to initiatives in which two or more investors agree to invest together to deploy infrastructure used to provide services such as internet broadband connections. By [sharing a network](#) through co-investment, operators also share the associated costs of building a new full-fibre network. Three main co-investment models are usually [identified](#) (the list is not exhaustive, and a mix of the models below is possible):

- **joint-venture model:** when an operator and the co-investor(s) are co-owners of a new entity or company, responsible for the deployment of full fibre networks;
- **reciprocal access model:** when an operator and the co-investor(s) reach a long-term risk sharing agreement whereby they are each responsible for deploying and operating their respective full-fibre networks in geographically separate areas and give access to each other;
- **one-way access model:** when an operator builds the full-fibre network and grants access to the other co-investor(s) based on a long-term risk sharing agreement.

Although most co-investment initiatives for full-fibre deployment involve only telecoms operators, private equity funds, pension funds and/or insurance providers have taken part in about a third of such initiatives.<sup>11</sup>

## What Europe is doing

### Promotion of co-investment, wholesale-only networks, spectrum management

One of the general aims of the European Electronic Communications Code ([EECC](#)) is to promote deployment, access and uptake of very high-capacity networks (VHCN),<sup>12</sup> including full-fibre networks and 5G. Specifically, the EECC has established rules to [facilitate](#) co-investments and wholesale-only business models for fibre deployment. National telecom regulators have the authority to refrain from imposing regulations on telecom operators with significant market power (SMP) if co-investment initiatives for fibre deployment meet specific conditions (e.g. the offer is open to all electronic communications networks and/or service providers; terms are fair, reasonable and non-discriminatory, etc.).<sup>13</sup> The code also exempts wholesale-only operators with SMP from certain types of regulation.<sup>14</sup> Additionally, to encourage investment and support the roll-out of 5G networks, the EECC has implemented measures such as extending minimum spectrum licence duration to a minimum of 20 years as well as promoting a light regulatory approach for the deployment of [small cells/antennas](#)<sup>15</sup> [essential](#) for 5G roll-out (e.g. competent authorities must not unduly restrict deployment of small cells).<sup>16</sup>

### Reducing costs for network deployment and migrating to fibre

The 2014 Broadband Cost Reduction Directive ([BCRD](#)) is the main instrument used to lower entry barriers and costs related to network deployments. It sets out harmonised rules on access to the physical infrastructure of all utilities for the purpose of building broadband networks such as ducts, poles, masts, etc. In February 2023, the Commission [presented](#) a set of actions, known as the 'connectivity package', consisting of the [draft gigabit infrastructure act](#), a [draft recommendation](#) to promote gigabit connectivity, and an [exploratory consultation on the future of electronic communications infrastructure](#).

The aim of the proposed gigabit infrastructure act (GIA) is to replace the existing BCRD and introduce a set of specific actions to simplify and speed up the deployment of very high-capacity networks, such as full fibre and 5G. For instance, GIA provisions enable telecom operators to collaborate with public works projects to install fibre optic cables simultaneously and facilitate small cell deployment for 5G through the use of street furniture such as light poles, traffic lights and billboards. The European Parliament and the Council reached a provisional [agreement](#) in February 2024. The text was adopted by Parliament during its second April plenary session, and it will now have to be formally adopted by the Council as well.

In parallel, the Commission also adopted the [Gigabit Recommendation](#) in February 2024, in which it provides guidelines to national regulatory authorities on matters such as pricing flexibility for VHCN deployments<sup>17</sup> and on how to smoothly conduct the migration from copper (legacy network) to fibre, also known as copper decommissioning. The results of the exploratory consultation on the future of the EU's electronic communications sector and its infrastructure were [published](#) in October 2023. Key takeaways include the need for i) innovation and efficient investment; ii) leveraging the single market to boost innovation and investment; and iii) securing the networks. Finally, on 21 February 2024, the Commission published a [consultation](#) on its abovementioned white paper on the EU's digital infrastructure needs. The Commission analysed the challenges the EU is currently facing in the roll-out of future connectivity networks, among them low investment, a fragmented approach to radio spectrum and the lack of a single market for telecoms. It also presented possible scenarios going forward. The consultation is open for feedback until 30 June 2024.

## Conclusions

The EU has set ambitious Digital Decade connectivity targets for 2030, with 7 years remaining to achieve them. As of 2023, more than half of the EU's connectivity targets have been met, with 5G coverage at 81 %, fixed VHCN at 73 % and full fibre coverage at 56 %. Many [Member States](#) have even more ambitious connectivity targets than those set in the Digital Decade programme in terms of targets or deadline, which speaks of their strong interest in deploying future-proof technologies. For instance, Austria aims to have almost all areas covered with 5G by end of 2025, and France plans to offer FTTH for all by the same deadline. Nonetheless, the Commission is concerned about the [full achievement](#) of the 2030 connectivity targets, as its projections show that fibre coverage progress may not exceed 80 % by 2028 and it acknowledges that basic 5G population coverage may not support future use cases backed by 5G stand-alone networks (known as full 5G) only.

Private investment is needed to achieve the necessary budget to deploy a gigabit society, and under-investment might be one of the biggest barriers to meeting the Digital Decade targets.<sup>18</sup> Attracting investors to the EU telecom sector and exploring new business models for network deployment to overcome the investment gap might be crucial.

The European Electronic Communications Code, which is already in force, and the connectivity package, currently undergoing final adoption, have both aimed to facilitate VHCN roll-out, including full fibre and 5G. The Commission's telecom white paper and the Letta report might provide ideas for a [potential](#) legislative proposal (the digital networks act) rumoured to see the [light](#) before summer 2025. Until then, it is important to analyse the pros and cons related to the fragmentation of the EU telecom market,<sup>19</sup> the need for a more harmonised approach to spectrum management (such as licence duration, reserve prices and the annual cost of spectrum),<sup>20</sup> and the ongoing [debate](#) on network cost contributions.<sup>21</sup>

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Madiega T., [EU electronic communications code and co-investment: Taking stock of the policy discussion](#), EPRS, European Parliament, February 2018.

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## ENDNOTES

- <sup>1</sup> For instance, as far as [fixed networks are concerned](#), fibre-to-the-premises (FTTP) and Cable Docsis 3.1 are considered to be technologies currently capable of delivering gigabit connectivity.
- <sup>2</sup> 5G stand-alone networks use 5G at both radio access and core network level, without relying partially on 4G infrastructure.
- <sup>3</sup> 2022 Communications Marketplace Report, [Appendix G](#); 2022 International Broadband Data Report, Section III on Broadband speed and performance comparisons.
- <sup>4</sup> In the US, high-speed internet is delivered mainly via cable DOCSIS 3.1 (covering [84.5 %](#) of households).
- <sup>5</sup> Cyprus, Malta, the Netherlands, Italy, Denmark, Finland, Luxemburg, Germany, Austria, and Lithuania.
- <sup>6</sup> The resulting total investment needed to reach the current digital decade targets is about €148 billion in investment, with an addition of between €26 billion and €79 billion depending on the deployment mode, for the main transport paths. This brings the [overall investment](#) that has to be achieved to at least €174 billion, including the public funds that may be required, but more likely beyond €200 billion depending on the options considered.
- <sup>7</sup> Total costs of full fibre and full 5G deployment decrease to €120 billion (a saving of around 20 %) and subsidies to €33 billion (savings of almost €10 billion)
- <sup>8</sup> [SWD \(2023\)570](#) on Implementation of the Digital Decade objectives and the Declaration on digital Rights and Principles, Annex 5 on Delivering the Digital Decade with EU investments. Beyond RRF funding, the estimate of over €23 billion in grants includes more than €4 billion in cohesion policy funding, around €1 billion in Horizon2020/Horizon Europe funding and around €1 billion in CEF funding. Additional funding has been granted under financial instruments (namely, Invest EU and the Connecting Europe Broadband Fund).
- <sup>9</sup> Cullen International, [Wholesale-only operators benchmark](#), September 2023.
- <sup>10</sup> Cullen International, [Models of separation and non-discrimination benchmark](#), September 2023.
- <sup>11</sup> Cullen International, [Co-investment in fibre broadband network deployments benchmark](#), September 2023.
- <sup>12</sup> Article 2(2) [EECC](#) defines 'very high capacity network' as: 'i) either an electronic communications network which consists wholly of optical fibre elements at least up to the distribution point at the serving location, or (ii) an electronic communications network which is capable of delivering, under usual peak-time conditions, similar network performance in terms of available downlink and uplink bandwidth, resilience, error-related parameters, and latency and its variation'.
- <sup>13</sup> See Article 76 and Annex IV of the [EECC](#).
- <sup>14</sup> See Article 80 of the [EECC](#).
- <sup>15</sup> See Commission [Implementing Regulation \(EU\) 2020/1070](#) of 20 July 2020 on specifying the characteristics of small-area wireless access points pursuant to Article 57 paragraph 2 of Directive (EU) 2018/1972 of the European Parliament and the Council establishing the European Electronic Communications Code.
- <sup>16</sup> See Article 57 of the [EECC](#).
- <sup>17</sup> No regulated wholesale access prices when the national regulatory authority (NRA) imposes certain non-discrimination obligations.
- <sup>18</sup> L. Parcu et al, [The future of 5G and beyond: Leadership, deployment and European policies](#), 2023.
- <sup>19</sup> J. Bryson et al., [Big Telcos Aren't Necessarily Better: A Case Study of EU versus US Market Concentration](#), 2023.
- <sup>20</sup> M. Mariniello and F. Salemi, [Addressing fragmentation in the EU mobile telecoms markets](#), 2015.
- <sup>21</sup> Belgian Institute for Postal Services and Telecommunications (BIPT), [Analysis regarding the request to impose mandatory contributions by internet platforms to telecom operators for the use of their networks \(fair share\)](#), November 2023.

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