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THE STATE OF DIGITAL COMMUNICATIONS

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CONTENT

TOWARDS A BETTER 2021, STRENGTHENING EUROPE'S DIGITAL BACKBONE

2020 turned out to be a radically different year from that expected, and at the time of writing it will doubtless throw up some unexpected turns of events. It is clear that the direct effects of the Covid-19 pandemic will continue to have a profound impact on Europeans' lives at least well into 2021.

The dramatic events of 2020 brought to light the fact that **telecommunications are both a lifeline and an enabler for modern societies.** Facts and figures in this year's report show clearly that Europe has resilient digital infrastructure, that European telecoms companies continue investing heavily and that their effort to innovate and become greener is measurable and concrete. 5G and fibre are confirmed as the two main pillars of the telecoms strategy going forward, along with increased innovation in the field of services and data.

At the same time, **this report highlights the significant challenges facing Europe in the digital field,** if it wants to lead the way on global digital markets based on innovative and strong networks. Compared to 10 years ago, Europe counts fewer and fewer companies in the "World Top 15" list of telecom operators. **Investment per capita** remains low compared to global competitors in America and Asia, essential spectrum resources for 5G are pricey and subject to complex conditions, and markets remain fragmented, leading to a weaker **financial performance** of the EU telecoms sector compared to peers. Facts and figures in this year's report show a clear rationale for EU policies that help strengthen the sector, so that socio-economic growth can be further accelerated by 5G, fibre and innovative telecom services.

European telecoms in the pandemic

The robustness of digital infrastructure and applications has been stress-tested like never before. Data traffic increased dramatically, practically overnight in some countries. However, telecom networks have proven to be largely resilient and have been pivotal in providing a measure of continuity to people's lives and livelihoods, in sustaining economic activity and in assisting in public health efforts or mitigating the effects of the disaster.

Most sectors of the economy have been hit hard by the pandemic. A few large companies, mostly in the digital sector, actually grew their revenue, while the digital infrastructure sector, such as telecom operators, continued to present declining revenues. Although it is true that the telecoms industry has suffered less direct negative impact on revenue than most other industries, any long-term recession in the total economy is bound to have, longer term, some indirect effect on telecoms revenue. Post-war Europe has seen sharp contractions before, but nothing quite as sharp as this. Most operators were recording abnormal falls in revenue by 2Q 2020: **services for SMEs, pay TV, mobile roaming and equipment sales were the worst-affected parts of the business,** fixed broadband the least-affected. Also, important "solidarity" offers (traffic and services for free or heavily discounted) provided by operators for citizens, hospitals, schools, administrations during the lockdown periods have had an impact. The revenue outlook at the time of writing was subject to a greater degree of uncertainty than usual, as a second wave of infection spread across Europe.

Though of course the pandemic has been a profound shock, in certain key respects it has accelerated trends we could already see in digital communications long before Covid-19 became a reality: digital interfaces replacing bricks and mortar retail; a rapid shift to online media consumption; a changing attitude of business, governments and citizens in the use and application of digital technology, including an accelerated shift to Cloud as home-workers shifted away from office LANs.

In other respects, the crisis, reversed, perhaps only temporarily, long-term declines: voice usage increased overturning a decade of decline; mobile apps gave way to websites, and video-communication, which Europeans never really warmed to, has suddenly been given an impetus. However, **none of these shifts have translated into new sources of revenue for telecom operators,** as many telecom services are flat-rated, which means that increasing voice or data consumption does not automatically translate in revenue increase. On the other hand, the increase in voice or data consumption continues to require sustained investment in network infrastructure and spectrum assets alike.

2020 trends and lessons for the future

The pandemic has created broader societal trends, some are an acceleration of existing trends, some not: where people choose to live; how they choose to pay; where they work; how they shop; how much they travel. Whether these are permanent shifts or not, all will rebound on the digital communications industry.

Even if we could separate out the effects of the pandemic, 2020 would have been a remarkable year in European digital communications. For many Europeans, it was the first taste of 5G, and 2020 saw some of the first commercial uses of public networks to support private industrial needs. **Investment in connectivity increased despite economic, policy challenges and COVID-related delays,** including to connect white areas not already covered by ultrafast broadband, and net additions of subscribers are at their highest-ever level in 2020.
The supply of equipment and software upon which digital communications industries depend was **subject to intense geo-political and disruptive pressures,** and the position of global suppliers was challenged across geographies. This is likely to translate into higher equipment costs where restrictions are imposed. Cybersecurity has become a decisive requirement for Member States and the EU, impacting operators' plans in many areas. Leading operators in Europe and elsewhere are progressively contemplating plans that disaggregate the vendor supply-chain from mainly hardware solution lock-ins to software workloads in commercial networks (Open RAN).

Operator investment trends, which were already apparent before the pandemic, also intensified. 2020 represented a collision of two largely independent investment cycles in Europe: the moment where the start of the heavy **5G investment cycle,** with high and disparate spectrum costs throughout Europe, coincided with a high point in connectivity, and in particular **FTTP deployment.** Infrastructure

investors poured significant amounts of money into the sector, co-investment vehicles between operators and between operators and investors have proliferated, and a new class of increasingly independent telecoms infrastructure businesses has emerged.

Telecoms operators have been put in the spotlight, and, by and large, networks held up well under the pressure of supernormal levels of usage. Many, probably most, of the behavioural and societal changes spawned by the pandemic will be permanent. Operators have had to adapt their own businesses, and to mitigate the effects of the pandemic on their own houses. However, their focus is shifting to the longer view: adapting to, and helping to shape, a future that is happening sooner than anticipated.
This has to happen as part of co-ordinated thinking involving policymakers. Immediate **issues arising directly from the pandemic** include:

- **a need to take into account geopolitical tensions** and further develop the debate on strategic independence;
- **a need for increased commitment to inclusive access** to very high-capacity mobile and fixed broadband services in the form of improved investment incentives that accelerate roll-out;
- **a need to step up focus on demand-side targets** and address the patchy uptake of digital services across EU member states;
- **a need to urgently reflect on spectrum auctions** as a tool to accelerate roll-out through an approach that recognises the long-term value of network investment, rather than further weakening and fragmenting the European telecoms sector;
- a possible further reflection on network management and prioritisation of capacity in **emergency situations**;
- an urgent reflection on the important role of **competition policy and enforcement in telecoms** as a tool to meet the European Commission goal to achieve digital sovereignty and build the adequate scale for competing in global digital markets;
- a consideration of the trade-offs between rapid network upgrades and **vendor restrictions**;
- due attention to **synergies amongst players**, in the form of co-operation for network deployment, including network sharing and cooperation/alliances for any kind of investment;
- a commitment to **resilience in critical digital communications infrastructure** through network modernisation or vendor diversity.

The largest societal issue, though, is one where the immediate impacts of the pandemic meet the long-term objectives of greening society. Nobody could have failed to notice that a side-effect of people's behaviour during lockdowns was a sharp fall in greenhouse gas emissions. Digital communications providers have a pivotal role to play in helping implement long-term policies that harness these changes to create greener and more sustainable living, even when the impositions of a health crisis have been removed. The indirect green benefits of digitalisation outweigh many times the direct impact that the ICT/telecoms sector has on the environment. This calls for a comprehensive policy reflection on how to use demand-side stimulus to dramatically accelerate digitalisation across all sectors of the economy and of the society.

The importance of investing in the right way for the future has never been clearer.

High societal value, low market valuation

The pandemic has increased strains on the European telecoms sector, and has exacerbated the dichotomy between the high value and importance attributed to telecoms connectivity and the low valuations that markets attribute to telecoms operators. As the European Commission recognises, connectivity is the most fundamental building block of digital transformation in Europe. This extends beyond just economic growth: connectivity and digital services are also **enablers of green solutions** across sectors of the society as a whole.

On the other hand, market valuations of telecoms operators are about the lowest in relation to EBITDA of any vertical, reflecting in no small measure two decades of regulation that has focused on keeping prices down and on nurturing low-risk service-provider competition at the expense of infrastructure-based competition. Demand and usage can surge in a super-normal way, yet market structure is set up and regulated in a way that makes top-line growth – and therefore investment in this vital sector – extremely difficult to achieve.

This report has been commissioned by ETNO to provide market context and a qualitive assessment of digital communications providers within Europe[1] and beyond. The report investigates three key areas:

SECTION 1

looks at what digital communications providers are doing, directly and indirectly, to support European economies and citizens

SECTION 2

focuses on the demand side of the equation, from both consumer and business perspectives

SECTION 3

considers how digital communications and services are changing for the future

SECTION 4

looks at the key learning points from 2020, underlining that networks are vital

1 Throughout this report Europe is taken to mean the EU27 plus Albania, Andorra, Bosnia, Iceland, Kosovo, Liechtenstein, Monaco, Montenegro, North Macedonia, Norway, San Marino, Serbia, Switzerland and the UK.

SECTION 1

Supporting Europeans in accelerating a digital society

1. DIRECT IMPACT FOR EUROPEANS

The first mission of telecoms operators is to provide capacity and coverage for trusted and secure communications. This is the fundamental underpinning of the digital society. The pandemic has shown just how important that first function of telecoms, connectivity, actually is.

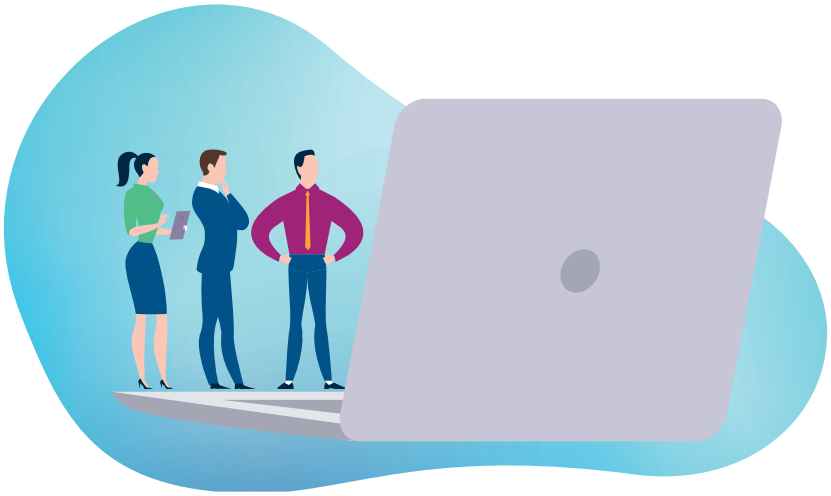
The European Commission has outlined two sets of ambitious targets aimed at ensuring that all European citizens, businesses, and institutions benefit:

FIG 1-1 : The two Commission targets

Target 2020	Target 2025
European Digital Agenda	Connectivity for a European Gigabit Society
Coverage of 30Mbit/s or more for every citizen	Access to 1Gbit/s for all schools, transport hubs and main providers of public services and digitally intensive enterprises
Usage of 100Mbit/s or more by 50% of households	Access to download speeds of at least 100Mbit/s to be upgraded to 1Gbit/s for all European households Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways

Source: Analysys Mason, 2021

In addition, the EC 5G Action Plan, published in September 2016, set as an objective the launch of at least one 5G network in every member state by the end of 2020.



1.1 Fixed and FTTP coverage

FIXED FIBRE-BASED BANDWIDTH IS VITAL FOR ECONOMIC DEVELOPMENT

- To overcome geographical limitations of other physical mediums and thereby to break down digital divides
- To supply the growing bandwidth needed to support new applications
- To support new architectures based on softwarisation and virtualisation, and to give access to affordable and secure cloud resources
- To supply low latency for new applications
- To contribute to greener networks

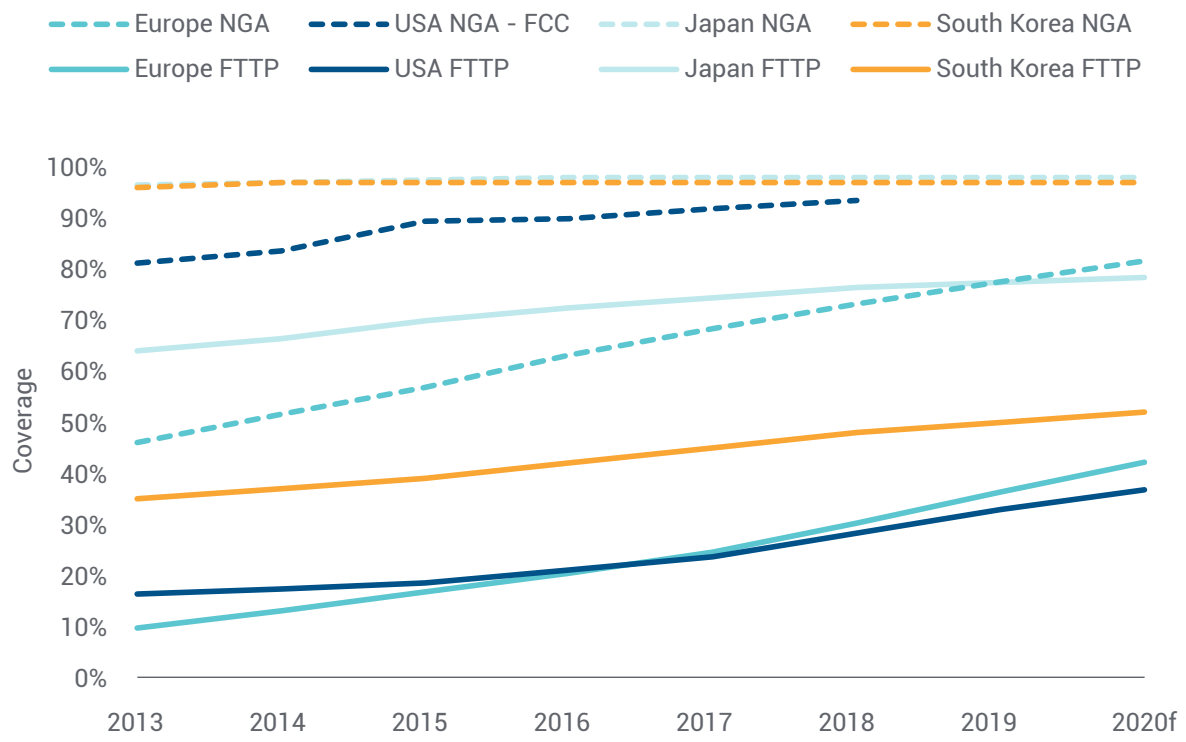
Fixed networks capable of delivering gigabit speeds are primarily FTTP (i.e. full fibre), fibre to the building with LAN cabling, or cable HFC with DOCSIS3.1. Some variants of 5G fixed-wireless access (FWA) can also do so, although the 5G FWA services that are currently available rarely offer this kind of downlink speed.

The global pandemic has demonstrated the importance of robust access at fixed locations. As well as providing faster speeds, FTTP networks are more predictable, more reliable and have lower operating costs and energy consumption than the other technologies. Passive optical networks (PONs), by far the most common form of FTTP, have no powered equipment in the field, require no cooling in the central office and their power consumption per line at the central office is about one tenth of that for copper networks technologies. Although the initial cost of build is high and rises rapidly in the 10%-20% of properties in the least dense areas, the expected asset life of the passive fibre networks is many decades.

In 2020 some FTTP roll-out was stalled by lockdowns, but the overall picture is of strong, and strengthening investment.

- There has been a growing consensus among existing operators that FTTP is amongst the right technology investment choices (driven in part by improving take-up rates), and hence there has been a significant pick-up in investment in large economies;
- A rapid rise in co-investment vehicles and carve-outs similar in certain respects to towercos. Investors now see FTTP as lower-risk than they did two years ago providing the catalyst for existing broadband players to accelerate roll-out over and above what cash-flows from business-as-usual will deliver.

FIG 1-2 : NGA and FTTP coverage, Europe, USA, Japan and South Korea, 2013 – 2020f



Source: Analysys Mason, FCC, 2021[2]

Full-fibre coverage increased by 6.6 percentage points, or 18 million premises passed, in 2019 and we expect it to rise by a further 6.4 percentage points, or about 17.4 million premises passed, by the end of 2020, despite constraints on some construction work during lockdowns. This means that about 43% of European premises will be passed by FTTP by year-end 2020[3]. That coverage figure is now higher than that in the USA, and should on current projections reach 50% by early 2022.

43%

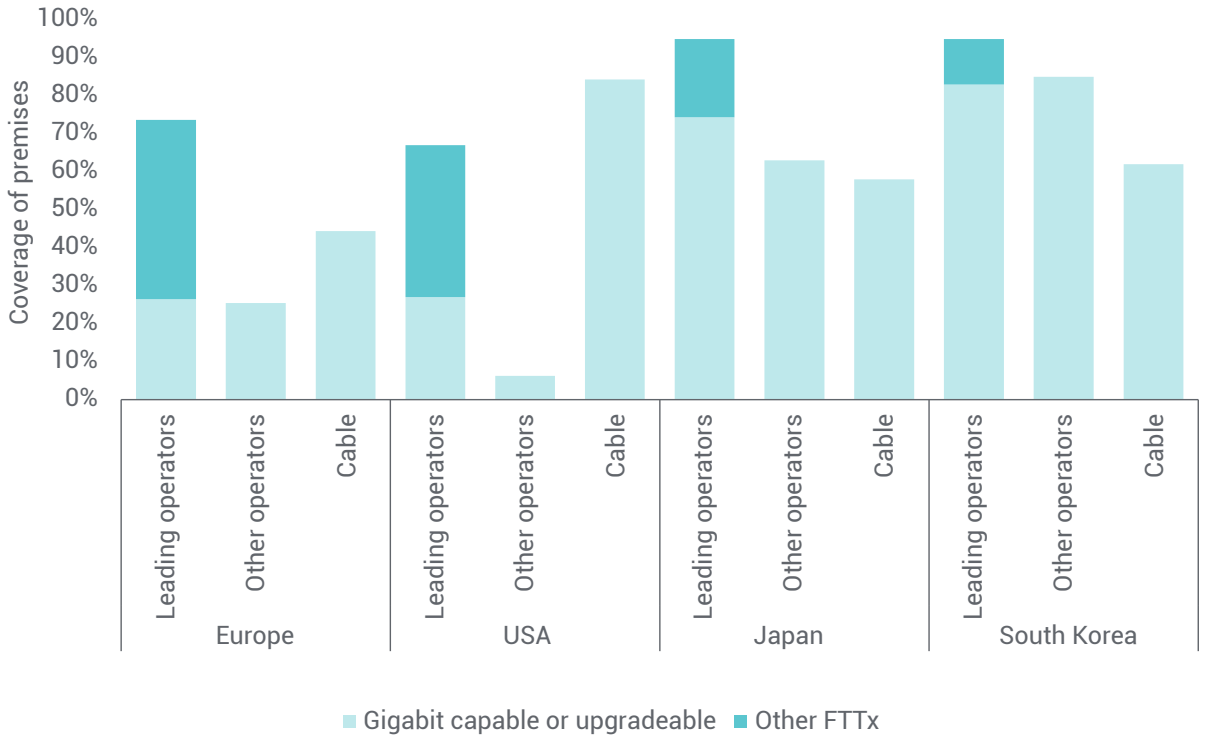
of European premises will be passed by FTTP by year-end **2020**.

50%

of European premises will be passed by FTTP by year-end **2022**.

2 The USA figures are based on FCC published calculations. The FCC's methodology is different and may overstate real availability. Analysys Mason estimates the real coverage number for NGA in Europe to be closer to 87% at year-end 2019.
3 See also EC Study on Broadband Coverage in Europe, 2019, which records 33.5% FTTP coverage at June 2019. https://ec.europa.eu/digital-single-market/en/broadband-connectivity

FIG 1-3 : Coverage of gigabit-capable or gigabit upgradeable networks, plus other FTTx, leading, alternative and cable operators, Europe, USA, Japan and South Korea, 2020f

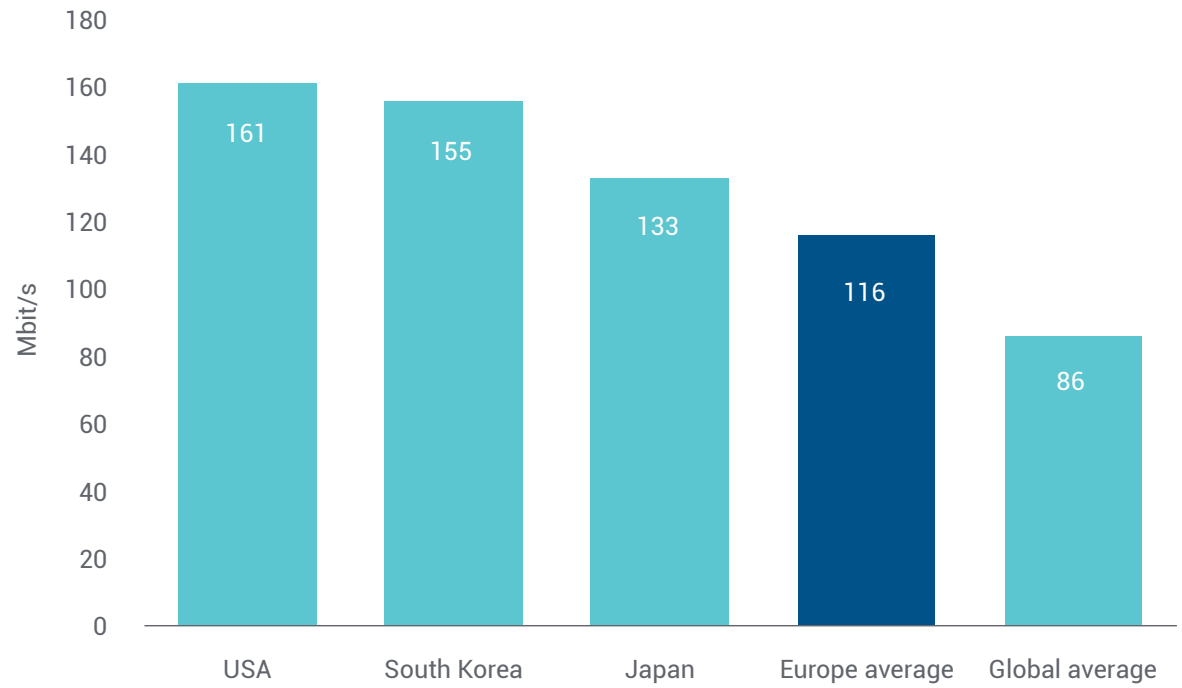


Source: Analysys Mason, 2021

Rural coverage still presents a challenge, and ultimately requires state aid. Some European governments have targets of 100% FTTP coverage, and some are already quite close to achieving full coverage also with the expected support from the National Recovery and Resilience Plans. Others have started work on ambitious plans to cover all of the most economically challenging areas with full fibre as well as other technologies, such as FWA.

As a consequence, average fixed access speeds continue to grow fast. Gigabit speeds are available across markets and they are empowered by a range of technologies. Affordable 1Gbit/s access is widely available in most markets, including via at least one FTTP and/or cable network. 10Gbit/s capable networks are now commercialised in several markets. In addition, for the first time, some 5G FWA services have in 2020 been made available in Europe marketed with a downlink speed of 1Gbit/s.

FIG 1-4 : Average fixed downlink speeds, Europe, USA, Japan and South Korea, September 2020



Source: Ookla, 2020

1.2 Mobile and 5G availability

Commercial 5G networks were, in November 2020, available in 18 countries in Europe. While in some member states auctions took place as early as 2018, in other countries there have been serious delays to 5G auctions, which will have had some knock-on effects on the timings of commercial launches, and which means that some European countries may not have achieved the basic objective of the 5G Action Plan. Many of the delays can be attributed to Covid-19. Some delays look set to be longer than one year. As a workaround, dynamic spectrum sharing means that 5G has been deployed in a few countries on existing bands used for 2G, 3G and 4G. Furthermore, temporary or provisional licences have also been awarded in a few.

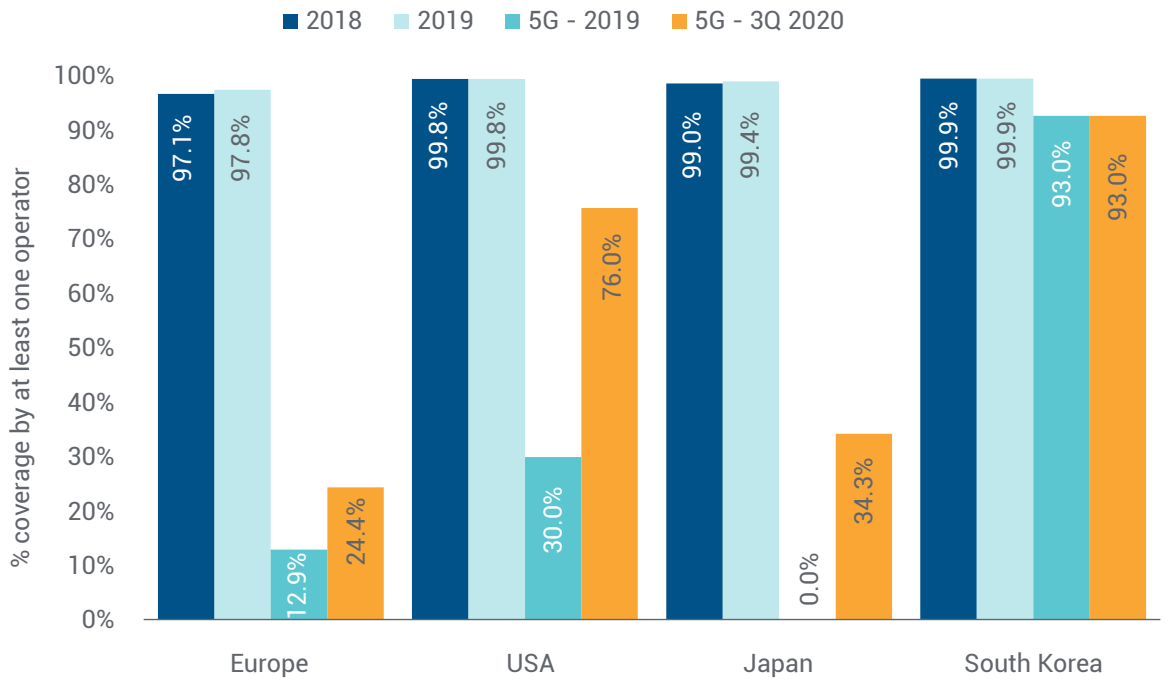
European telecom operators have expressed concern at practices that can have profound impacts on the investment case and speed of roll-out. These include reserving national spectrum for private networks or providing preferential treatment for new entrants in spectrum auctions. Operators were also alarmed by continued fragmentation in Europe of spectrum usage conditions, which negatively impacts investment conditions in 5G where established operators were discriminated against to promote new entrants. In some cases, operators witnessed access obligations, including national roaming.

Geopolitical and security considerations have meant that some European governments have reduced the number of competitors in the 5G equipment market and given that some operators have single RAN equipment in 4G ready for 5G, in extreme cases this might necessitate the

removal of existing equipment before 5G roll-out. This has again delayed some 5G roll-out (in some countries bans or limitations also apply to fixed network equipment). Over time, the ongoing Open RAN initiative can be of help in overcoming the abovementioned concerns and opening the vendor market to increased competition.

5G coverage, where it has been launched, is still quite localised in most of Europe, and stood at about 24% of the population at September 2020. **FIG 1-5** shows the population coverage based on the operators in individual countries with the highest self-reported coverage. On the whole – and there are exceptions – European operators have tended to focus on deploying using 3.5GHz spectrum largely on existing infrastructure grids in major urban areas. While 700MHz has been licensed in many markets, use of this band for 5G coverage has so far been limited to a handful of markets, although the low frequency means national coverage is relatively straightforward to attain. US coverage is higher because operators there have used sub-1GHz bands that do not deliver the same gains in capacity. 26GHz mmWave has been allocated in a handful of European countries, but deployment so far has been negligible compared to the USA, for example, where mmWave frequencies have been used more intensively because of a lack of mid-band spectrum. Population coverage for 3.5GHz and higher bands is a somewhat problematic metric insofar as propagation of the signal inside buildings in 'covered' areas will be limited: South Korean operators claimed 93% population coverage, but studies have shown that real-life availability is much lower.

FIG 1-5 : Percentage of the population covered by at least one LTE mobile operator, Europe, South Korea, Japan and the USA, 2018, 2019, plus at least one 5G operator, 3Q 2020

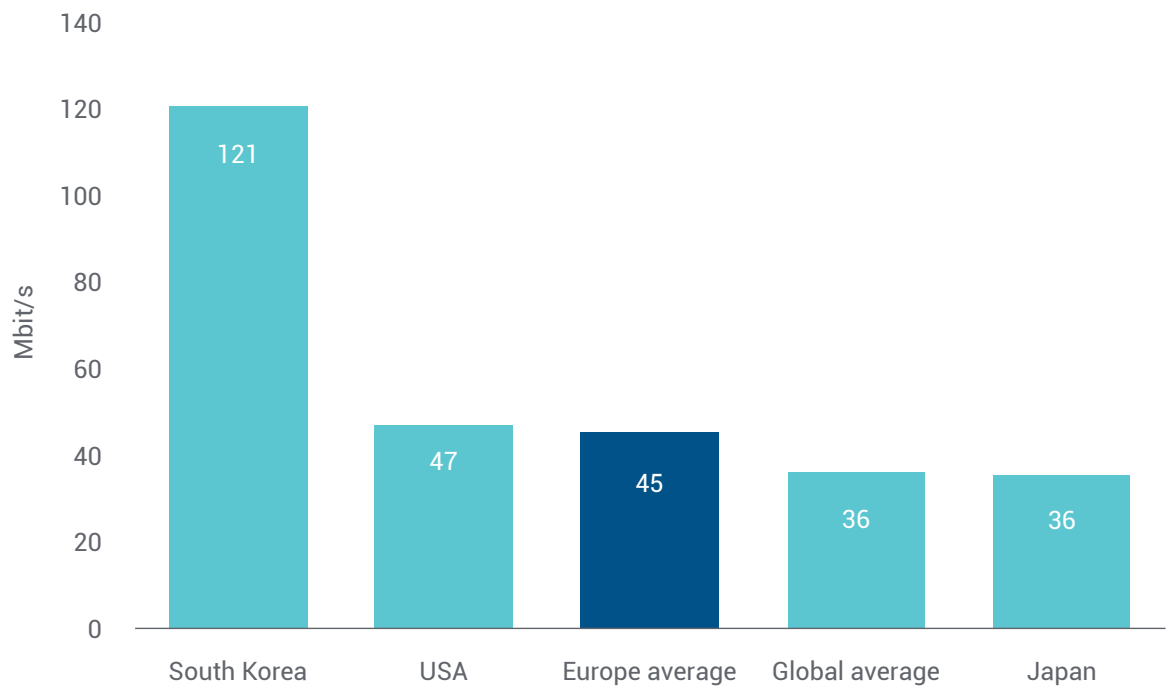


Sources: ITU, Analysys Mason, GSMA 2020[4]

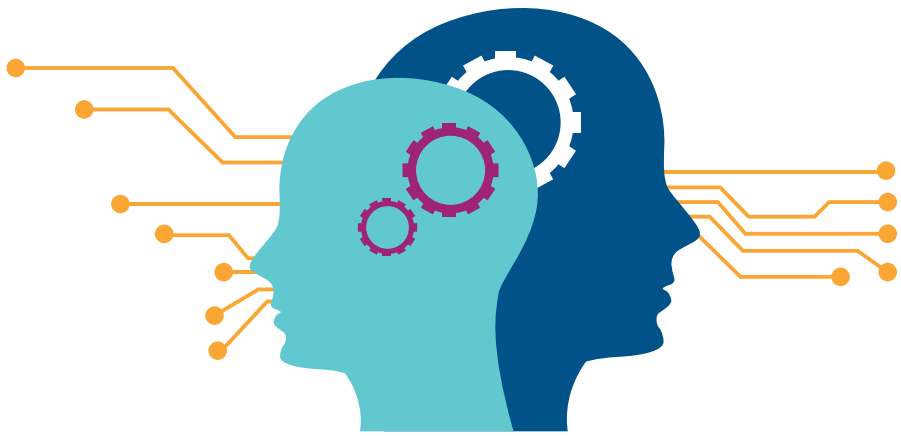
4 5G figures are for the maximum stated coverage by any individual operator as reported by the GSMA

Average mobile speeds continue to increase. Individual European nations have some of the highest figures here, largely depending on availability of 5G, and the blended average for Europe increased 15% in October 2019 compared to a year previously. Among the comparator countries, South Korea is unique in already having wide coverage on the main 5G spectrum bands. This gives it new, and still relatively empty, capacity, which explains its much higher average speed. This is noteworthy as in general the Covid-19 pandemic has intensified average usage per subscriber for many operators, something which in general reduces average speeds.

FIG 1-6 : Average mobile downlink speeds, Europe, USA, Japan and South Korea, September 2020



Source: Ookla, 2020

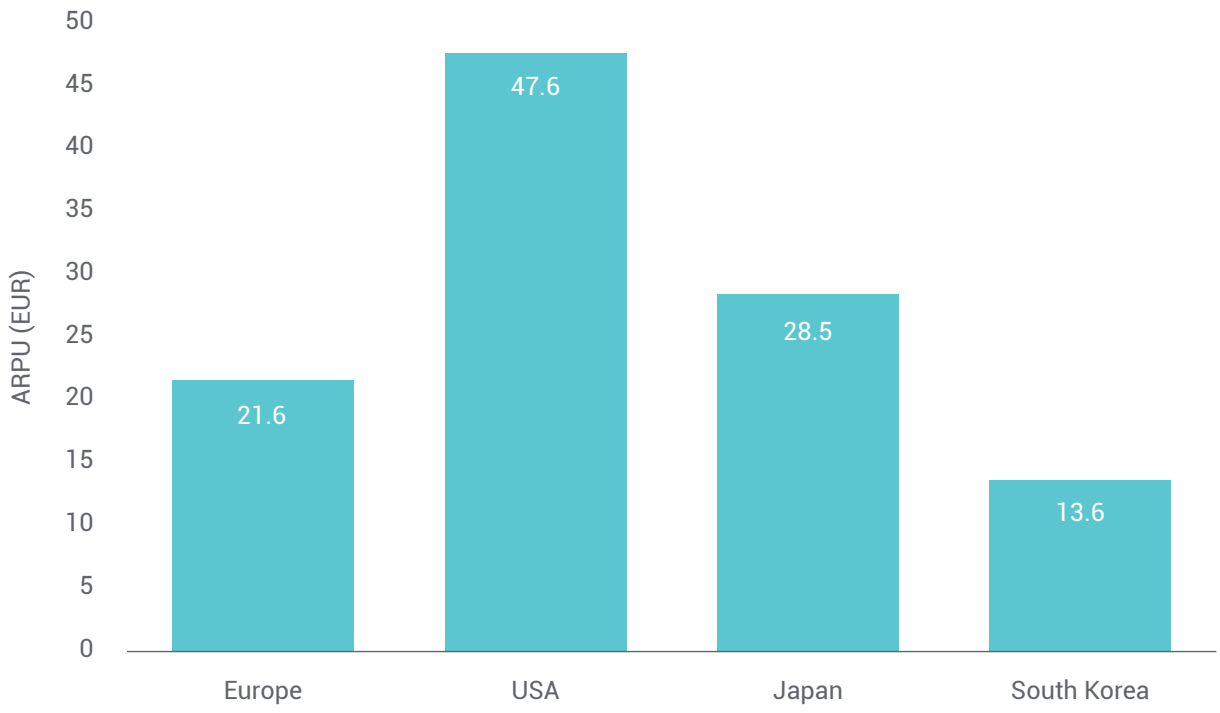


1.3 Prices remain very low by global standards

Prices and spend on digital communications services in Europe remain extremely low in comparison to other developed regions.

Despite the expanding choice of fixed broadband infrastructure, competition in retail broadband is still supplemented by regulation that creates retail opportunities for players who do not invest in their own infrastructure. The breadth of these opportunities is far greater than anywhere else in the world and markedly different from the USA. This results in Europeans paying low retail prices for broadband, reflected in low ARPU.[5]

FIG 1-7 : Fixed broadband ARPU, Europe, USA, Japan, South Korea, 2019



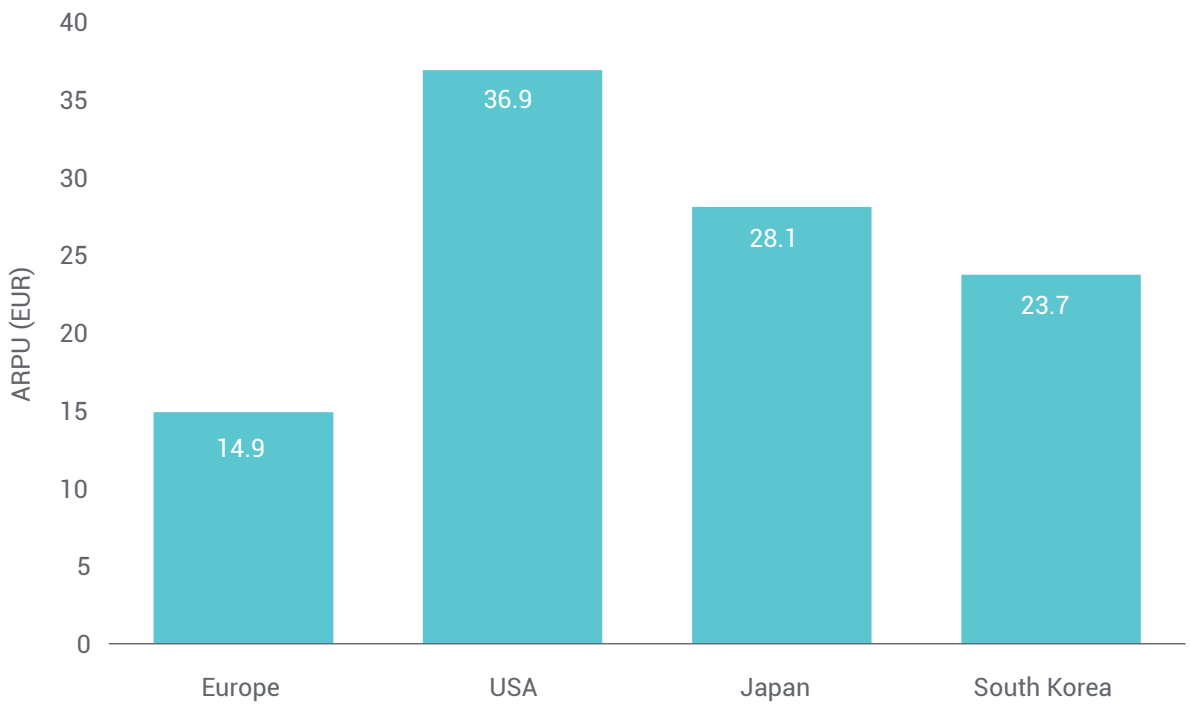
Source: Analysys Mason, 2021

5 Fixed broadband tends to be sold in bundles along with other services such as voice, mobile and TV. ARPU is total annual retail revenue - minus revenue attributed to voice-over-broadband and video - divided by average active broadband subscribers.

South Korea has even lower fixed broadband ARPU than Europe, in part because of a high level of infrastructure-led retail competition, and in part because, unlike in Europe, it is fixed broadband and not mobile that tends to get cross-subsidised in fixed-mobile convergence (FMC) retail bundles.

As in fixed broadband, a high level of competition in European mobile results in low prices and low ARPU.[6]

FIG 1-8 : Mobile ARPU (excluding IoT SIMs), Europe, USA, Japan, South Korea, 2019



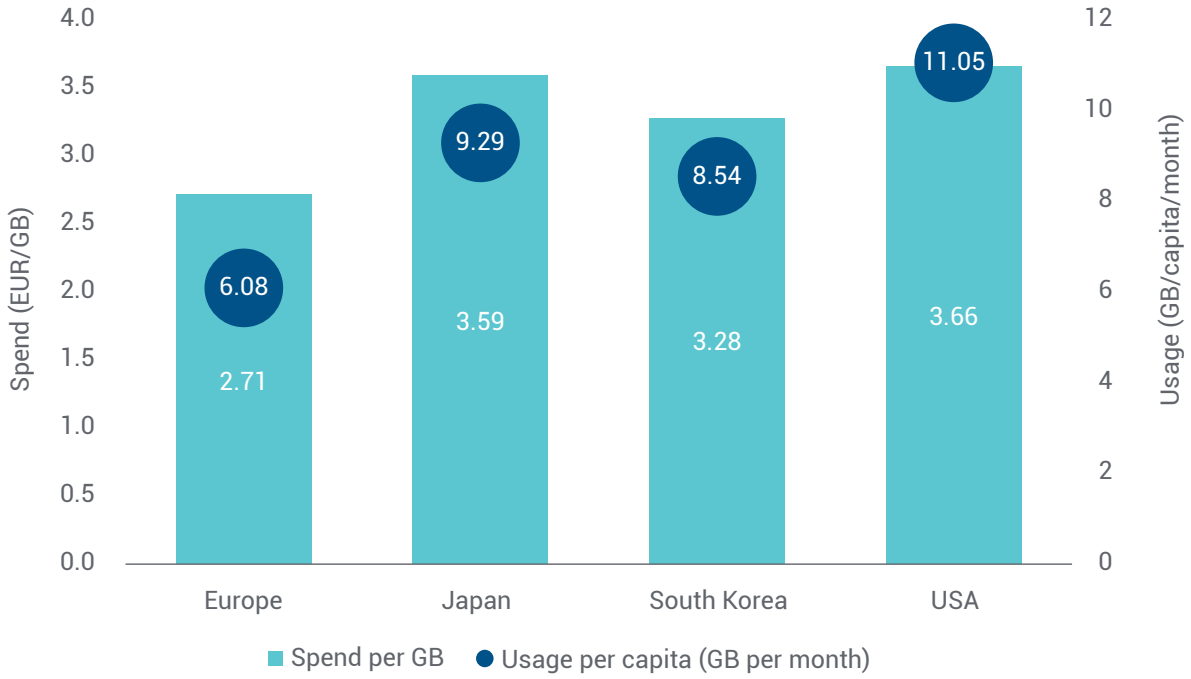
Source: Analysys Mason, 2020

The low ARPU means that spend per GB of data (yield) is markedly lower in Europe than in USA and Japan, even though usage on average is also lower. American, South Korean and Japanese consumers use more, and spend more on a per-unit basis on mobile data than European consumers.

> **“Europeans have more and more access to superfast internet, but use it less than global peers”**

6 Mobile ARPU is total service revenue (including revenue from call termination) divided by average active non-IoT subscribers. The European mobile ARPU figure is a weighted average across the whole of Europe (ETNO perimeter). The metric is not adjusted for purchasing power parity (PPP).

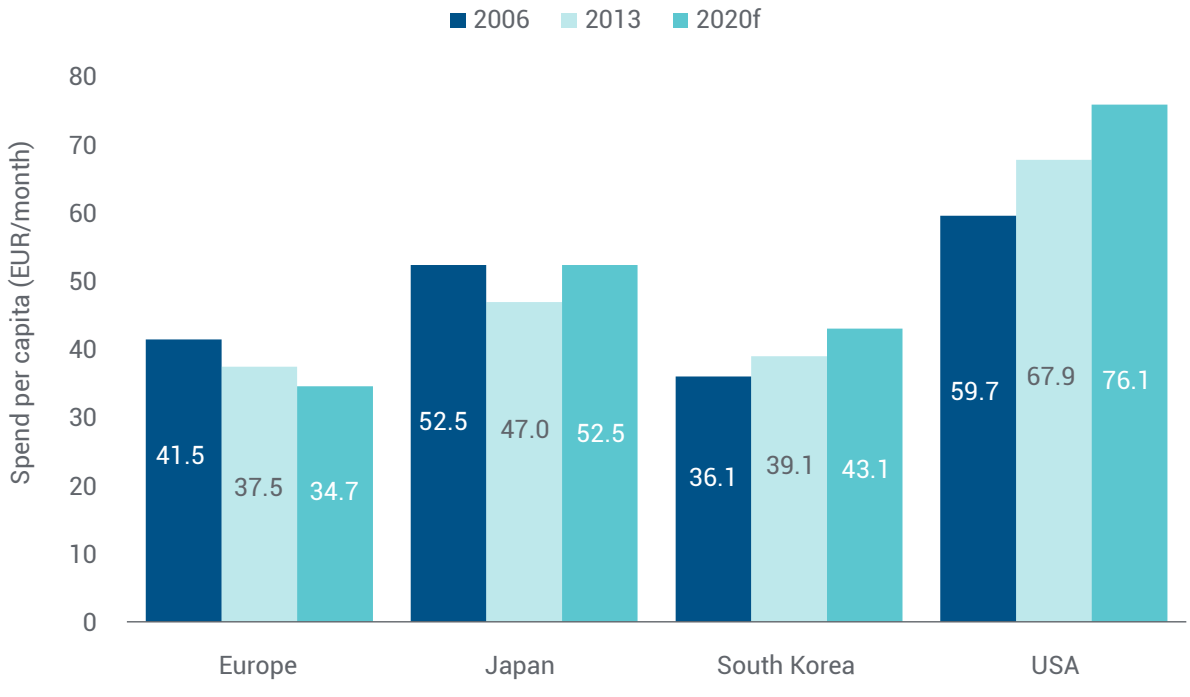
FIG 1-9 : Average spend per gigabyte of mobile data used and average mobile data usage per capita, Europe, South Korea, Japan and the USA, 2019



Source: Analysys Mason, 2021

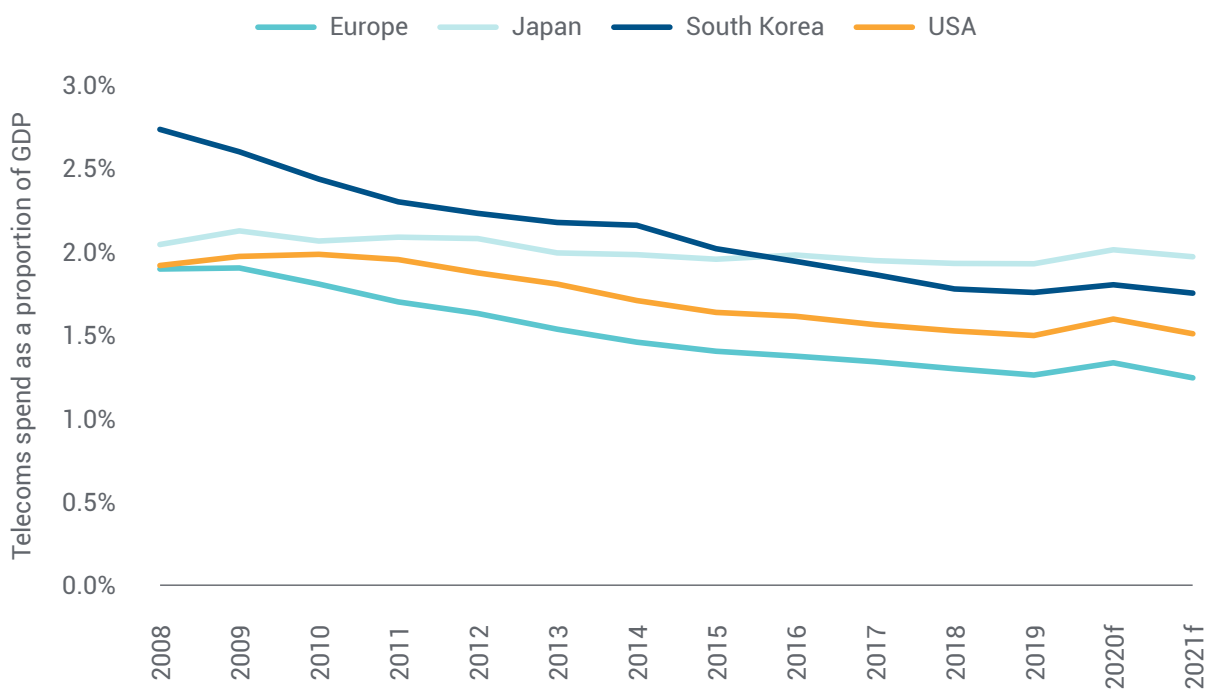
Overall spend on telecoms remains lower than comparator countries. Unlike for the comparator countries spend per capita is falling in absolute terms. The differences are stark, even when adjusted for GDP.

FIG 1-10 : Average mass-market telecoms spend per capita, Europe, USA, Japan and South Korea, 2006, 2013 and 2020f



Source: Analysys Mason, 2021

FIG 1-11 : Mass-market telecoms service spend as proportion of GDP, Europe, USA, Japan and South Korea, 2008-2021f

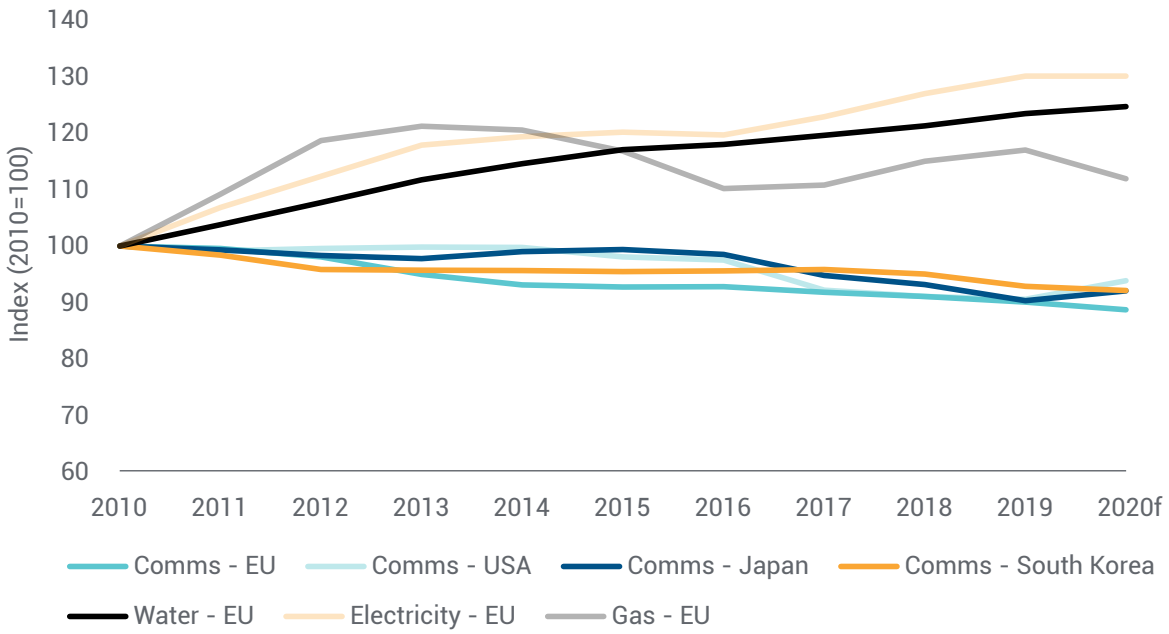


Source: Analysys Mason, 2021

FIG 1-11 shows that in 2008 Americans, Japanese and European consumers spent about the same proportion of GDP on telecoms as each other, but since that year the Europe figure has declined the most. This also reflects the traditional regulatory focus on prices at the European level, which in our opinion clearly reflects on both the overall performance of the sector and on its investment capacity. The forecasts for the full year 2020 are subject to a greater-than-normal degree of uncertainty because of the impact of second lockdowns. 2020 in any case will clearly be a year where the long-term trend will be temporarily reversed. Digital communication services are considered essential and largely non-discretionary and are therefore more resilient to GDP changes than most other segments of spend by consumers and businesses. In 2021 we would expect a reversion to the long-term trend, assuming some degree of return to normality. The indicators above are for service revenue only: the largest non-service source of operator revenue from consumers is for device sales; these have taken a large hit in 2020 because of economic uncertainty and closure of high-street stores.

A further way of looking at this is to index communications prices against other infrastructure-based service industries.

FIG 1-12 : Harmonised index of consumer prices (HICP) for infrastructure-based services, Europe, and harmonised index of consumer prices for communication services, Europe, Japan, South Korea and USA, 2010–2020f (mid-year values)



Source: OECD, Analysys Mason, 2020

Price erosion of basic communication services is a phenomenon that can be observed globally, and it stands in contrast to other infrastructure-heavy essential services. Rapidly rising demand in terms of traffic and expectations of service make the comparison between communications and other services difficult to assess. However, communication services in Europe have, compared on a like-for-like basis with communication services in other global regions, suffered earlier and deeper price erosion. Unlike in Japan and USA, there has been no rebound on this measure in 2020.

On the face of it, consumers and businesses benefit from falling prices for essential services. However, low consumer spend on telecoms in Europe is a structural phenomenon, borne of regulation. The short-term benefit to consumers has to be weighed against the ability of operators, faced with lower margins and an increased need to focus on cutting operating costs, to invest in a way that keeps European telecoms in terms of quality, performance and efficiency, on a par with telecoms networks worldwide. And it has to be weighed against the drag that lower investment has on broader digital development.

1.4 European operators have directly contributed to alleviating the effects of the pandemic

As businesses that supplied the basis for continuity to people's lives during lockdowns, ETNO members also contributed directly to mitigating the effects of the pandemic. **Telecoms networks have performed well;** they are dimensioned to cope with busy-hour loading, which is generally in the evening, so additional traffic in the daytime, when loading is usually lower, has not generally created capacity problems, although there was a recommendation made by some operators to consumers to offload mobile data to Wi-Fi as much as possible. **Operators have directly helped hospitals and emergency services,** local communities, customers, public administration, schools/universities etc. In Italy, TIM extended the coverage of its fixed UBB network reaching 3 million new households and companies in 3 000 municipalities in the white areas. Some of these initiatives represent a direct cost, some risk price erosion, and others rely on the unique position and insights that mobile operators have about mass locational behaviour.

Consumer demand for Internet connectivity grew very fast and operators offered discounts. Several ETNO members provided enlarged mobile data plans for the same monthly fee in order to accommodate actual or anticipated demand during lockdowns. One ETNO member, Síminn, simply removed all data-caps from mobile subscriptions. Slovak Telekom offered free speed upgrades on all fixed broadband. Consumer demand for content also grew fast as people were having to spend all leisure time at home. Members such as DT, Orange and Telefónica offered temporary free access to paid-for entertainment content.

Operators provided targeted additional support for vulnerable groups. Elderly people are more likely to have no form of Internet access. Vivacom provided free fixed voice calling for the vulnerable low-income groups, in particular the elderly, and BT placed a bill cap on fixed voice calling. In some countries many households rely entirely on mobiles for Internet access. For children doing schoolwork from home, this proved less than ideal. Vivacom donated equipment such as laptops or tablets for home schooling and provided free mobile data. TIM and Telekom Romania provided free mobile data for use on distance learning platforms. Altice Portugal joined the #EuAjudoQuemAjuda ("I help those who help") movement promoted by the Portuguese

Red Cross; through mobile devices (tablets) and unlimited 4G data plans, the company provided technological support for those that might have been infected by Covid-19.

Businesses faced two kind of crisis. First, they needed urgently to find some form of continuity in the face of lockdowns. **Operators provided support for businesses** with dedicated services such as cloud and conferencing, often in the form of free trials. Second, many types of businesses faced an existential crisis because they were simply unable to trade. In this respect, many operators have allowed – albeit often at regulators' behest – greater leeway for late payment of bills.

Several operators provided direct support for healthcare initiatives. Deutsche Telekom and SAP developed the German Corona-Warn-App and had a crucial role in setting up the European gateway service that makes the corona tracing apps from several EU countries work together hand-in-hand. At the request of the European Commission several operators provided mass anonymised data from their mobile network to analyse movement streams and likely spread of the illness. Several European operators also provided concrete help for SMEs which were struggling to quickly shift to remote work. Deutsche Telekom and T-Systems offered customers free webconferencing and office solutions for 3 months to help companies transition to remote working. Telefónica, Cosmote, and United Group/Vivacom among others, made large direct donations for purchase of medical equipment in Spain, Bulgaria, Croatia, Slovenia, Serbia and Montenegro. Orange donated directly to health services and NGOs in the African markets in which it has a presence. Altice Portugal and Huawei made communications equipment available to the Ministry of Health allowing thousands of Portuguese people to stay connected, giving hundreds of tablets with 4G mobile data connection and Wi-Fi infrastructure.

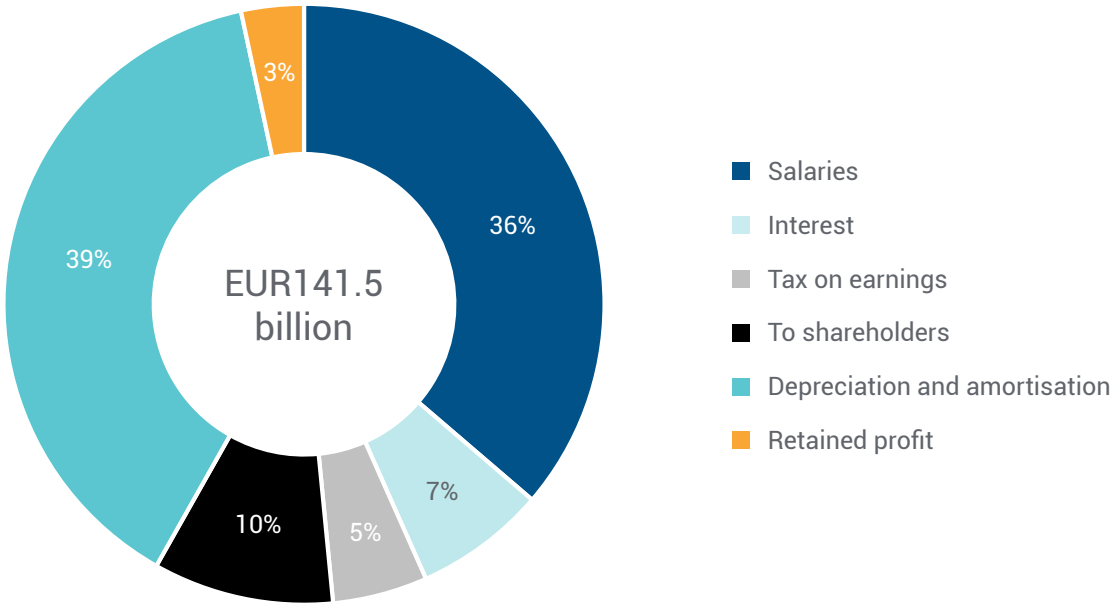
> **“During lockdowns, networks performed well and telcos provided immediate customer support”**

2. INDIRECT IMPACT FOR EUROPEANS

ETNO members contribute indirectly to European well-being in several ways: through taxation, through investment in skills and rewarding employment, and through sustained capital investment.

At a group level, ETNO members (including non-European subsidiaries) created EUR141.5 billion of value-added (revenue minus the cost of goods and services) in 2019, compared to EUR136.9 billion of value-added created in 2018.

FIG 1-13 : Breakdown of value added from ETNO members (group level), 2019

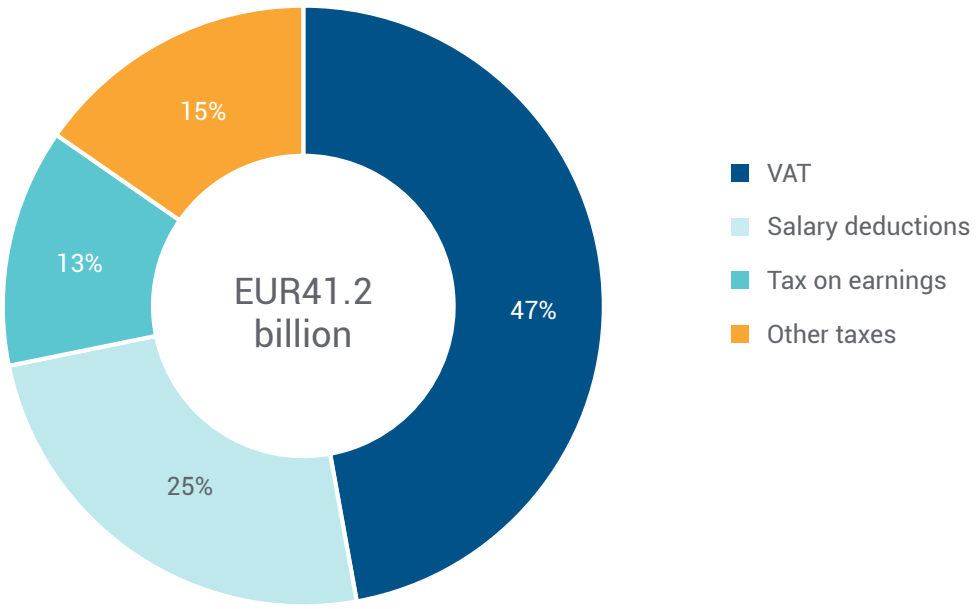


Source: Analysys Mason, 2021

2.1 Contributing via taxation

For their European operations only, ETNO members paid in 2019 around EUR41 billion in direct taxes (tax on earnings and other direct taxes) and indirect taxes (VAT and salary deductions), in total about 21% of their revenue base. Other direct taxes include property taxes, plus telecoms specific charges such as annual licence fees, universal service costs and the cost of financing national regulatory authorities.

FIG 1-14 : Total direct and indirect tax, ETNO members (Europe only), 2019



Source: Analysys Mason, 2021

Current tax rules are largely based on physical presence and were not designed to cope with business models driven primarily by intangible assets, data and knowledge, and which have fewer constraints on where they establish physical presence. As a result, companies with purely digital business models and small physical presence (such as global digital service providers) typically pay less than half the tax rate of businesses with traditional business models, many taking profit on European business in either European countries with favourable taxation or outside Europe altogether. Attempts to create an EU-wide common digital tax have not succeeded, but Austria, the Czech Republic, Italy and Spain have introduced digital taxes on sales by big tech companies. France is set to implement such a digital tax. Additionally, the European Commission committed to table a draft proposal in case the OECD is unable to deliver on this matter. The UK has proposed, but has so far held off from, implementing a similar tax.

2.2 Quality employment

ETNO members employ about 630 000 staff in Europe, about three quarters of the total employed by operators. These are quality jobs, and average remuneration is approximately 40% above average full-time salaries in each market. Although some of the modernisation projects within the telecommunications industry have required additional field technicians in the roll-out phase, the future lifeblood of digital communications businesses will depend more heavily on ICT skills, especially relating to cybersecurity, AI or software-based services. In business-facing roles this has never been clearer than during the pandemic, where digital interaction has been paramount. As the intelligence of networks moves away from dedicated hardware and towards the datacentre and the cloud, a new breed of engineers is required to carry operator businesses forward and to compete against service providers that are cloud-native.

These kinds of skills remain in short supply in Europe. A report commissioned by the European Commission reported that of those enterprises that tried to recruit ICT specialists, 58% had problems filling vacancies.[7] The Covid-19 pandemic is likely to shake up the labour market, but it is unlikely that the ICT labour market will have been badly affected. Moreover, employment in ICT remains extremely biased towards men: women account for only about one in six jobs in ICT in Europe.

Hence for operators, upskilling of the existing workforce and creating a balanced and diverse workforce, are vital. ETNO members all have upskilling projects that amount on average to about 33 hours per employee per year, and the proportion of women among the workforce is rising, although it is still only about one third and biased towards less senior roles. ETNO members, together with UNI Europa ICTs, the European federation of service worker trade-unions, initiated in 2020 the DUFA! (Digital Upskilling For All!) project aimed at developing best practices related to upskilling plus inclusion and diversity in the telecommunications sector.

2.3 Shareholder return

Like their counterparts worldwide, ETNO members regularly disperse a high share of net profit to shareholders. Dividend payments in 2019 were about 78% of 2019 net profits. Since the shareholders are often institutional investors such as pension funds, the steady profitability of major European telecoms operators is important. In 2020 the steady flow of dividends will be interrupted, and several major European telcos have indicated that dividend payments will be lower or suspended. Investment required mostly for infrastructure upgrades often cannot be funded from regular cashflow, and the Covid-19 pandemic adds to pressure (or perhaps provides an understandable reason to pause).

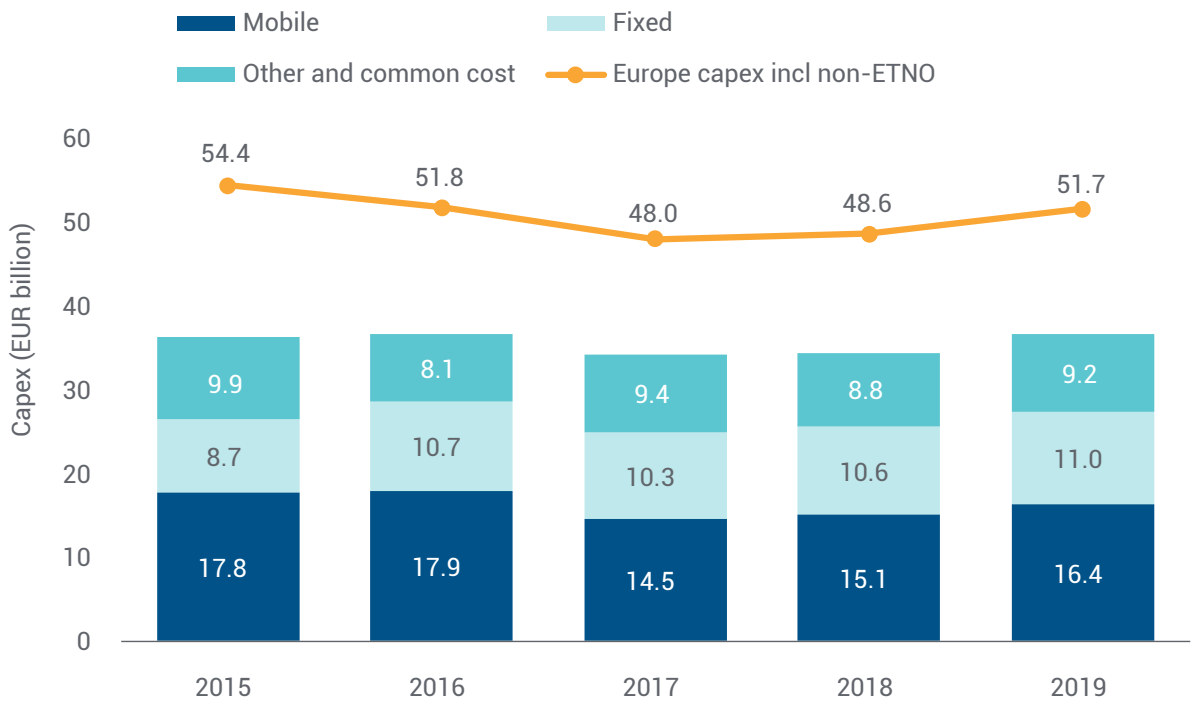
7 https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200221-1

2.4 Capital investment

European operators are heavy investors in relation to their revenue base, but intense price competition means that investment per capita, even allowing for GDP differences, is low compared to other advanced economies.

Prior to the pandemic, investment in European telecoms was already strengthening. In 2019, investment by ETNO members was EUR36.6 billion: this represents 6.3% growth over 2018. Capex on both mobile and fixed networks grew in absolute terms, and it grew in relation to revenue.

FIG 1-15 : Split of Europe capex into fixed and mobile for ETNO members, plus total Europe capex, 2015 - 2019 (capex excludes spectrum)

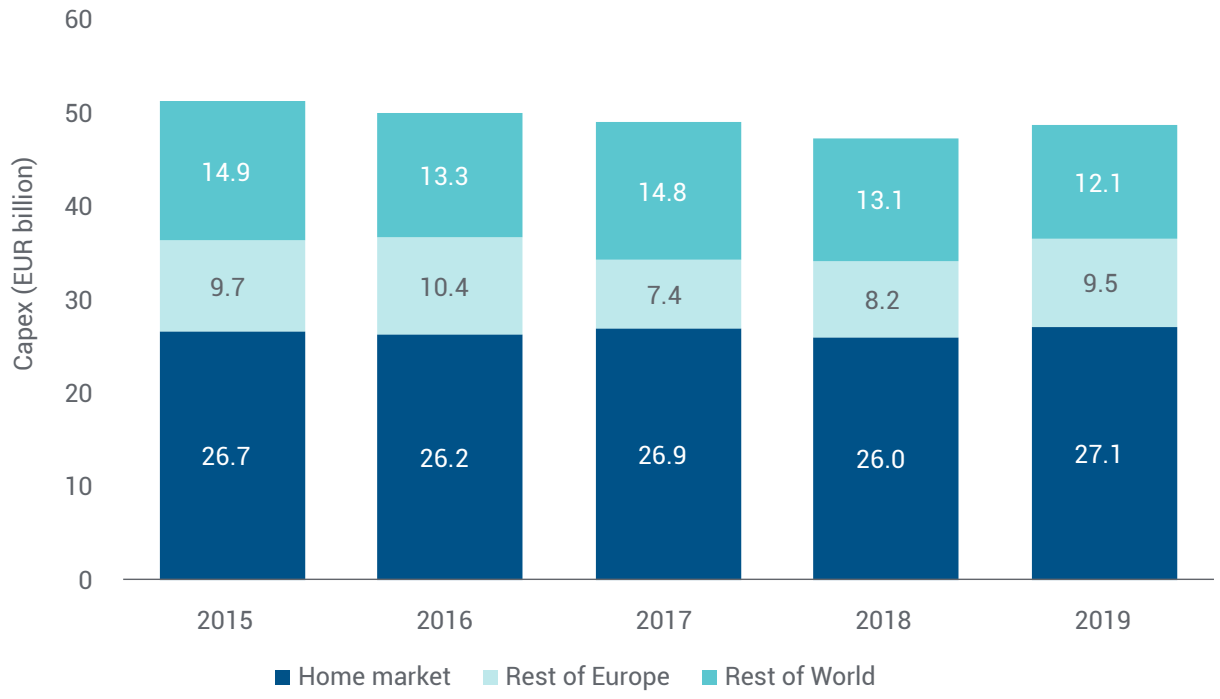


Source: Analysys Mason, 2021

In 2019, ETNO members spent EUR48.7 billion excluding spectrum but including capex in markets outside Europe.

> **"ETNO members remain Europe's investment leaders"**

FIG 1-16 : ETNO member capex, home markets, Rest of Europe and Rest of World, 2015 - 2019, excluding spectrum

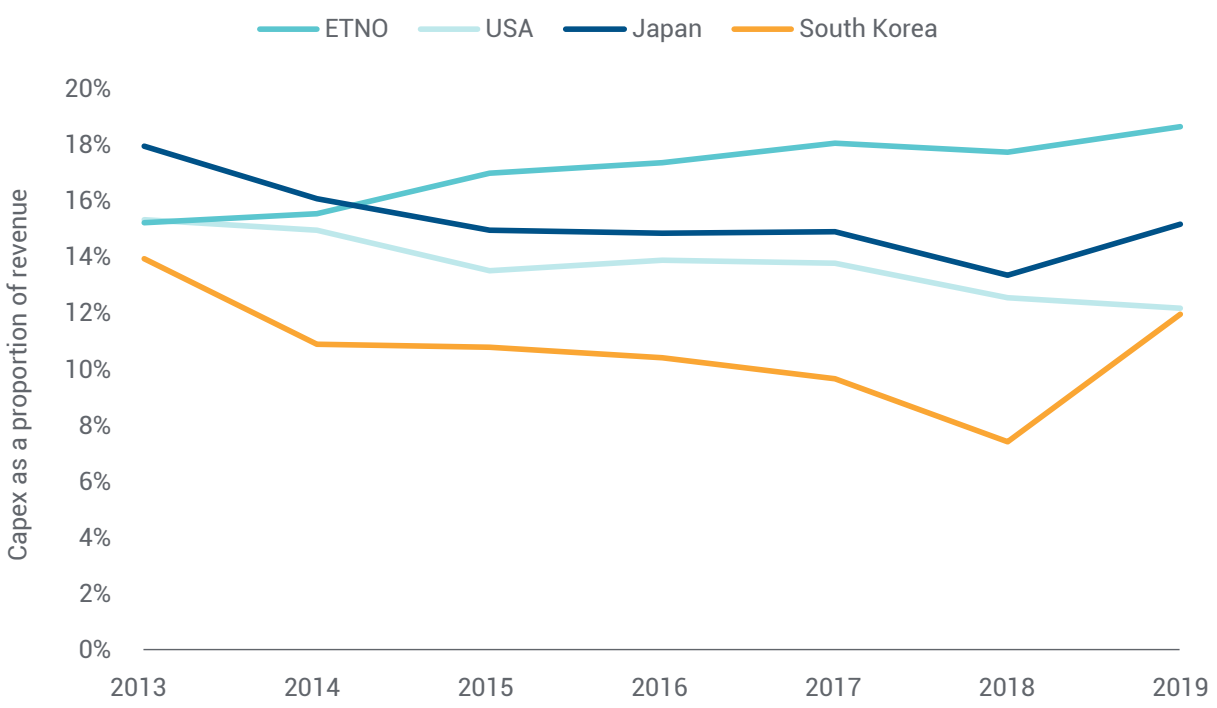


Source: Analysys Mason, 2020

ETNO members' capital intensity, at 18.7% in their home markets, remains significantly higher than that of equivalent operators in comparable regions such as the US, Japan or South Korea. This high intensity is in part attributable to diseconomies of scale for smaller members. However, over the past five years the principal reason has been the phasing of investment in upgrading fixed networks. In 2019 work on upgrading mobile to 5G started in several European markets adding to capital intensity. For 2020, we anticipate a sharp uptick in this metric in Europe, for all of the above reasons, plus an anticipated decline in revenue brought about by the Covid-19 pandemic.

“European investment is sizeable, but we trail global peers”

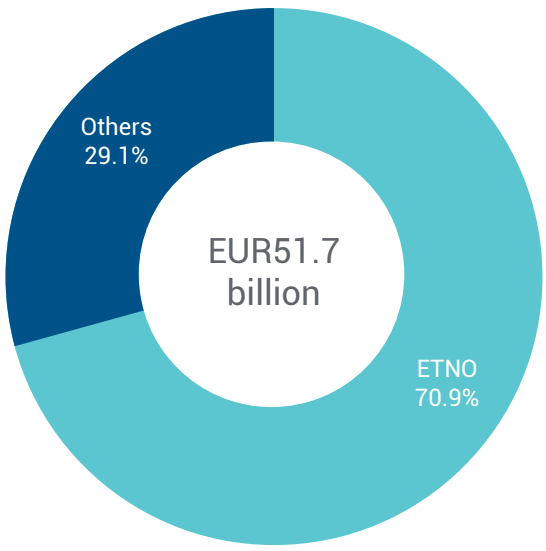
FIG 1-17 : Capital intensity in home markets, ETNO members and comparable leading operators USA, Japan and South Korea, 2013-2019



Source: Analysys Mason, 2020

ETNO members accounted for 70.9% of European telecoms capex in 2019, up fractionally over 2018 (this ratio includes capex by joint ventures where control remains with the operator). In real terms this is an increase in capex of EUR2.4 billion or 7% over 2018.

FIG 1-18 : Split of capex between ETNO and other operators

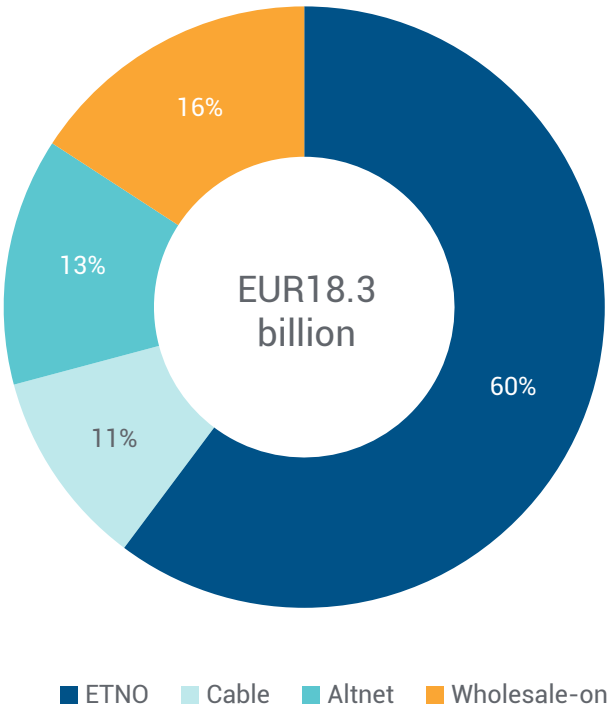


Source: Analysys Mason, 2020

Mobile capex by ETNO members rose by 9% in 2019, as 5G started to kick in. Mobile capex tends to be concentrated in the hands of the operators themselves: even when tower companies have been created, these tend to have small capex bills. There has been a continued trend in Europe towards more active network sharing that looks set to be confirmed in the years to come for 5G roll out.

Fixed network capex, however, is distributed among a greater diversity of players, some of which are new and some of which are somewhat outside of the orbit of established telecoms players. As migration from copper to fibre occurs, fixed access is becoming more fragmented, in a few cases less vertically integrated, and more competitive. ETNO members accounted for 60% of fixed capex in 2019, roughly the same as in 2018. While at EU level there is only one alternative wholesale-only play with a truly national ambition, there are several growing wholesale-only players that are active at regional/local level (including broadband intervention schemes), all with coverage figures that are still limited. In addition, there is a growing number of new, mostly regional, altnets.

FIG 1-19 : Split of capex between ETNO and other operator types, fixed only

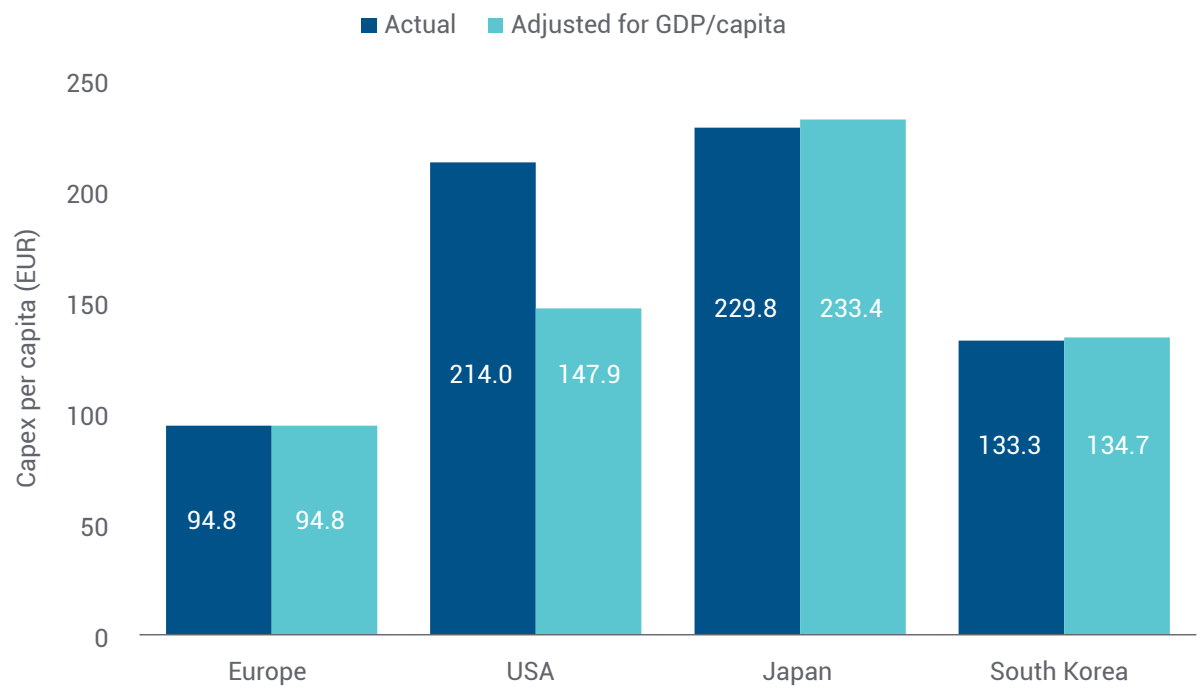


Source: Analysys Mason, 2020

This level of capital intensity among ETNO members brings both direct and indirect benefits to Europeans, but it disguises the profound problem at the heart of the European telecoms sector.

While capex as a proportion of revenue is high, revenue per capita is so low that investment per capita is also low. The European telecoms sector, taken as a whole, invested EUR95 per capita in 2019, which is significantly lower than the amounts invested by operators in the USA, Japan and South Korea, even after allowing for differences in GDP. Japan's investment per capita is about two and a half times higher than in Europe.

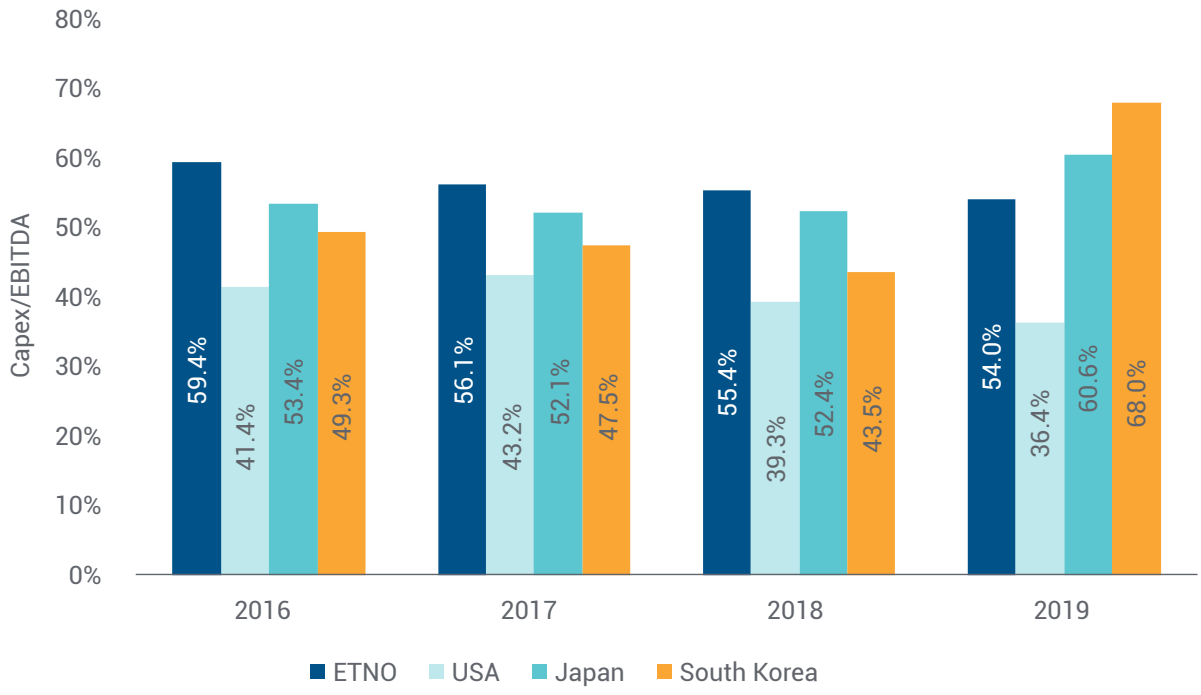
FIG 1-20 : Capex per capita, Europe, USA, Japan and South Korea, 2019



Source: Analysys Mason, 2020

A further way to look at this is the ratio of capex to EBITDA. At a group level, this has, in recent years, been higher among ETNO members than among peers elsewhere in the world because of the phasing of fixed network modernisation. The ratio changed rapidly among the comparator operators in Japan and South Korea, which have historically low EBITDA margins, and which are ramping up investment in 5G, but it did not among those in the USA, where 5G investment has been less intense and which, because of their more limited fixed-line footprints, place less emphasis on fibre connectivity.

FIG 1-21 : Capex/EBITDA, ETNO members and peers in USA, Japan and South Korea, 2016–2019



Source: Analysys Mason, 2020

For the European digital sector to flourish and for Europeans to derive maximum benefits, whereby operators spend a lot in relation to their means, but little in relation to their end-users, this fundamental imbalance has to change.

INVESTMENT DURING 2020

The Covid-19 pandemic has brought about some slow-down to investment during lockdown months. To a certain extent, operators have been able to mitigate this by juggling workloads: for example, the reallocation of customer connection capex for FTTP build to the 'homes-passed' network.

The Covid-19 pandemic has not been the sole factor in creating short-term delays in investment in new networks. Geo-political factors and increased attention on security and "strategic independence" drove several governments to restrict choice in the vendor market, which affected equipment in critical parts of 5G and even some fixed networks. This has meant in some cases the adoption of lengthy verification procedures, the replacement of 4G network elements as well as finding a new supplier for 5G. In many cases it will not so much delay 5G – operators can and do still launch non-standalone 5G very soon after auctions have concluded – as add complexity to the roll-out of 5G cores, which would in any case be at least three years off. Postponements to 5G spectrum auctions have created further short-term delays, generally of up to a year. Some of these delays can be attributed to Covid-19, but by no means all.

However, longer term investment plans have not in general been watered down, despite some negative impact on cash-flows. In fact, spending is likely to rise. A downturn turns out to be a good time to invest, especially in strategic infrastructure:

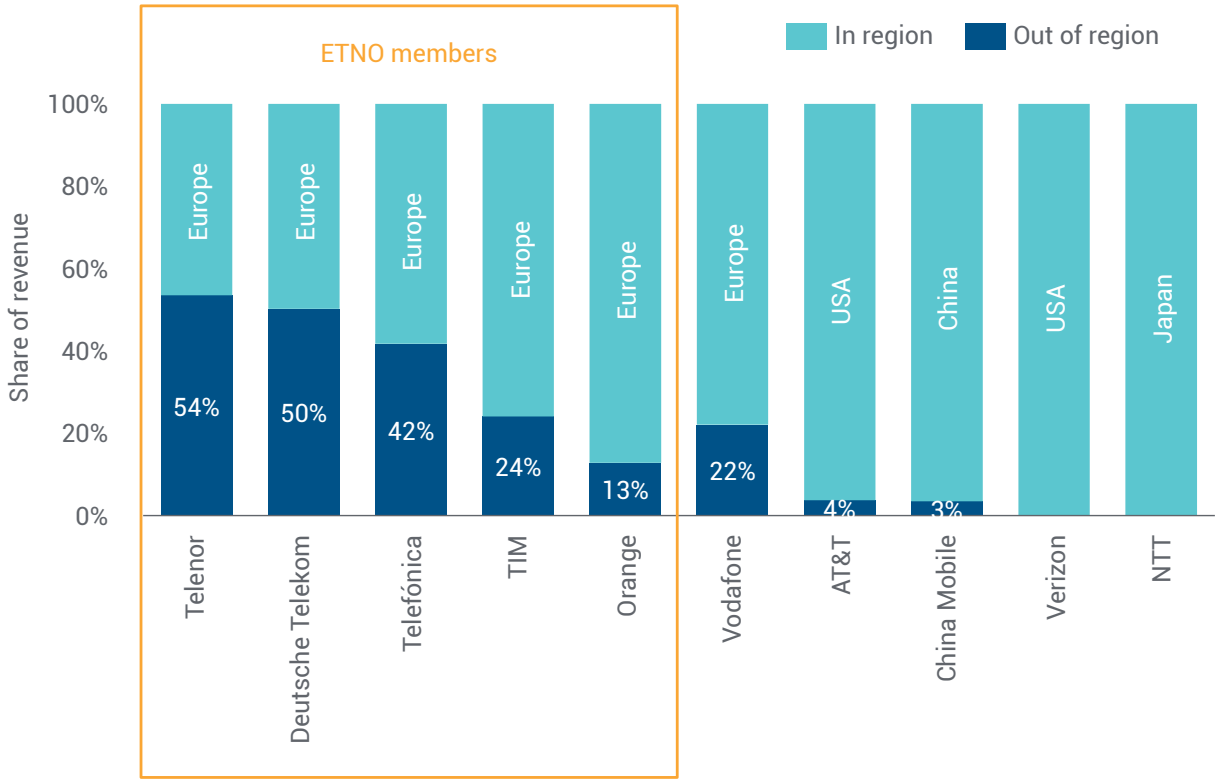
- the cost of debt is low (as it has been for some time), but so too are contractor costs;
- infrastructure investors are enthusiastic about co-investing in digital infrastructure, especially in FTTP and datacentres. The dampening effect of the pandemic on other classes of infrastructure (e.g. airports or retail space) accentuates this enthusiasm for the digital.

Operators, not just in Europe, have in the last two years been noticeably keener on optimising their asset portfolios, mainly but not exclusively, in the form of enhanced network sharing agreements, or the sale of towers, unlit fibre and other physical infrastructure. This has facilitated greater capital investment in modern networks. Asset optimisation tends to veer in economically uncertain times towards defensibility rather than higher risk and higher growth assets. For operators, this works both ways; the larger European operators (ETNO members) have over the last year become markedly less averse to utilising third-party infrastructure in those cases where owner-economics would be less defensible (for example in the case of FTTP overbuild).

2.5 Creating global influence for Europe

A softer kind of indirect benefit for Europe is the enduring global influence of European telecoms operators. Despite a general trend towards retrenchment to core markets, several of the larger European operators still maintain global presence as mass-market operators in non-European markets. Few of the larger operators in other global regions have this level of influence. Three ETNO members derive around half of their annual revenue outside Europe.

FIG 1-22 : Proportion of revenue from in-region and out-of-region operating businesses, last full financial year



Source: Analysys Mason, 2020

European telecoms operators remain a strong presence the top list of global players, with operations and investments beyond Europe. However, in the past 10 years, the number of European operators in the list of the top 15 world operating groups by revenue has decreased from 6 to 4. Of the top 15 in 2020, all except three operators, all European, had grown their revenue base over 10 years, and the sole European operator to have grown (Deutsche Telekom) did so on the basis of non-European operations. This echoes the calls to strengthen the sector as a means to pursue European leadership in global digital markets.

FIG 1-23 : Top 15 operating groups in the world by revenue, 2010 and 2020

	Last financial year at Mar 2010		Last financial year at Mar 2020	
Rank	Operating group	EUR billion	Operating group	EUR billion
1	AT&T (USA)	88.5	AT&T (USA)	161.5
2	NTT (Japan)	78.3	Verizon (USA)	117.5
3	Verizon (USA)	77.6	China Mobile (China)	98.4
4	Deutsche Telekom (Europe)	64.6	Comcast (USA)	97.1
5	Telefónica (Europe)	56.7	NTT (Japan)	94.2
6	Vodafone (Europe)	50.1	Deutsche Telekom (Europe)	80.5
7	China Mobile (China)	47.6	Softbank (Japan)	52.4
8	Orange (Europe)	45.9	China Telecom (China)	49.6
9	Telecom Italia (Europe)	27.2	Telefónica (Europe)	48.4
10	KDDI (Japan)	26.5	América Móvil (Mexico)	47.6
11	BT (Europe)	23.5	KDDI (Japan)	44.3
12	Sprint Nextel (USA)	23.1	Vodafone (Europe)	43.7
13	China Telecom (China)	21.9	Orange (Europe)	42.2
14	Softbank (Japan)	21.3	Charter (USA)	38.9
15	América Movil (Mexico)	21.0	China Unicom (China)	38.4

Source: Analysys Mason, 2020

Being a 'traditional' licensed operator and selling to the mass-market is far from the only way in which global presence can be established. Activities of ETNO Members include for example bringing critical backbone infrastructure to one of the world's least-well served regions, inland West Africa, exporting digital products and services developed in Europe and financing start-ups with seed funding in emerging markets. ETNO members' business lines are continually evolving to changes in technology paradigms. 5G and virtualisation introduce new ways to expand geographical presence without physical network infrastructure, and private network models allow operators to act as experience network builders and integrators without being traditional licensed operators.

SECTION 2

Demand-side digital services acceleration that operators are supporting

1. TELECOMS DEMAND METRICS

The patterns of demand for telecoms services changed dramatically in 2020 as a result of the pandemic, and the restrictions on travel and office-based working in most European countries. The shift to stationary, home-based work and leisure during the lockdown periods reversed the trend for traffic on mobile networks to grow more quickly than on fixed networks. Mobile traffic shifted location, with rises in commuter towns and suburbs and sharp falls in the previously busiest areas. The long-term trend of usage switching from Web to mobile apps was reversed as people spent a higher proportion of time on large screens than on mobile devices.

There has been an increase in voice calls as a result of limitations on physical meetings, and traffic patterns have been less bursty at different times of day, as a result of more flexible working patterns that are less tied to workplace hours and routines. Videocalling, hitherto a rather unloved application in Europe, suddenly became popular and even a lifeline. Video content, whether on-demand or linear, and online gaming saw large increases in usage.

Anecdotal evidence of changes in demand from the first weeks of the lockdowns starting in March 2020 can be truly astonishing:

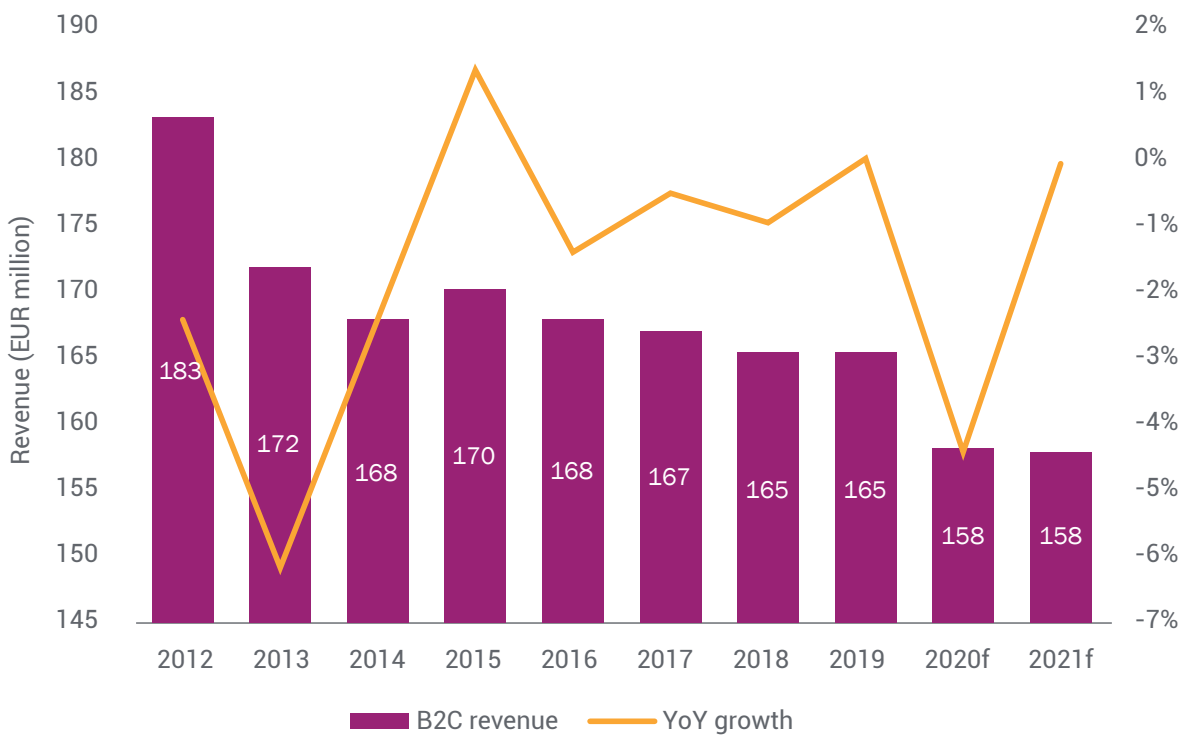
- Zoom traffic rose by over 500% in the first month;
- In some counties traffic increased by 775% (v. a 200% increase at global level) and traffic over fixed networks increased by 70-90%;
- In one EU Member State average usage rose over 100% and peaked at just below 1000GB per month in April;
- In another EU country mobile voice usage rose 100% in first two weeks of the lockdown;
- Netflix sign-ups in Europe 1Q 2020 surged 57% over the previous quarter to 7 million.

1.1 Revenue patterns

European mobile and fixed telecoms service revenues decreased by 18% over the decade between 2009 and 2019. This marked decline has impacted the health of the sector as well as its investment prospects. The period 2016-2019 saw more stability in revenue, but service revenue in 2020 will be markedly down on that in 2019. This means that the dramatic changes in data usage and in demand for more-advanced connectivity brought about by Covid-19 will not have translated into higher revenues.

The shift in connectivity usage from office to home may have mitigated the effects of falling consumer spending power on B2C revenues, but this revenue still declined in 2020 as a result of recessionary factors in many countries, and of increasing levels of price competition in fixed and mobile services. After four years of stability in B2C revenues, 2020 will see a sharp drop of 4.4% compared to 2019, to a total of EUR158 billion (see **FIG 2-1**). This is largely Covid-related – prior to the pandemic, the forecast was for a small drop of under 1%, similar to the declines seen in 2017 and 2018. However, B2C revenue is expected to stabilise in 2021 and start to grow again after that.

FIG 2-1 : Revenue growth in consumer services (Europe), 2012–2021f



Source: Analysys Mason, 2020

The same pressures are reflected in the figures for mobile and fixed broadband ARPU (average revenue per user).[8] These have proved resistant to growth, despite efforts by operators in many countries to improve data rates and quality of service, though those upgrades may have prevented sharper declines over the past few years.

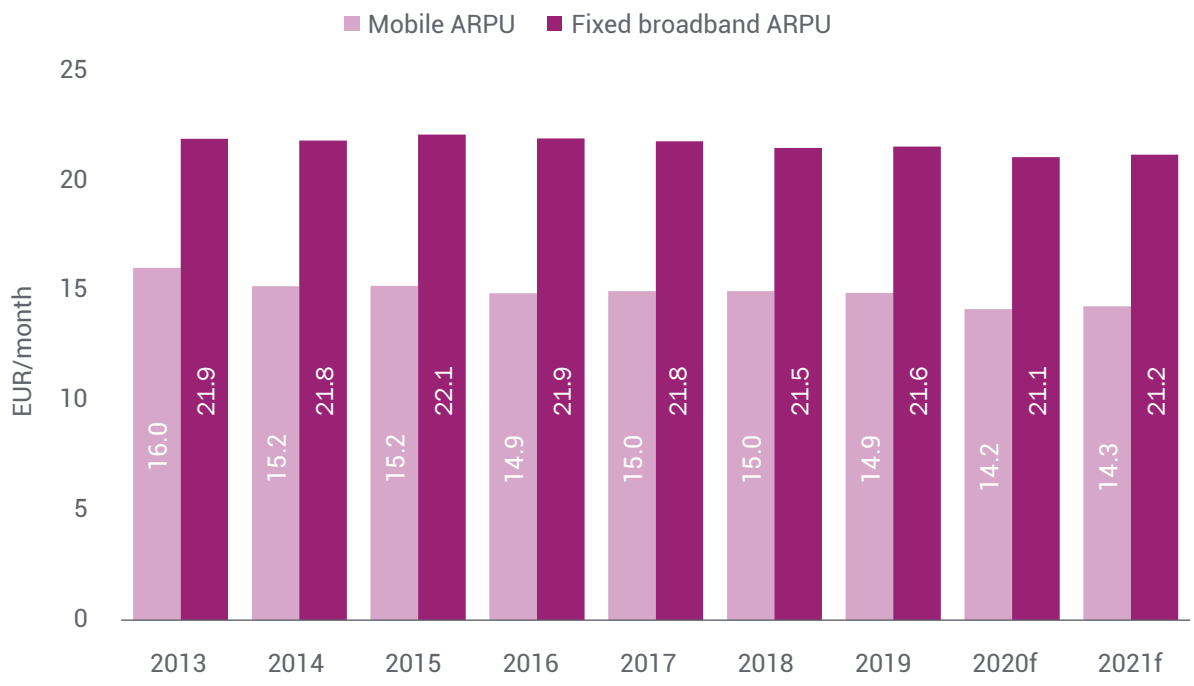
In fixed broadband, ARPU rose slightly in 2019, to EUR21.6, a trend driven heavily by upgrades driven by usage. In 2020, that figure is expected to fall to EUR21.1 and remain largely flat in 2021, a reflection of discounting amid personal financial uncertainty.

Mobile ARPU has been fairly stable, at EUR14.9-EUR15 per month, for the past four years, but in 2020, it is predicted to fall to EUR14.2 (see **FIG 2-2**), and a modest recovery is anticipated in 2021. The decline is not all related to the pandemic, but also to competitive pressures in Western Europe. This region is highly saturated and there is intense price competition in several countries.

8 Fixed broadband tends to be sold in bundles along with other services such as voice and video. ARPU is total annual retail revenue - minus revenue attributed to voice-over-broadband and video - divided by average active broadband subscribers. Mobile ARPU is total service revenue (including revenue from call termination) divided by average active non-IoT subscribers. Neither metric is adjusted for purchasing power parity (PPP).

So far, the pressure on ARPU has not been alleviated by 5G, partly because of slower take-up (compared to that of 4G services at the time of launch), and also because of competitive pressures. However, as 5G coverage increases and networks support additional capabilities such as low latency, operators will have enhanced opportunities to enable new user experiences and new consumer applications, such as immersive entertainment, which may accelerate the pace of migration to 5G and drive new revenues.

FIG 2-2 : Mobile ARPU and fixed broadband ARPU, Europe, 2013-2021f



Source: Analysys Mason, 2020

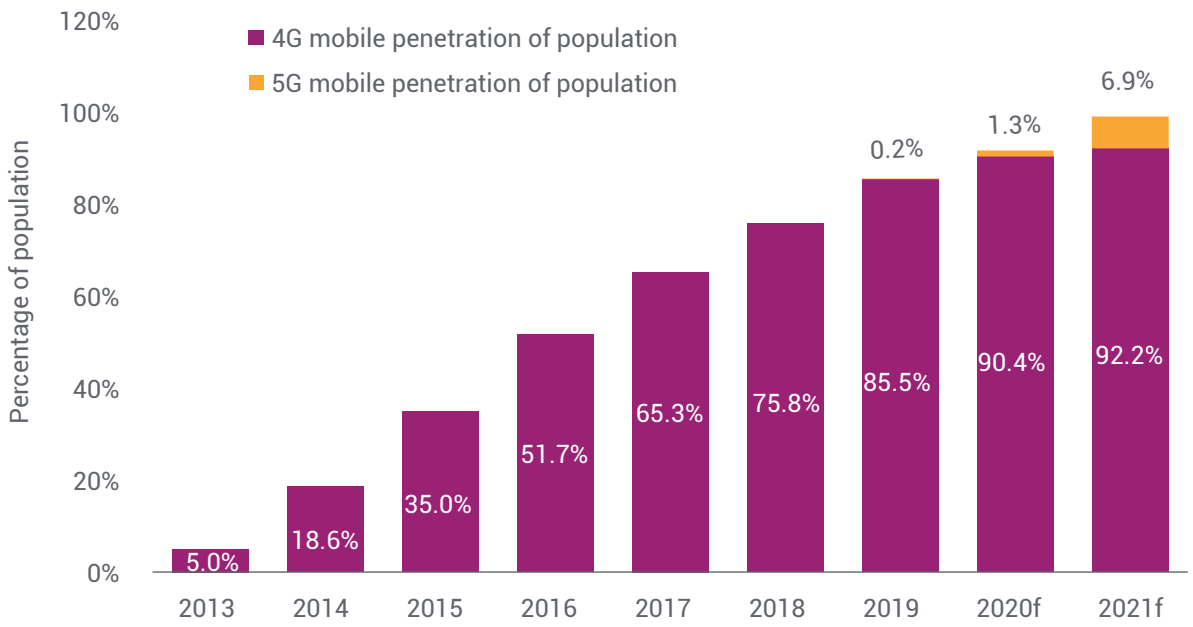
1.2 Mobile connections

Any impact on ARPU from 5G will not be significant in the short term. The vast majority of mobile connections in almost all European countries are based on 4G (see **FIG 2-3**). In 2020, 4G penetration is set to rise from 85.5% in 2019 to 90.4%.

Despite 5G network launches in selected areas of 18 European countries, the new network accounts for fewer than 1.3% of total mobile connections in 2020. This will rise rapidly from 2021 onwards – next year, 5G is expected to account for almost 7% of mobile connections across the region, while 4G penetration will still be rising too, to reach 92%.

By the end of 2021, users on 2G/3G networks alone will represent less than 1% of the total mobile base, down sharply from 8.3% in 2020. In some countries, there are already plans to retire older networks within the next 3-5 years, with 3G likely to be switched off before 2G in most markets. However, these figures exclude machine-to-machine (M2M) connections, and some operators will keep their 2G networks running for up to another decade to support certain M2M applications which require ubiquitous coverage combined with low data rates.

FIG 2-3 : Total number of 4G and 5G connections (excluding M2M) as a percentage of the population, Europe, 2013–2021f



Source: Analysys Mason, 2020

> **“ Penetration of 5G networks is picking up and is projected to reach 6.9% of the population in 2021 ”**

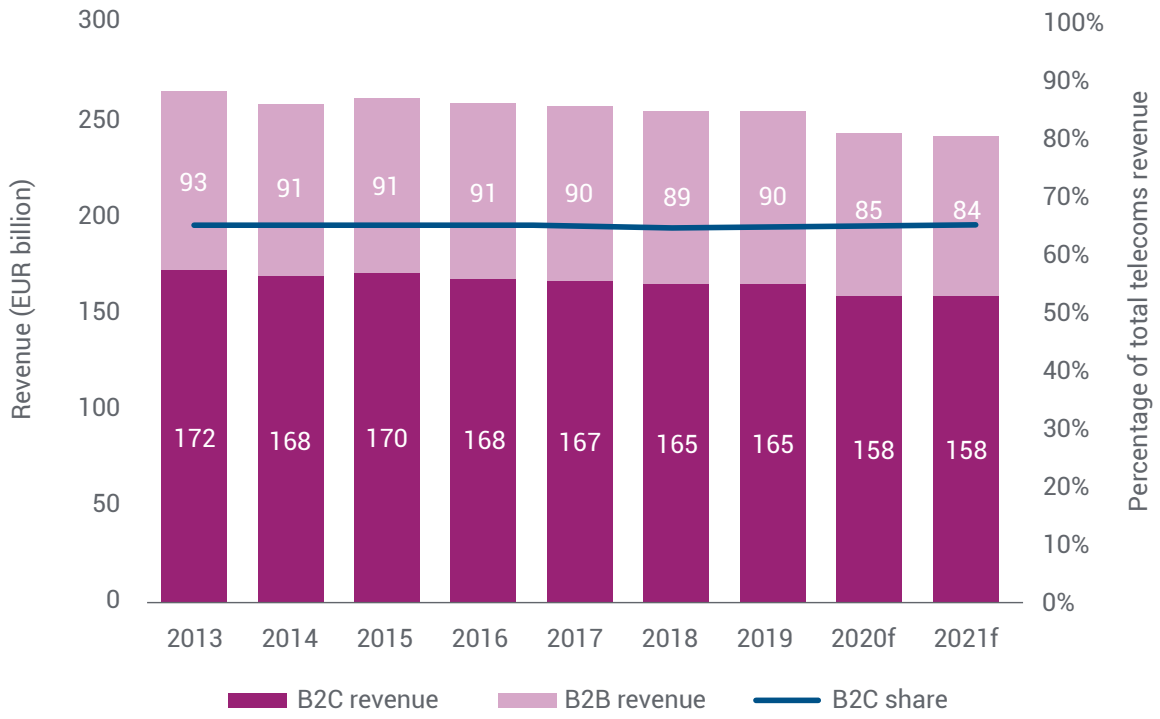
1.3 B2B and B2C revenue comparisons

The pandemic is having a deeper impact on operators' B2B revenues than on B2C, and this is likely to be more persistent in 2021. Slowdowns in consumer revenue relate to price competition and pressures on spending power, but demand for telecoms services, and their perceived criticality, has been intensified. This provides confidence that revenues will bounce back once consumer confidence is restored. For many businesses, changes in usage may be more long term if a permanent shift to flexible working is a result of the pandemic. And recovery from a period of reduced trading and subsequent recession will be a long process in certain industries, such as retail, and certain markets which have other underlying challenges, such as the UK.

This is seen in the comparison between operators' projected revenues from B2C and B2B sectors in 2020 and 2021. The year-on-year fall in revenues will be sharper in the B2B business, falling by 5.5% to about EUR85 billion in 2020, and a further 1.2% in 2021. This compares to a 4.2% fall in B2C revenues followed by stabilisation. The result, in terms of operators' revenue mix, is a reversal of the trend for B2B to account for gradually increasing percentage of revenues, which has been seen since 2017. By contrast, B2C revenues will grow from 64.9% to 65.2% of the total in 2020 to 2021, the highest percentage since 2011.

This shift will have some influence on 5G strategies. Some operators indicate they will refocus their short-term investments (before 2023) more heavily towards consumers and postpone deployments that were specifically targeted at businesses. However, in some markets, especially those where 5G is part of government-supported industrial strategies, the opposite effect will be seen, with operators redoubling their efforts to work with enterprises, seeking to place telecoms services, particularly 5G, at the heart of business recovery programmes.

FIG 2-4 : B2B and B2C revenue, Europe, 2013–2021f

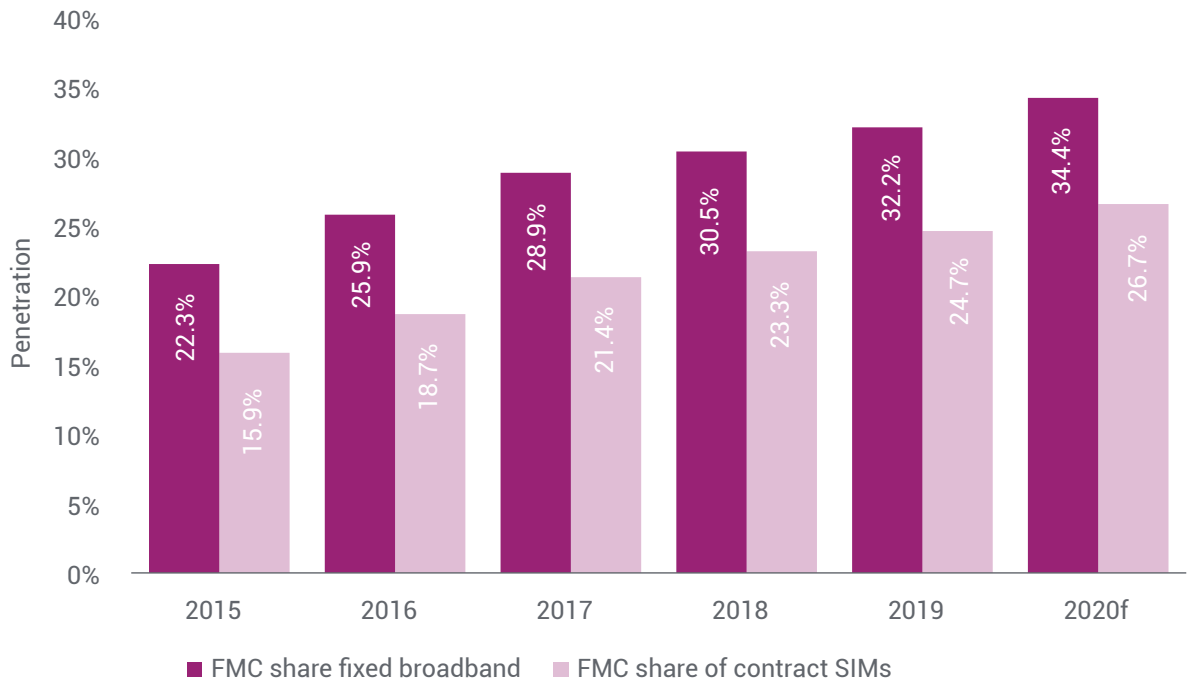


Source: Analysys Mason, 2020

1.4 Fixed-mobile convergence

Fixed-mobile convergence is becoming an increasingly significant feature of the European telecoms landscape, although household and business take-up across individual markets is very uneven. In the most penetrated markets over 70% of fixed broadband subscriptions, and over half of contract SIMs, are part of an FMC bundle, whereas in many markets the proportion for both is below 20%.

FIG 2-5 : FMC share of fixed broadband subscriptions and FMC share of all contract SIMs, 2015-2020f



Source: Analysys Mason, 2021

In 2020, the number of FMC accounts continued to grow in nearly all countries in Europe, and is set to continue to do so in future years. The level of take-up of FMC packages is mostly price- and supply-driven, and operators' willingness to discount varies, as does their motivation for offering such discounts. Some of the earliest examples, and the steepest level of discounts, were among operators driven by upselling FTTP access and securing a swifter return on steep investments in homes passed. This may persist as FTTP build and infrastructure-based competition increases in many markets. Many of the later examples of FMC were, however, driven by M&A activity between fixed-focused (mainly cable) and mobile-focused players. Cost-savings, cross-selling opportunities and churn stabilisation (with the long-term aim of being able to raise prices) were the financial rationales, and in these cases discounting has tended to be less aggressive. Already established fixed-plus-mobile integrated players generally followed suit with their own FMC discounts. While in-market mobile consolidation is very difficult to get past regulators and competition authorities, fixed-plus-mobile M&A activity continues apace in many European markets, and it is expected that further FMC discounting will occur.

In some markets the absence of more than one significant player with both fixed and mobile infrastructure has restricted availability of bundles, and in others with a higher proportion of price-sensitive households, bill-payers seem unwilling to commit to high-ARPA (average revenue per account) bundles, even where a saving could be made. For some major operators, though, FMC accounts and ARPA, rather than mobile and broadband subscribers and ARPU, are already the critical consumer KPIs. Competition between infrastructure-based FMC plays will increase through more M&A activity and new fibre build, and this is likely to subdue ARPA and cancel out gains from upselling other in-bundle services, which include smart home, media, utilities and even financial services.

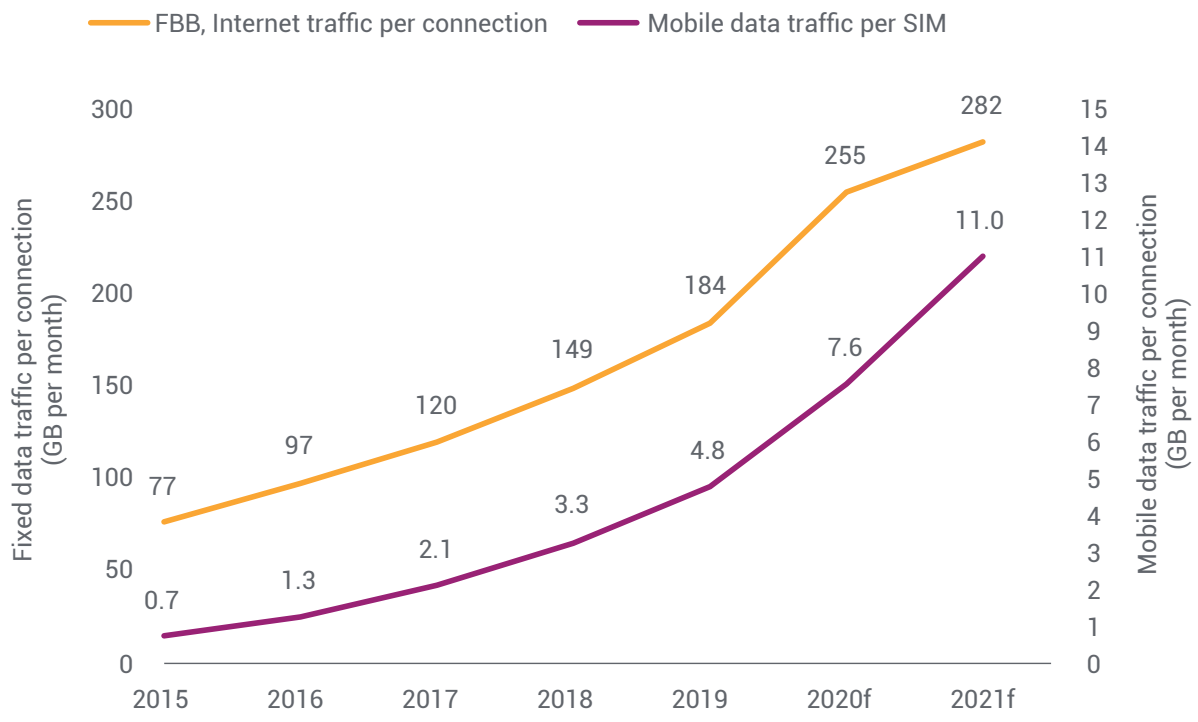
1.5 Fixed and mobile usage trends

Fixed and mobile data usage in Europe continues to grow strongly whether convergence is a factor or not (see **FIG 2-6**). Fixed networks still account for over 90% of data traffic. This is not being affected significantly by 5G, at least in 2020 to 2021. The impact of 5G fixed wireless access (FWA) is a more credible substitute for fixed broadband than 4G was, but it will be mainly significant in locations where fixed broadband is expensive or slower. In time, large 5G data plans could enable consumers to use 5G instead of Wi-Fi or fixed broadband, but there are very few signs of this occurring yet in Europe, and for indoor use FTTP and the latest generation of Wi-Fi provide a superior performance in terms of speed, reliability and latency.

However, despite the muted impact of 5G, the growth in mobile data usage per SIM has leapt sharply since 2018. In Europe, it rose by 47% between 2018 and 2019, and is expected to rise by an even higher percentage, 58%, between 2019 and 2020, before falling back to 46% growth in 2020 to 2021. The growth rates are higher in the Central and Eastern Europe region (CEE), though traffic rates per SIM are slightly lower. In 2018 to 2020, usage in Western Europe rose by 86%, while in CEE, it rose by almost 100%.

This compares with a 24% rise in usage per connection for fixed broadband services in 2018 to 2019, and, on the back of super-normal growth during the pandemic, an expected 41% rise in 2020 compared to 2019. Fixed has of course a far higher starting point, with a fixed connection carrying 34 times more Internet traffic, on average, than a mobile one in 2020.

FIG 2-6 : Fixed and mobile data usage per connection, Europe, 2015–2021f



Source: Analysys Mason, 2020

TV screens remain the largest driver of increased usage of all broadband connections in Europe, as broadcast services are steadily substituted with IP-based alternatives. This has been intensified by the increased take-up of video streaming services such as Netflix and Amazon Prime during lockdowns, and the proliferation of such services, with new launches include Disney+. Local broadcasters and cinemas have launched their own catch-up or on-demand services. On mobile connections, the main video usage is on free platforms such as YouTube.

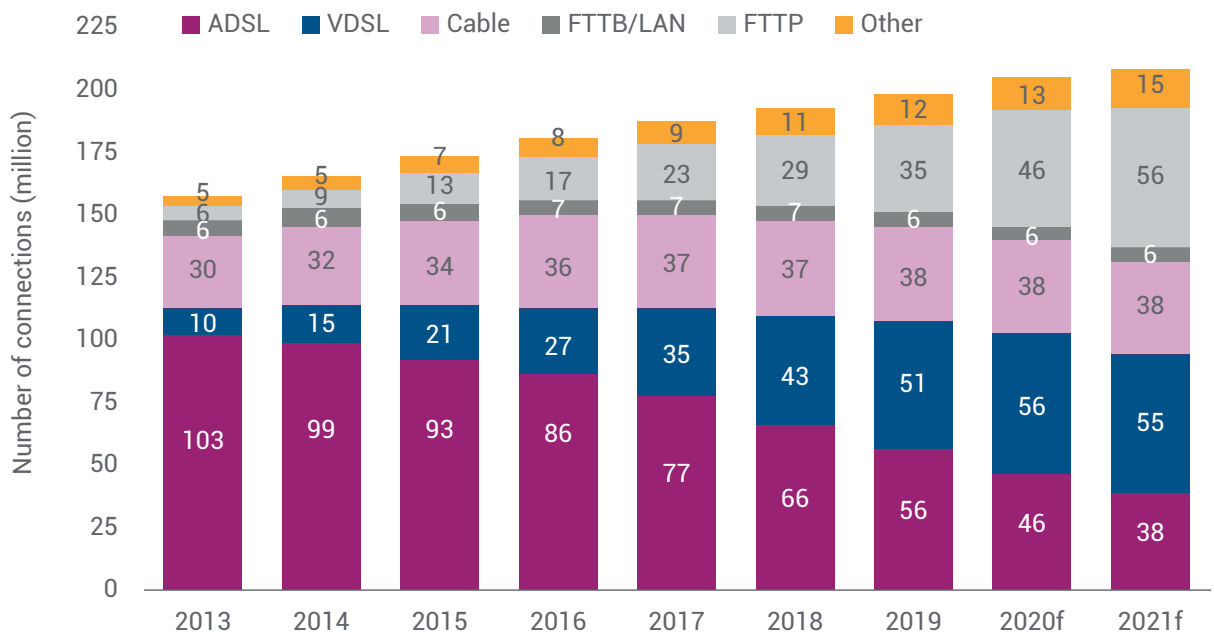
The shift towards video as the main source of home broadband usage has been offset somewhat by increased usage of home and mobile broadband connections for business purposes such as videoconferencing, which would have previously taken place in offices. Fixed broadband networks are dimensioned for busy-hour usage, which remains in the evening, so additional daytime traffic of this kind placed no additional strain on the networks. During the earliest week of lockdowns the largest single driver of additional traffic was not the use of any kind of service; it was simple downloading of games or games updates to while away the hours of enforced confinement. Openreach recorded a 40% spike in the last week of March which it attributed in part to major content releases, a much larger spike than it would normally see for such events.

The continuing rise in FBB traffic is closely associated with upgrades to more advanced technologies. The appetite for faster, higher quality connectivity has, consumer surveys indicate, been intensified by the increased reliance on home broadband during the pandemic. This will be an additional driver for growth in adoption of FTTP services.

Despite recessionary pressures and restrictions on customer installations during lockdowns, take-up of FTTP is set to increase by 30% in 2020 (see **FIG 2-7**), and this technology will likely overtake the installed base of connections as VDSL in 2021. After VDSL connections grew by 19% in 2019, compared to 2018, the growth rate will slow to about 9% in 2020 and is likely to stop growing in 2021. ETNO members are driving this technology shift. Cable take-up appears to be reaching a peak at around 38 million connections. FWA, especially 5G-based FWA, is starting to provide a credible substitute for some xDSL in some locations.

> **“Fibre connectivity is picking up, with over 56 million connections expected by 2021”**

FIG 2-7 : Fixed broadband connections by technology, Europe, 2013–2021f



Source: Analysys Mason, 2020

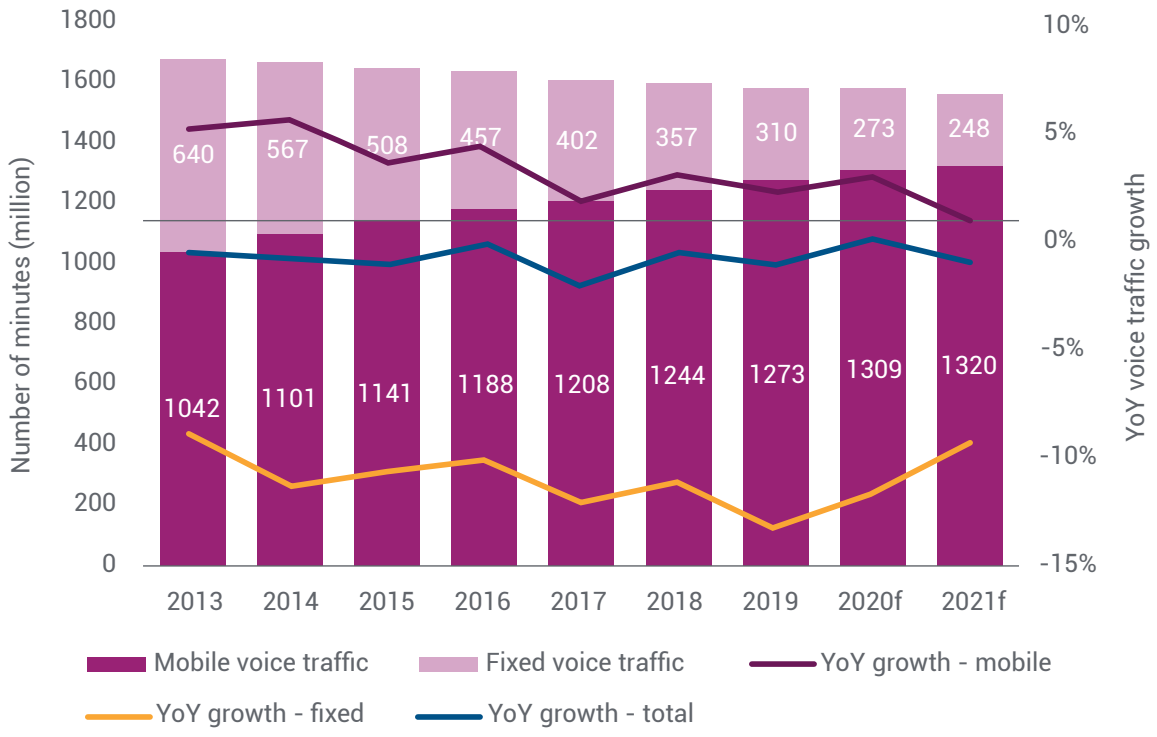
1.6 Voice

One way in which the pandemic has reversed previous trends in usage relates to voice. Over the past few years, fixed voice traffic has been declining at double-digit rates per year, while mobile voice, though growing, was doing so at a steadily slower rate, as usage switched to over-the-top voice services or to non-voice communications.

In 2020, use of managed mobile voice services increased by 3% in the ETNO countries, a percentage point higher than in 2019 and the highest growth rate since 2016 (see **FIG 2-8**). Fixed voice usage is still in decline, though less sharply than before, and in 2021, the decline is expected to be in single rather than double digits, for the first time since 2014.

The bounce back of managed voice services is not necessarily at the expense of over-the-top alternatives, but signifies an increasing level of voice calling overall, as people's freedom to meet in person was constrained. However, particularly for business calls from home, quality is increasingly important, and operators are addressing this by introducing enhanced calling services in some markets to improve quality and ease of use. Many are also rolling out Voice over LTE as 4G coverage improves, including in eastern European markets, where VoLTE availability had previously been limited.

FIG 2-8 : Voice traffic, Europe, 2013–2021f



Source: Analysys Mason, 2020

1.7 Demand-side challenges for operators

For all that European consumers are heavy users of digital services, and for all the accelerated increase in the use of these services caused by lockdowns, operators face difficult demand-side challenges.

A Covid-19 induced recession will reduce spending power. Unemployment is expected to rise and there will be downward pressure on wages. This will curtail discretionary spend. Take-up of new services depends on refresh rates for devices, which is largely discretionary and is slowing. Tying services to mobile devices dilutes margins for operators. For all their efforts to differentiate, telecoms operators' services are fairly commoditised: net promoter score surveys consistently show price to be the largest influence on decisions.

There are limited hours in the day to consume services. Much data traffic growth, and in the early years of smartphones much data traffic spend, was driven by increasing time spent on devices. Time is now saturated, so only the bandwidth requirements of the service, not the consumer demand for the service, drives data consumption.

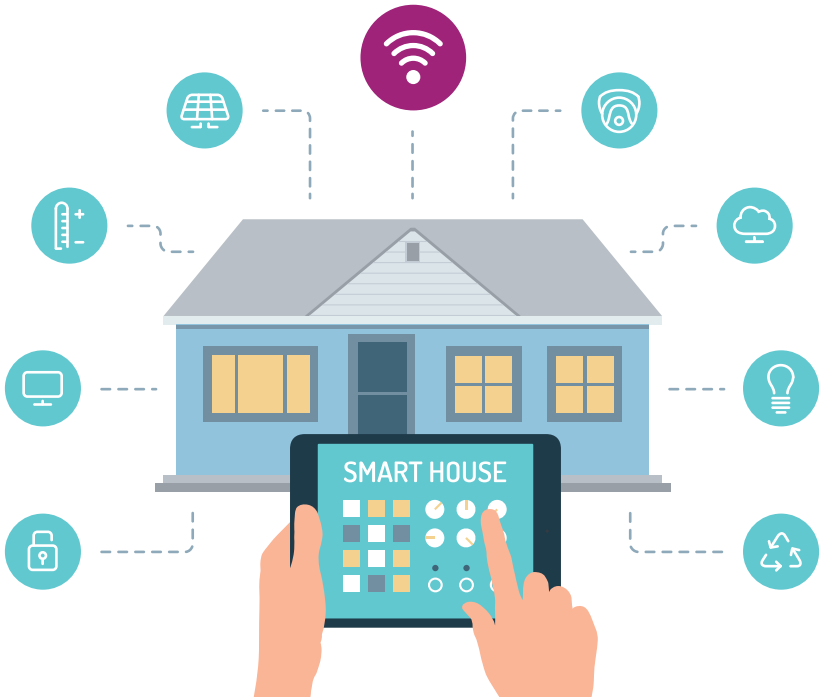
Demand for data services remains highly elastic. There is no evidence that demand for mobile data has resulted in any increased overall mobile revenue, and slow secular declines in mobile revenue seem to indicate that supply-side efficiencies in a competitive market outstrip growth in demand, resulting in slight deflation. This phenomenon is exacerbated by time saturation.

Operators like efficient networks and services because it lowers their costs, but many customers do not care; they might be quite happy with, say, the somewhat clunky co-existence of Wi-Fi and 4G/5G, and they might think their xDSL service is fine and will not change unless they have a financial incentive to do so. Some customers might prefer a human voice in a call-centre or a trip to the downtown store to their digital counterparts. Covid-19 has forced many to change habits, but a significant proportion of customers will not or cannot change. In cases of this kind, the cost of providing the legacy service does not simply scale downwards with dwindling customer numbers; more often than not, there is a fixed cost to keeping the older service, and in some cases consumer protection regulation complicates switching off the legacy service.

2. TRENDS FOR DIGITAL SERVICES SUPPLIERS

The digital services landscape in Europe is diversifying. Operators and large-scale Internet players (or OTTs) are both looking to expand their portfolios to address larger shares of total household spending, and to reduce churn. For instance, many providers are adding new options, such as smart home or financial services, to their bundles, while OTTs are adding security, healthcare, banking and many others to their media platforms, often leveraging popular devices such as smart speakers to deliver a unified experience.

The pandemic has stimulated such strategies by accelerating the shift from the physical to the digital world for many users, in key activities such as shopping, banking and the arts. Video consumption obviously increased dramatically, and there was huge growth in video calling and conferencing. Some time-consuming and data-intensive activity that replaced real-life activity will diminish as life returns to normal; data consumption has to some extent fallen back as restrictions are eased. However, a new-found facility with digital interaction means consumers and organisations will build up digital engagement again as it suits them and away from the enforced isolation of lockdowns, and it creates a broader platform for future services and applications. For example, the education of citizens in digital interactions is likely to ensure that the shift to digital will remain in place long term, at least to some extent. Arguably the activities that are least suited to digitalisation are live sports and music or theatre, hence the competition, in many markets, not just for video rights to broadcast large events, but to develop immersive platforms seeking to replicate the physical experience and so enable a premium-priced service.



2.1 Operators and OTTs

All this may shift the balance of power between OTTs and the telecoms sector in Europe once more. Over the past decade or more, the OTTs have been taking an increasing share of TV and video consumption, at the expense of pay-TV providers and broadcasters. They have also attracted a rising share of mobile voice and messaging usage. De facto, OTT services - including data-harvesting based ones - ended up competing directly with key European industries such as broadcasting or the telecoms. This has profoundly changed the position of the operators in the communications and media landscape but has not resulted in the complete demise of their business model, as was sometimes predicted in the early years of OTTs' rise to prominence.

Some European operators have adapted well to the presence of the OTTs, and they have often formed partnerships with them where the end-user has some unique financial incentive to buy the OTT service via the operator.

- Telia has a partnership with Swedish music-streaming service Spotify (a rare example of a Europe-based OTT with global clout);
- BT has a partnership with Comcast-owned Sky for the NowTV app, an OTT version of Sky's TV content;
- Telefónica has partnerships in several markets for the relatively new Disney+.

Despite the increasing collaboration, however, **the issue of how to translate this into more network investment is still open.** Some are hoping that 5G will enable new ways to increase their share of the overall value chain, although the shift of many business and consumer activities to the cloud clearly stands to benefit OTTs that have made investment in that infrastructure at huge scale.

The presence of OTTs is one of the main reasons many operators have refocused their revenue mix on connectivity, their traditional strength, rather than services. As higher-quality connections drive usage of OTT services, especially video, so operators' connectivity becomes more critical, though the challenge is to monetise it effectively. In particular, increased demand for connectivity driven by OTTs' services has not actually improved telecoms operators' revenues; a net negative impact remains. For some European operators, the five largest OTTs account for 80% of network capacity used, pay nothing directly, yet contribute to driving up costs.

It is true that OTTs often moved earlier and built trans-national platforms that enable them to innovate and expand more quickly than operators, and have probably pre-empted telecom operators taking a larger role in video and digital services. However, OTTs have fought to impose net neutrality regulation, impeding any option for quality-based business-models. Moreover, OTTs compete with telecoms operators in the provision of voice and video services with little or no consideration of their impact in the market by competition or telecoms regulatory authorities.

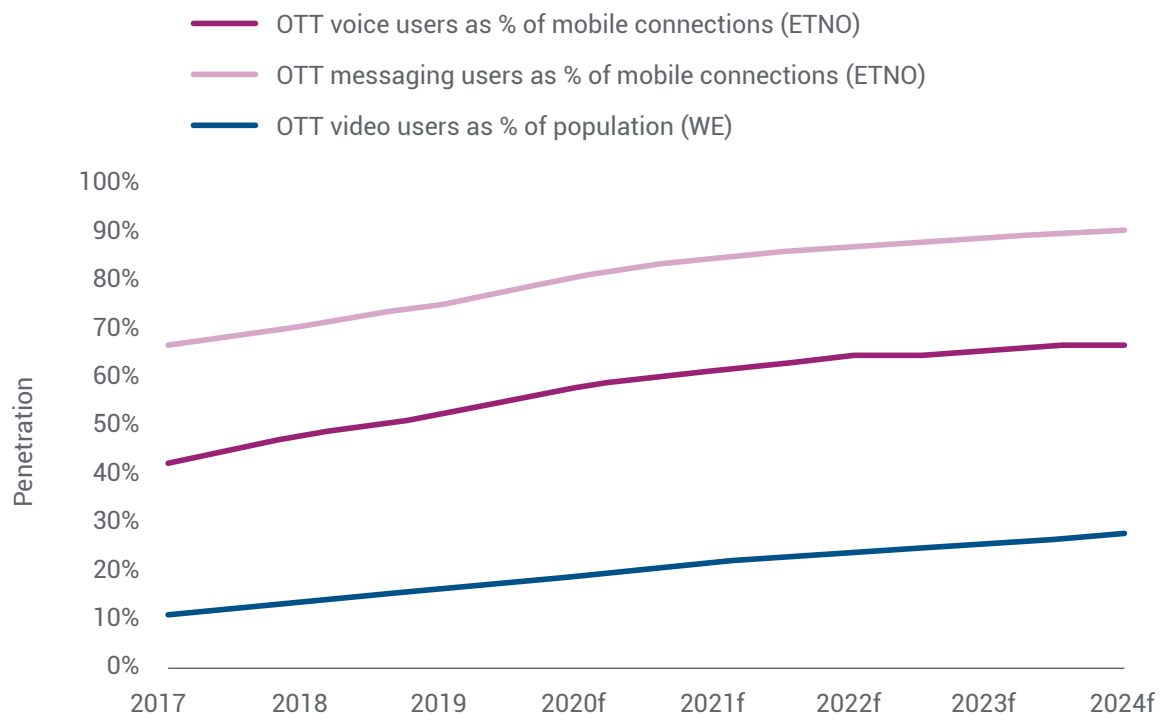
What is clear is that telecoms networks and OTT services are inextricable. A majority of mobile subscribers in ETNO countries now use OTT voice and messaging services (see **FIG 2-9**). This is often in addition to operator-managed offerings such as SMS/MMS. Efforts by some mobile operators to enrich their own voice services, with technologies such as Rich Communications Services and HD Voice, and so attract users away from OTT alternatives, have proven largely ineffectual. In 2019, OTT voice was in use on 52% of mobile connections in ETNO markets, the first year it topped 50%, and this figure is expected to rise to 67% in 2024. In messaging, the impact of services like WhatsApp makes the percentage even higher – 75% in 2019, rising to 90% in 2024.

As for video, OTT services have been proliferating, challenging broadcasters and pay-TV providers. By contrast with voice, there is no significant

competition offering from mobile operators. Netflix and Amazon Prime dominate the landscape, but there have been new launches such as Disney+; and there are country-specific services, some owned by TV providers (like the UK's Britbox and NowTV); on-demand and streaming services from cinema operators; and multi-language services like TracePlay.

By the end of 2020, the penetration of online video services will have increased more significantly than in recent years because of the pandemic. In Western Europe, it will grow from 16% to 19% of the population and forecast to rise steadily after that to 28% by the end of 2024.

FIG 2-9 : Penetration of OTT services, Western Europe, 2017–2024f

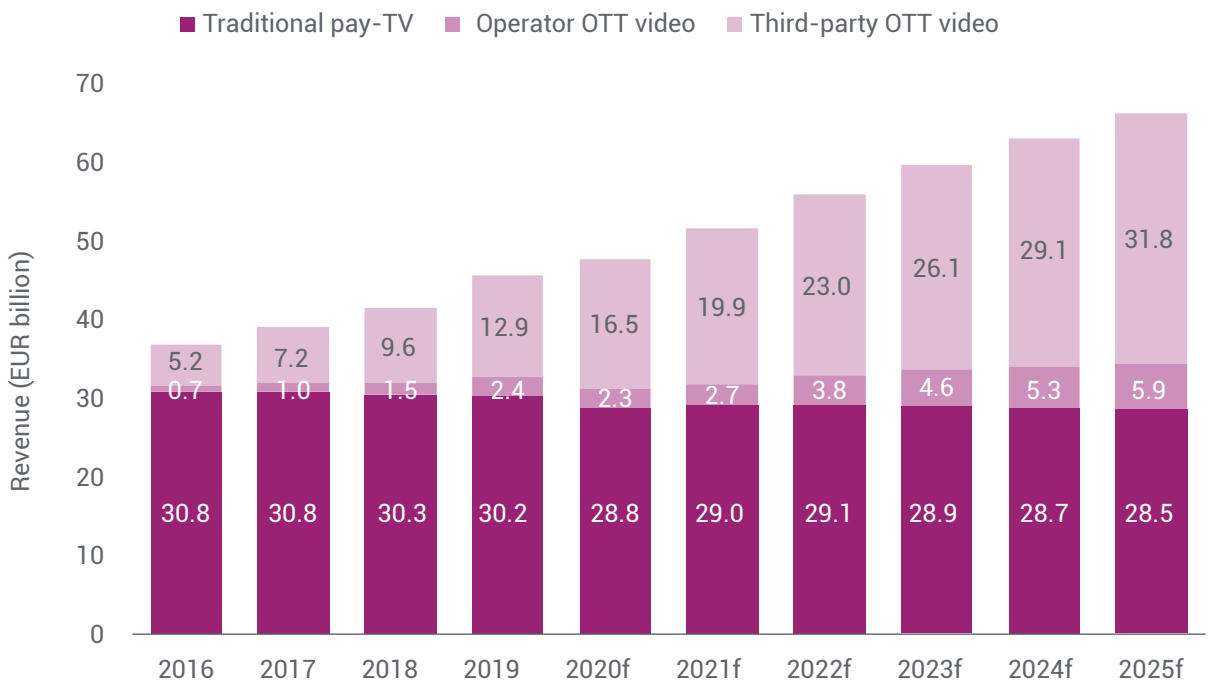


Source: Analysys Mason, 2020

The long-term impact of the pandemic on the digital services market may shake up the relationships between telecoms operators and OTTs again. Consumption of video and voice, the areas where the OTTs' impact has been greatest on the telecoms sector, have both increased across all platforms during the 2020 lockdowns, but while this has incentivised players like Netflix to increase their investment in content production in Europe, for network operators it has been hard to marry rising usage with increased revenues.

FIG 2-10 shows how deeply OTT video is affecting the TV revenue distribution, although traditional pay-TV revenues, after a sharp drop between 2019 and 2020, will stabilise through the early 2020s. However, all the growth is in OTT TV, whether supported by the pay-TV operator, or by a third-party, or fully OTT, platform. Consumer spend on OTT video looks set to overtake pay-TV as soon as 2023. In 2020, these third parties' revenues accounted for about a third of all spend; on current projections it will be nearly a half by 2025.

FIG 2-10 : Traditional pay-TV and OTT retail revenue, Western Europe, 2016–2025f



Source: Analysys Mason, 2020

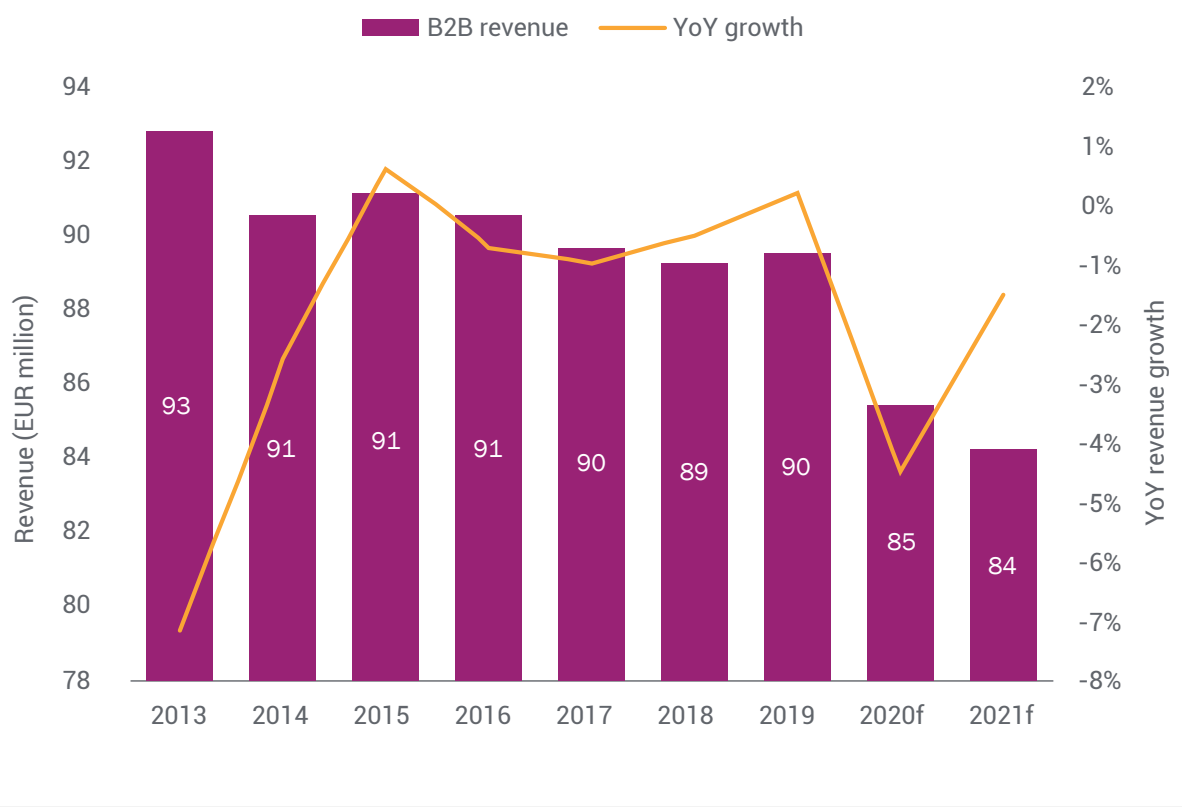
However, operator OTT services have a higher growth rate than third parties, though from a smaller base, and for some operators, this will more than compensate for the loss of revenues from traditional pay-TV, which will accompany the fall in satellite and cable subscriptions. Operators and pay-TV providers in most countries in Western Europe, and some in Central and Eastern Europe, are either launching their own OTT offerings or acting as aggregators for third party video services. Some are experimenting with new payment models to encourage adoption, such as pay-per-view for sports events or short-term subscriptions with no minimum term. As a result, after 2020 significant growth is expected in Western European operator OTT revenues – similar growth to third party OTT (about 19%) in 2021, but after that, far faster growth rates. By 2025, operator OTT is predicted to account for 9% of retail revenues in this market in Western Europe, and similar trends will also be seen in CEE, though they are developing more slowly there.

2.2 B2B services

As described in this section, B2B telecoms revenues will be hit harder by the pandemic's effects than B2C. In the medium term, there will be an important role for telecoms networks in supporting businesses in their recovery from the 2020 crises. This may be to support permanent shifts to a more digital, remote way of working, or to enable digital transformations that could improve resilience. But in 2020, many businesses have made less use of telecoms services on their own premises, or to support mobile workers, and others have, at least temporarily, slowed down planned investments in new services and processes enabled by 5G or FTTP.

After a period of fairly stable B2B revenues since 2014 (see **FIG 2-11**), there will be a sharp drop, of 4.5%, in 2020. This is only slightly more than the fall in B2C revenues (4.4%), but whereas the latter will stop declining in 2021, and start to grow again in 2022, B2B revenues will continue to fall in 2021 (projected by 1.5%) and only start to grow again, modestly, in 2023. At that point, it will be important for operators to have services in place that could stimulate B2B spending by providing businesses with ways to improve their own efficiencies or competitiveness, some of which may be enabled by 5G.

FIG 2-11 : B2B connectivity services revenue, Europe, 2013–2021f



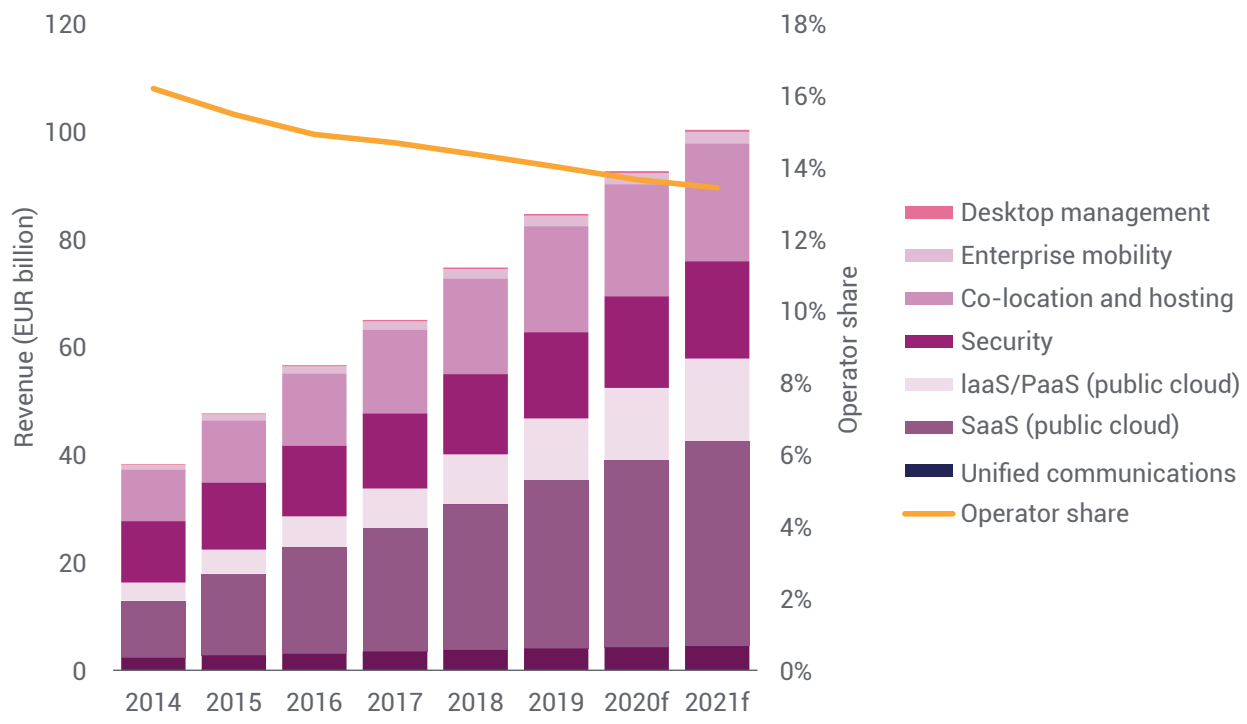
Source: Analysys Mason, 2020

That is likely to involve an increased focus on non-connectivity revenues so that operators can take a greater share of businesses' spending, even if connectivity revenue remains stagnant. There are several important service categories in which there has been steady year-on-year growth since at least 2014, and in which operators can play a significant role. Several relate to the transition of business functions to the public cloud, including Software as a Service (SaaS), and the related categories Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Among the non-connectivity B2B services highlighted in **FIG 2-12**, these two categories will have the highest growth – 20% and 24% compound annual growth rate (CAGR) respectively in 2014 to 2021. Operators are forging increasingly strategic alliances with public cloud players, which in turn regard large operators as key partners in extending their enterprise reach, especially towards the edge of the network. Some larger operators are also looking into opportunities to develop their own edge-cloud capabilities.

However, there are challenges for telecoms operators to take a significant role in the value chain, given the scale of the cloud giants, and some will remain focused on more traditional sources of B2B added-value revenue, such as unified communications and enterprise mobility, even if these are likely to have lower growth rates (10% and 14% in the period). Overall, all operators' share of the B2B services market in Europe has fallen, from 16.2% in 2014 to 14% in 2019. That share will remain under pressure from other players in this complex market, but operators will defend their revenues effectively with new service launches and strategic partnerships, and their market share is expected to fall only marginally by the end of 2021, to about 13.4%. Through initiatives like Gaia-X, and soon the establishment of the EU Alliance on Industrial Data and Cloud, the EU and its industrial base is trying to better organise itself to defend digital sovereignty and to deliver cloud services in line with EU values on privacy and transparency.

> **“Beyond connectivity, European telcos are more and more involved in B2B services”**

FIG 2-12 : Non-connectivity B2B services revenue, Europe, with operator market share 2014–2021f



Source: Analysys Mason, 2020

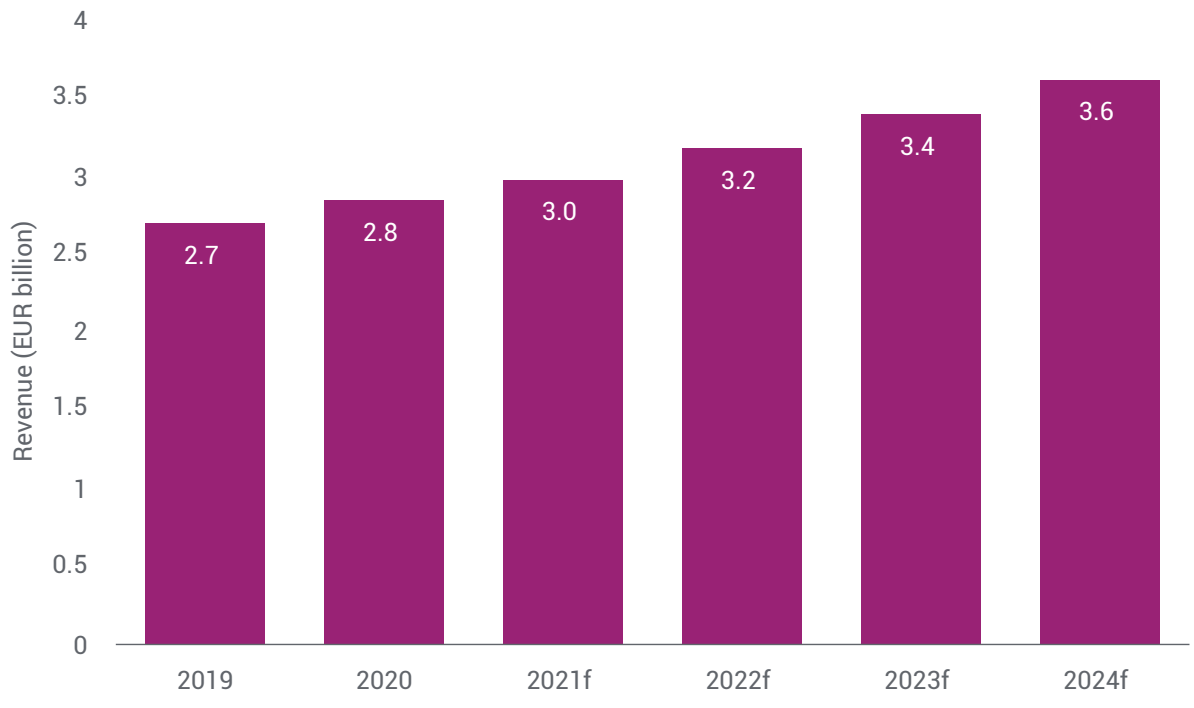
	2014	2015	2016	2017	2018	2019	2020f	2021f
Unified Communications	2.3	2.8	3.2	3.5	3.8	4.1	4.3	4.5
SaaS (public cloud)	10.6	15.1	19.6	22.9	26.9	31.2	34.8	38.0
IaaS/PaaS (public cloud)	3.3	4.5	5.8	7.4	9.3	11.5	13.4	15.3
Security	11.4	12.4	13.1	14.0	14.9	16.0	17.0	18.0
Co-location and hosting	9.5	11.5	13.4	15.5	17.8	19.7	20.8	21.9
Enterprise mobility	0.9	1.1	1.3	1.6	1.8	1.9	2.1	2.2
Desktop Management	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4
TOTAL	**38.2**	**47.7**	**56.7**	**65.0**	**74.8**	**84.7**	**92.7**	**100.4**
Operator share	16.2%	15.5%	14.9%	14.7%	14.4%	14.0%	13.7%	13.4%

2.3 Digital security services

Operators have successfully boosted their B2B and B2C revenues through the supply of security services. This has been achieved both through organic growth, and through acquisitions.Proximus's acquisition of ION-IP in 2018 enabled the operator to expand its service portfolio in the Netherlands and increase the number of cyber-security vendors that it partners with. The aim of operators' acquisitions is often also to increase the cyber-security value-chain coverage of their services (for example, through acquiring a company with managed services or software development capabilities).

Acquisitions enable specific operators to accelerate their security revenues and to provide services that conform to EU rules, thereby contributing to the EU goal of strengthening its digital sovereignty. Overall growth for security services provided by telecoms operators in Western Europe is predicted to have a more modest CAGR of 6% between 2019-2024.

FIG 2-13 : Security revenue for Western European telecoms operators



Source: Analysys Mason, 2020

"Active IoT connections continue booming: 838 million expected by 2027"

2.4 The Internet of Things

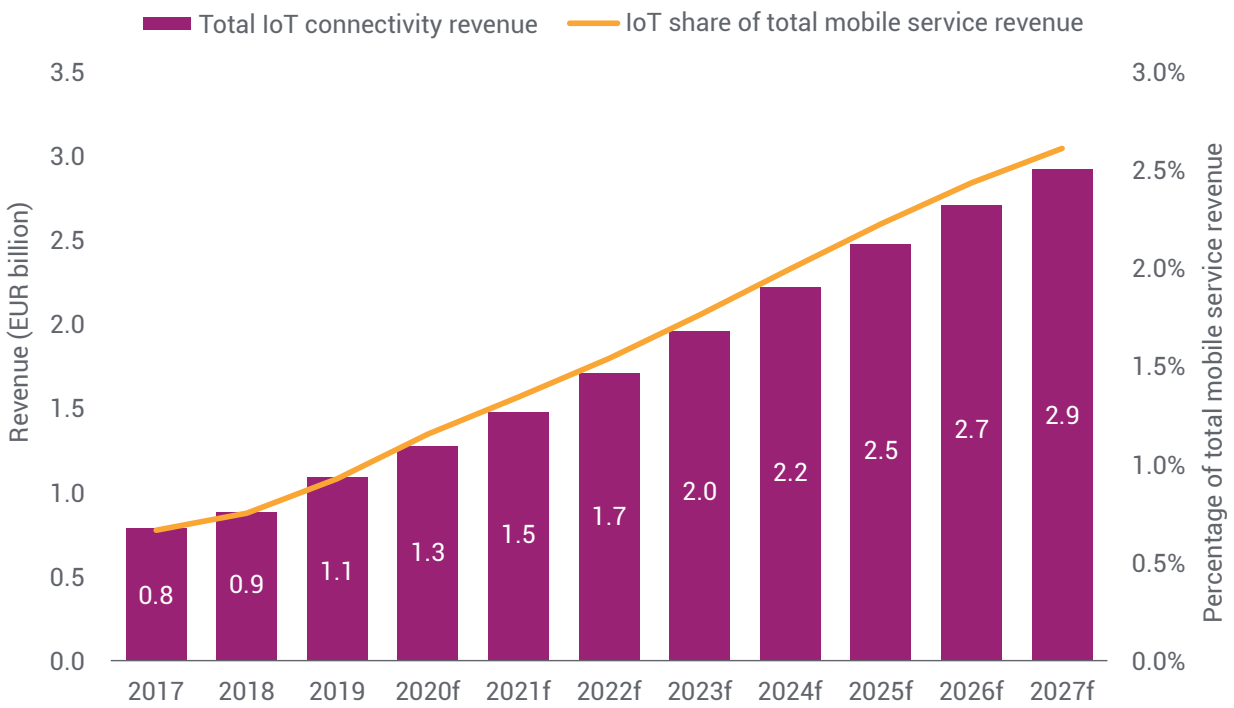
One area in which telecoms operators have high hopes of boosting their B2B revenues, for connectivity and other services, is the Internet of Things (IoT). IoT connections are growing rapidly in Europe. At the end of 2019 there were 164 million IoT connections and this figure is set to grow sharply, by 28% year-on-year to 211 million in 2020 and then by another 30% in 2021 to 275 million. The CAGR for the decade from 2014 to 2024 is projected to be 24%.

These connections are growing for both B2B and home-based applications. The latter may have been stimulated by the lockdowns; the former are unlikely to be dramatically affected by the pandemic since industrial IoT deployments are generally part of long term transformation initiatives, which were underway before the crisis. In some cases, especially in industries that have been hard hit by Covid-19, such as automotive, there may be some acceleration of the move towards automation and IoT to generate efficiencies.

However, it is challenging to translate all these connections, which are implemented over a variety of wireline and wireless networks, into operator revenue. The value chains for many IoT applications are complex, with non-operators often capturing revenues for devices, data monitoring, data analytics and other activities. Connectivity alone generally represents less than 10% of total revenue from an IoT application. In 2019, total IoT connectivity revenue in the ETNO countries reached EUR1.1 billion, only 0.4% of total telco revenues in the region and 1.2% of B2B connectivity revenues (see **FIG 2-14**). The revenues will grow steadily to reach EUR2.9 billion by 2027 (forecast), but in 2025, IoT connectivity is still projected to account for only 3% of B2B connectivity revenues.

Much of the optimism about operator-supported IoT centres on mobile connectivity, and especially 5G, but the amount of additional revenue this will generate is modest in this sector also. In 2019, IoT accounted for 0.9% of mobile service revenue in Europe, and by 2027 this is forecast to have risen to just 2.6%.

FIG 2-14 : IoT revenue forecast, 2017-2027f



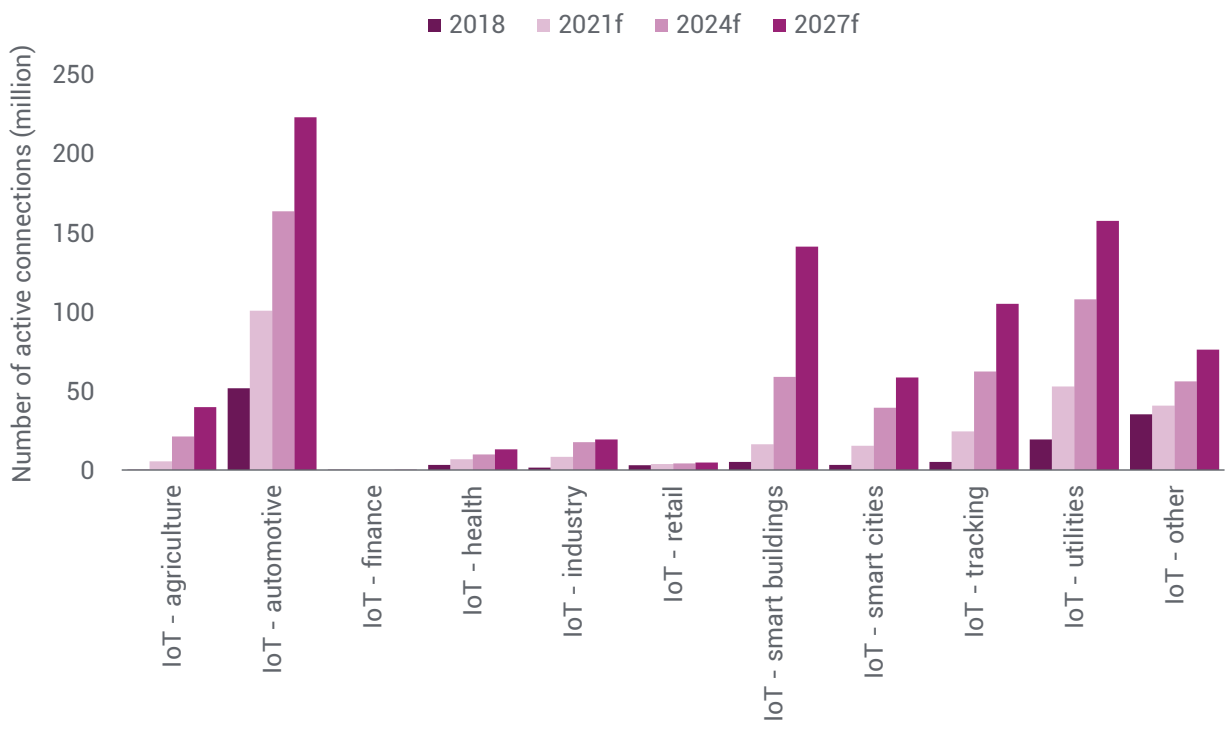
Source: Analysys Mason, 2020

The limited growth potential from IoT connectivity will propel some operators to develop a wider portfolio of IoT services for consumers and, particularly, for selected vertical markets in which significant take-up is expected in the short to medium term. Building a rounded IoT proposition for a vertical market requires investment in ecosystem and channel partnerships and specific connectivity requirements, so many operators are initially focusing on a few industries, while planning to develop broader, multi-sector platforms in the later 2020s. Several ETNO members are targeting key sectors such as automotive and seeking to leverage pan-European scale.

In terms of active IoT connections, whether operator-enabled or not, automotive dominates the picture, and is the primary focus of many pan-European IoT service launches by operators (see **FIG 2-15**). In 2019, this industry accounted for 66 million active connections, or 40% of the total, followed by utilities, on 28 million or 22%. The fragmentation of the IoT landscape, which is challenging for telecoms operators seeking to build large-scale platforms, is seen in the fact that 17% of connections are in 'miscellaneous' sectors which individually account for less than 0.5% of the total in 2019.

By 2027, automotive and utilities are still expected to be the biggest IoT users, but will account for a smaller percentage of connections (27% and 19% respectively) than in 2019. Active connections across all industries will have risen by 24% CAGR (since 2017) to 838 million, but the highest CAGRs are predicted in agriculture (from a very small base), tracking and industry/manufacturing. In terms of connection numbers, smart buildings will be the third largest user, accounting for 17% of the total, followed by tracking services.

FIG 2-15 : Number of active IoT connections by vertical industry sector, Europe, 2018, 2021f, 2024f, 2027f



Source: Analysys Mason, 2020

Sector	Number of active connections (million), 2018	Number of active connections (million), 2021f	Number of active connections (million), 2024f	Number of active connections (million), 2027f
Agriculture	0	6	21	40
Automotive	52	101	163	223
Finance	0	0	0	0
Health	3	7	10	13
Industry	2	8	18	19
Retail	3	4	4	5
Smart buildings	5	16	59	141
Smart cities	3	15	39	58
Tracking	5	24	62	105
Utilities	19	53	108	157
Other	35	41	56	76
TOTAL	**128**	**275**	**541**	**838**

SECTION 3

How digital communications providers help to deliver a new digital future

While the Covid-19 pandemic leaves operators facing new challenges that few would have anticipated a year ago, in many respects it has accelerated changes that were already visible and underway. The crisis has shown how societies can adapt around the digital, and how economies can benefit, and it has fostered a greater sense of urgency among telecoms operators about effecting digital transformation. Additionally, the crisis has offered new and clearer perspectives on issues around the role of the digital in bringing about other broader and necessary changes to European society, including:

- helping to deliver a greener world;
- creating a digitally smarter society while not letting go of human values;
- levelling up differences between regions and social groups;
- expanding economies again by harnessing new technology like 5G;
- proactively looking ahead to the next generation of network technologies.

This section explores these issues and concludes on the unique role that network operators have in ensuring and helping to deliver a new digital future and the difficult balance of obligation and reward they face.

1. BUILDING A CLIMATE-NEUTRAL SOCIETY

Europeans are looking to build back a green recovery from the pandemic, using the EU Green Deal which strives to make Europe the first climate-neutral continent. The three goals of the European Commission's Green Deal are: to have net-zero emissions of greenhouse gases by 2050 (climate-neutral); to break the link between resource usage and economic growth; and to ensure all people and regions are involved.

At both the political and industrial level, there is growing awareness that a climate-neutral society requires a dramatic acceleration of digitalisation across all sectors of the economy. The GeSI's SMARTer 2030 report study shows that for every 5% increase in access to digital technology, there is a corresponding CO2 reduction of 16%.

Figures show that the **enabling potential** of the telecoms industry is as important as its efforts to reduce its own footprint. A recent report[9] has shown that mobile technologies are helping to enable carbon reductions 10 times the emissions of the mobile sector across the wider economy. In fact, in terms of societal impact, this has a significant potential in achieving the EU Green Deal targets. A case in point is Deutsche Telekom. The company estimates that in 2019 the positive CO_2 effects enabled by DT's customers across Europe were 74% higher than DT's own CO_2 emissions (in Germany even 144 %). The positive CO2 effects made possible on the customer side by using DT's products and solutions amounted to almost 15.8 million tonnes in Europe.

9 The Enablement Effect, December 2019, GSMA | Mobile Technologies Enabling Huge Carbon Reductions in Response to Climate Emergency - Newsroom

ETNO members have a long-standing commitment to reducing CO2e emissions and to other sustainability goals. The three primary areas that are being supported are:

- **Promotion of the circular economy** – focused on the full life cycle of equipment and devices to ensure that plans are made for retiring, recycling and refurbishing. This is a voluntary measure that operators are passing on to upstream and downstream suppliers helping to create the demand for a new economy based on green requirements.
- **Investment in greener technology** and procurement of greener technology – where new technology, being fibre or 5G, are more efficient than previous ones, and where network and wider ICT equipment is selected on its energy-use and efficiency. There are additional benefits with many investments that result in cost saving on energy purchased.
- **Creation of funding frameworks to increase investing in sustainable projects** – these include "Green Bonds" already issued by Telefónica, Telia Company, Orange, TIM and Swisscom.

The telecoms industry, as a heavy consumer of ICT equipment, devices and services, has a strong part to play in making these sustainability goals achievable. The scale and scope of telecoms services also support other industries' and governments' ambitions for a greener society. These goals also align with the United Nations Sustainable Development Goals and timescales. Building a green economy challenges the old idea that sustainability costs more and replaces it with one where the green economy creates opportunities to deliver new economic growth. Telecoms has a strong part to play in making these goals achievable as an enabler of growth opportunities and includes:

- Telecoms services supporting remote working helping to reduce the need to commute, a positive change that has been accelerated during the pandemic.
- Facilitate the use of IoT devices to enable smarter working practices, such as smarter logistics, better maintenance plans, more sustainable farming, and smart cities or logistics.
- Sharing of data, in compliance with the applicable rules, to create more precise use of resources, smart street lighting, efficient rubbish collection, smart car parking or information on devices or users.

1.1 Energy efficiency and new networks

Telecom operators are large consumers of energy, and have steadily improved the power-efficiency of the equipment used on their networks and through procurement of more efficient devices, through smarter use of devices, through use of more efficient IT and virtualisation.

The roll-out of optical networks and 5G will continue to improve this efficiency. Full-fibre FTTP networks are more power-efficient than copper networks, irrespective of data usage. They require no cooling and have no powered outside plant. 5G networks provide more efficient transmission of data for each kWh of energy consumed; Ericsson has claimed this is potentially as high as four times more efficient as compared to 4G. However, every new standard that has been rolled out has increased energy consumption, and usage of 5G will still increase overall power consumption for operators until previous generation mobile networks are retired. This being said, 5G is the most energy-aware standard so far; it includes smarter operations that invoke sleep modes designed to help break the historical link between new standards driving energy consumption upwards.

Although in the short-term energy usage may go up, as reflected in some operator numbers in 2019, the application of 5G in various contexts will bring about indirect reductions in energy usage. These include for example the use of

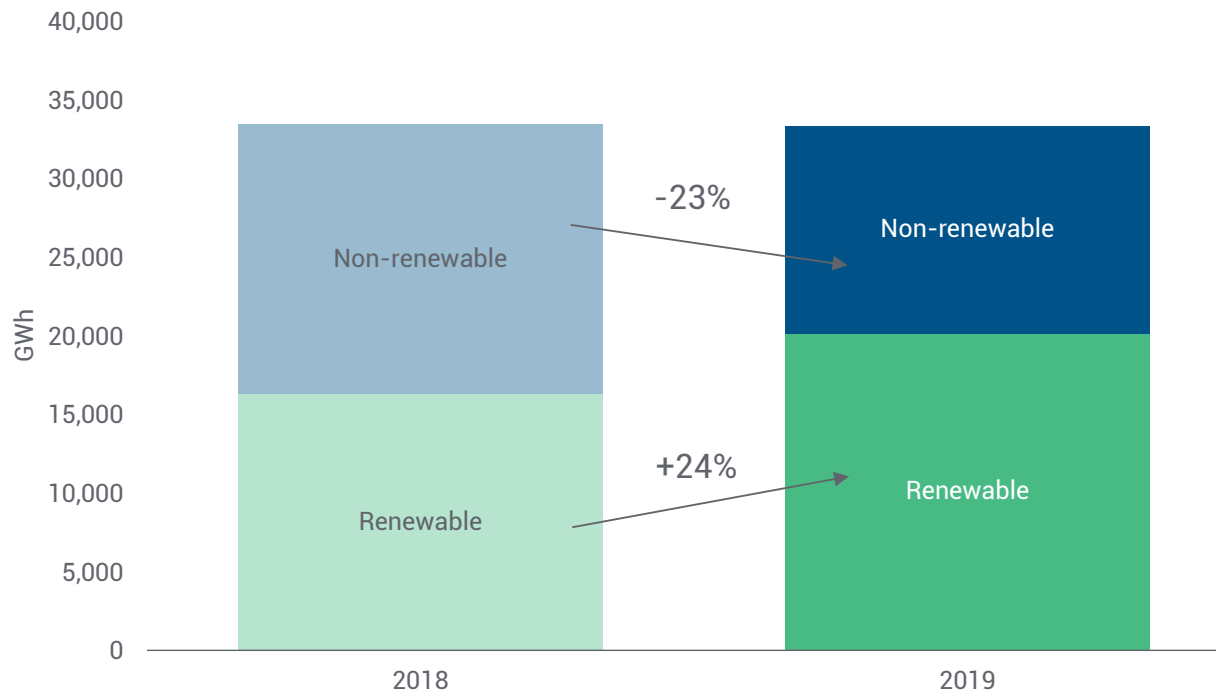
remote plant inspections that use more-efficient unmanned vehicles, remote medicine to reduce unnecessary journeys, support for IoT devices within smart cities using low-bandwidth, low-power 5G devices. These all sit within a wider array of potential smarter applications that could be deployed at the network edge using cloud and AI technologies.

Network sharing and outsourcing systems to more energy-efficient cloud infrastructures for IT will continue to improve energy efficiency rates in the industry.

1.2 Energy consumption and carbon emissions

Energy consumption has been a metric monitored by ETNO members for many years both to save costs and to lower CO2e emissions. From data collection performed within ETNO, it emerged that between 2010 and 2018 there was an increase in data carried by networks by 1100%, yet a reduction in associated carbon usage by 40% and only a 6% increase in electricity usage. In 2019 energy consumption was broadly flat.

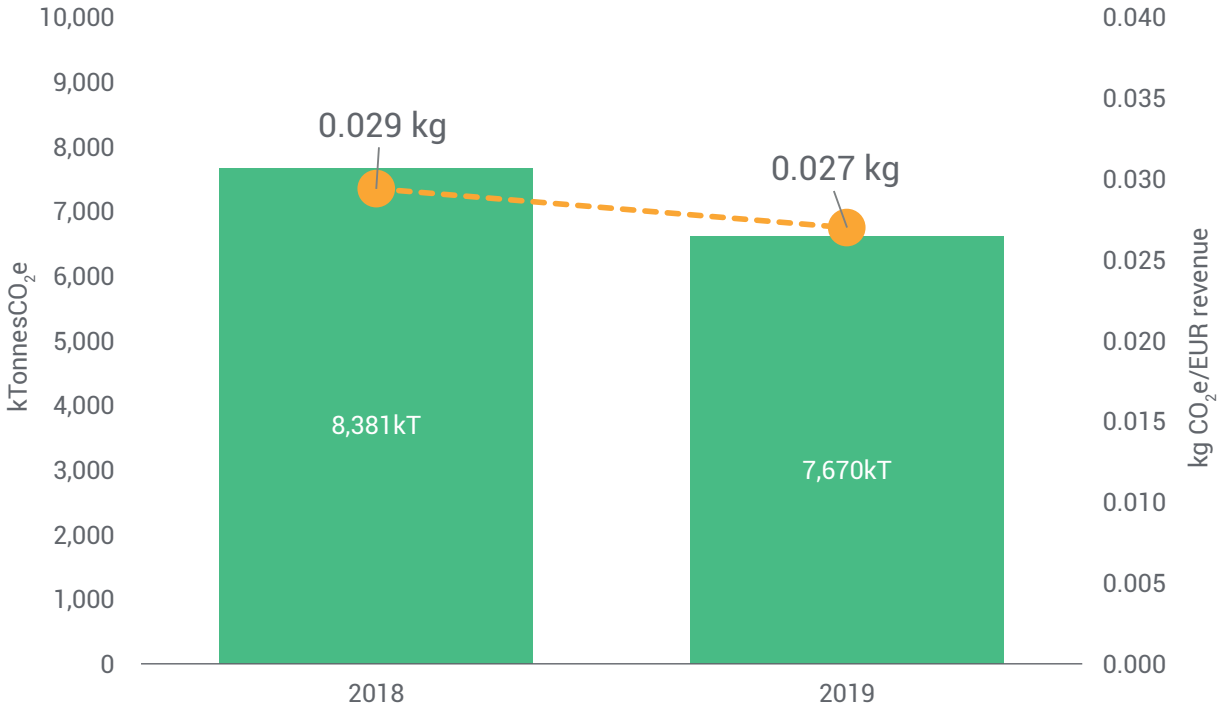
FIG 3-1 : GWh/year for renewable and non-renewable energy, Scope 1 and 2, 2018 and 2019, and year-on-year growth ETNO Group level



Source: Analysys Mason, 2020

> **“Green transition in telecoms: renewable energy goes up, emissions per revenue go down”**

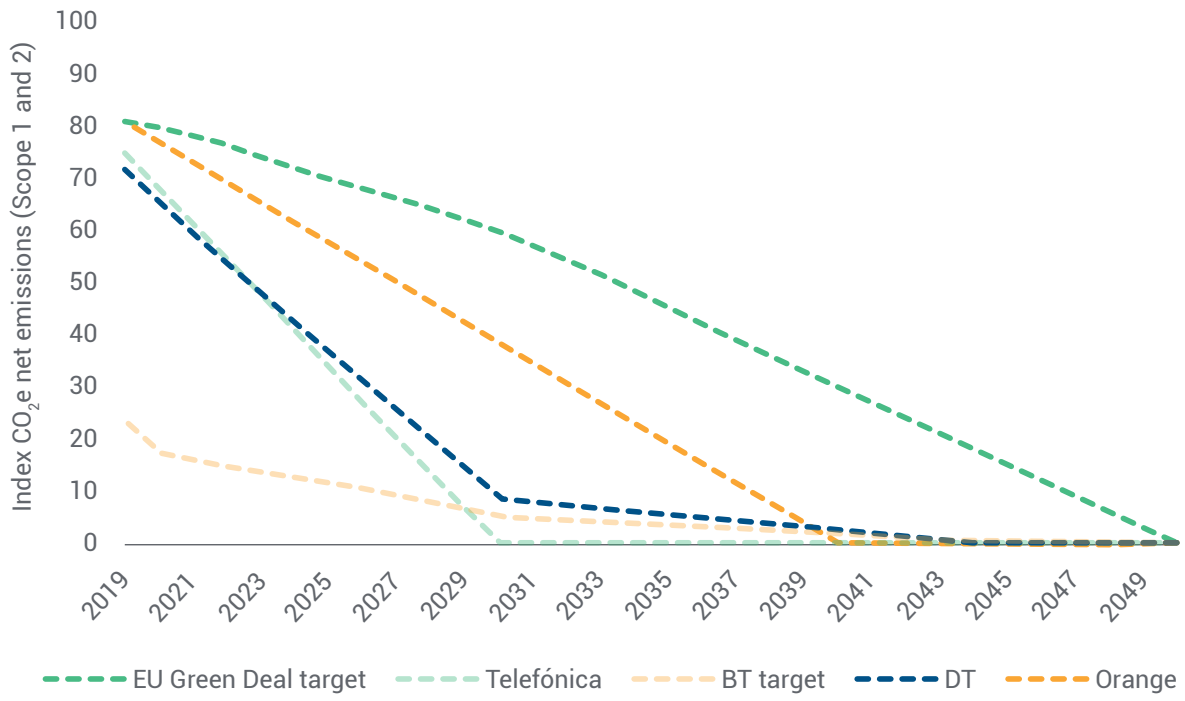
FIG 3-2 : CO2e emission, 2018-2019, and per revenue, Scope 1 and 2 only, ETNO member group level



Source: Analysys Mason, 2020

ETNO members remain active in their focus on reducing the emissions under their control (under Scope 1 and Scope 2), and they have targets that are similar to those of cloud providers in many cases. Several ETNO Members (including Deutsche Telekom, BT, KPN, Swisscom, Telefónica and others) are members of the global collaborative RE100 group, 260 companies committed to going 100% renewable, reporting annually on their progress. Several ETNO members, Including Deutsche Telekom, Telefónica and Orange, are among a wider list of large enterprises from various sectors that also support the EC target to achieve at least a 55% reduction of emissions by 2030.

FIG 3-3 : Selected Scope 1 and 2 CO2e emissions targets against EU 2030 targets



Source: Analysys Mason, 2020

ETNO members have recently accelerated their plans to lower Scope 1 and Scope 2 CO2e emissions. In December 2020 Telefónica shifted to a target of 2025 for zero net emissions. Deutsche Telekom and BT are aiming for a 90% reduction on their 2017 emissions by 2030. In addition, BT targets to achieve zero net emissions by 2045. Orange is targeting 2040 for carbon neutrality without offset, along with Telefónica. This year Deutsche Telekom will obtain all electricity from renewable energies. Rapid early improvements will however become more difficult to replicate as the shift to renewable energy is completed and harder-to-accomplish tasks remain.

Several ETNO members partner with hyperscale cloud providers, which in turn are expected to act to dramatically reduce their own footprint. Microsoft Azure has targeted 100% renewal energy by 2025. Google Cloud Platform claims to be the greenest cloud provider, with 100% renewable energy and a goal of being 100% decarbonised by 2030. Amazon AWS has a goal to use 80% renewables by 2024 and 100% by 2030.

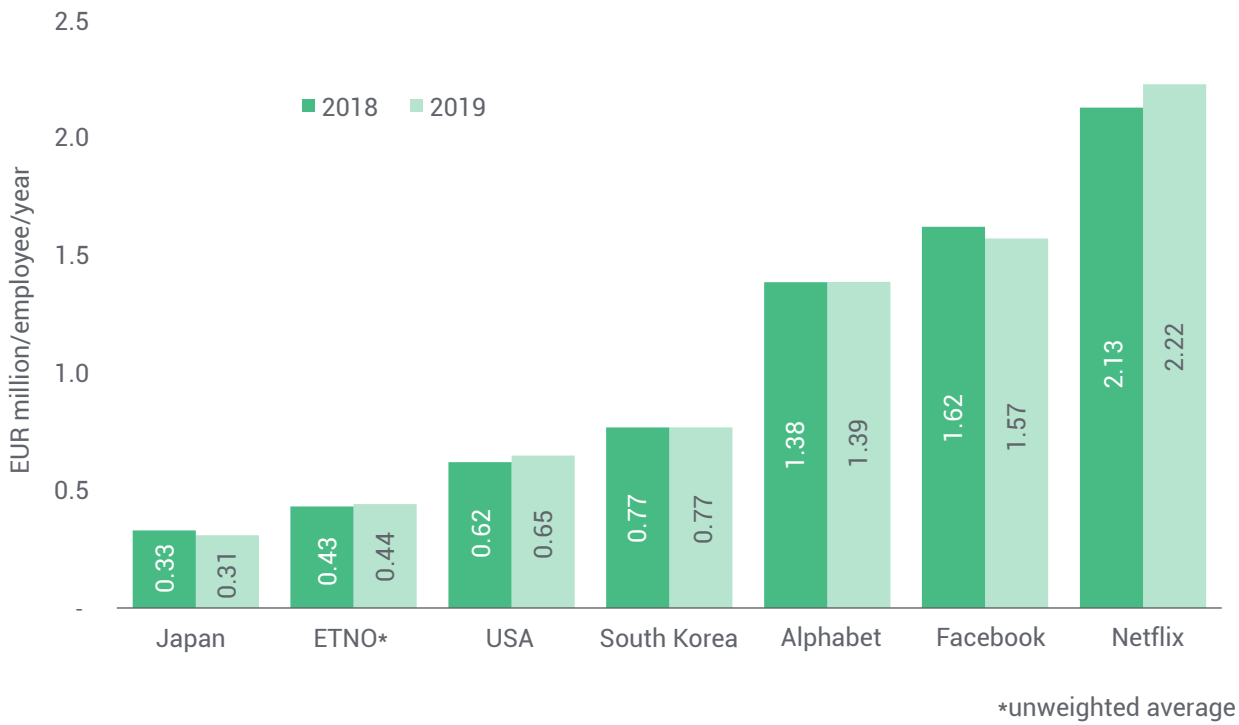
Responsibility to reduce carbon emissions runs throughout the supply chain and in addition to the carbon emissions under their control, ETNO members are also active in influencing other parts of their upstream and downstream supply chains. Telia, for example, is engaging with equipment suppliers to create plans to reach zero CO2 by 2030, including in their supply chains.

2. CREATING A SMARTER SOCIETY WITH AI TECHNOLOGY

ETNO members have a direct need for AI to improve the efficiency of their operations. At the same time, wider use of AI to support new and more complex services represents an opportunity for them. AI is central in the development of systems and processes with telecoms to address these dual goals.

A measure of the internal need can be gained from a comparison of productivity (revenue per employee) in the European telecoms sector, telecoms in comparable global regions and among the hyperscalers. While ahead of Japan, it is behind the US and South Korea, and far behind hyperscalers. The comparison with hyperscalers, which rely heavily on AI and analytics-based tools and processes, is not altogether fair of course – somebody after all has to deploy and look after the geographically distributed bits of a telecoms network – but it gives some idea of the economies of scale and of the agility that can be achieved at the service layer.

FIG 3-4 : Revenue per employee, 2018-2019, ETNO operator members, comparable leading operators in USA, Japan and South Korea, and selected web hyperscale companies



Source: Analysys Mason, 2020

> **“On AI patents, Europe is behind top global peers”**

Customer-facing processes for marketing and for customer support can be improved with AI technology: for example, the use of SmartBots, such as Orange's bot for customer support or for helping to offer tailored experiences for content or services. Mass personalisation to track every customer's experience is now possible through synthetic Net Promoter Scores (NPS) to monitor each subscriber's experience.

Telecoms are active in supporting AI technology in their own business and operating support systems.

- AI is being used for use-cases associated with customer care, using automated virtual assistants that provide direct support for customers or act as intermediaries to provide call-routing to support assistance. AI is used to provide hyper-customisation of offers to subscribers to support micro-segmentation to increase offer take-up.
- Within network operations AI supports predictive maintenance and services assurance functions to improve network performance and cybersecurity. Network planning uses complex machine learning to optimise network roll-out and designs and then to support dynamic self-optimisation networks (SON).

The delivery of new 5G services will require the use of AI technology. Support for complex 5G slicing services and the associated orchestration and monitoring will require an ever-higher degree of automation. The 3GPP standard has recognised the importance of AI to 5G and has developed standards to support its use, such as NWDAF (Network Data Analytics Function).

In fact, AI is a growing part of total telecoms-related analytics and AI software sales globally. It now accounts for about 20% of revenues.

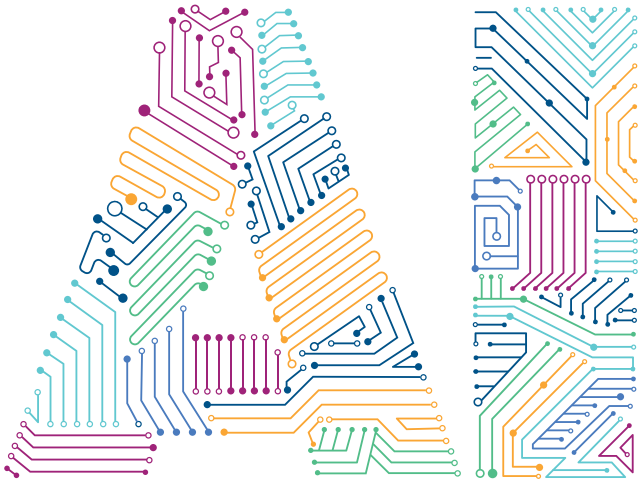
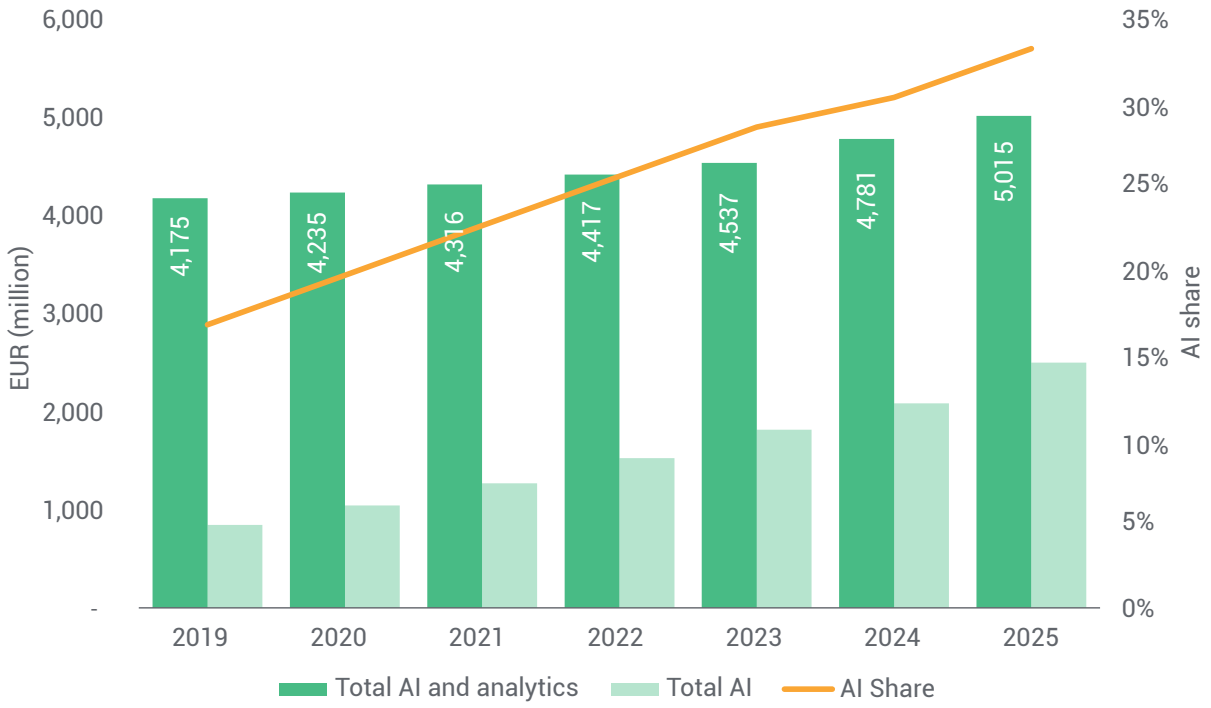


FIG 3-5 : Global telecoms software revenues associated with AI and analytics



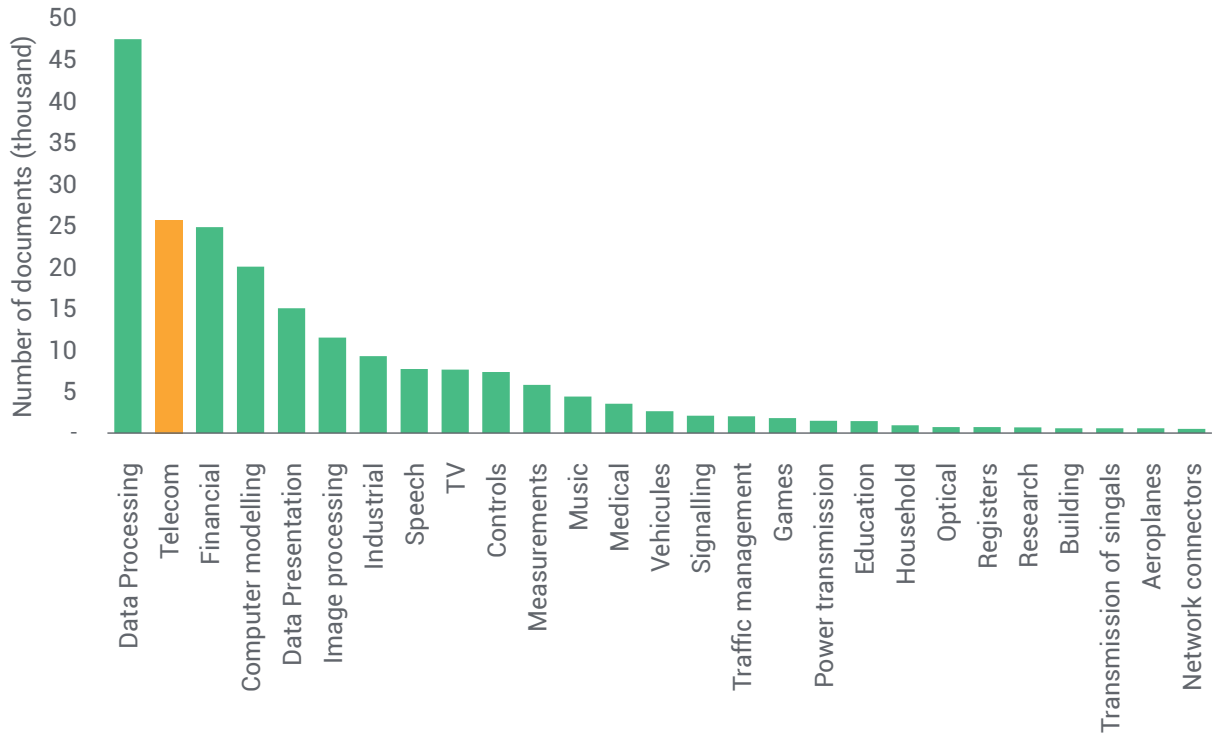
Source: Analysys Mason, 2020

Telecom operators' support for and implementation of AI within their operations helps foster the growth of AI more widely within the European region, in accordance with the EU ethical principle. The relative number of telecoms operators and locally-headquartered equipment providers within Europe, as compared to other regions, helps provide more opportunities for staff and companies to deploy AI. This helps to support European ambitions to grow and support the advanced technologies needed to build a more digital economy.

Europe needs to compete with other regions world-wide to help create a smarter society, to support its citizens with more sustainable, efficient, and better lives, but also to remain competitive and help raise wages and livelihoods. Telecoms operators have a major part to play directly in creating jobs as well as supporting other organisations. They have to compete for highly skilled talent in new technologies against other sectors, which include big data, analytics specialists, cloud technologies and new web-based companies. In this respect, the European telecoms sector punches above its weight; analysis on LinkedIn in 2020 shows that about 40% of telecoms-focused AI staff globally are based in Europe.

Patents are a measure of the level of innovation in a sector or market. Two metrics, when viewed together, serve to indicate that the European telecoms sector has a high level of activity in the AI area. The European patent office (EPO) grants patents for inventors of technologies to gain a degree of protection for their work. Each patent granted is applied for within industrial vertical categories, one of which is telecoms. Telecoms has the second-highest number of patents granted between 2010 and 2020.

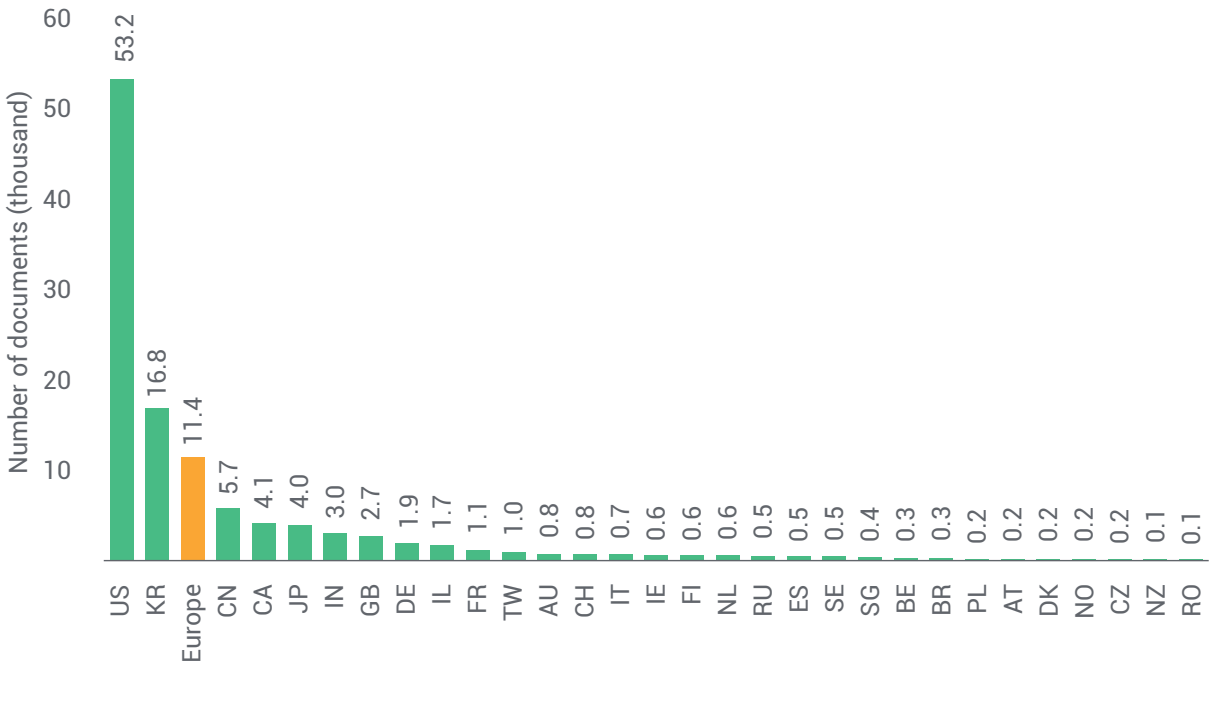
FIG 3-6 : European patent office 2010-2020 patents granted by category



Source: Analysys Mason, 2020

Europe has a significant role in the creation of new AI products; taken as a whole, Europe is the third most significant by the country of the inventor but is some way behind the USA and South Korea.

FIG 3-7 : Number of AI patents 2010-2020 by country



Source: Analysys Mason, 2020

3. LEVELLING UP DIGITAL SOCIETY

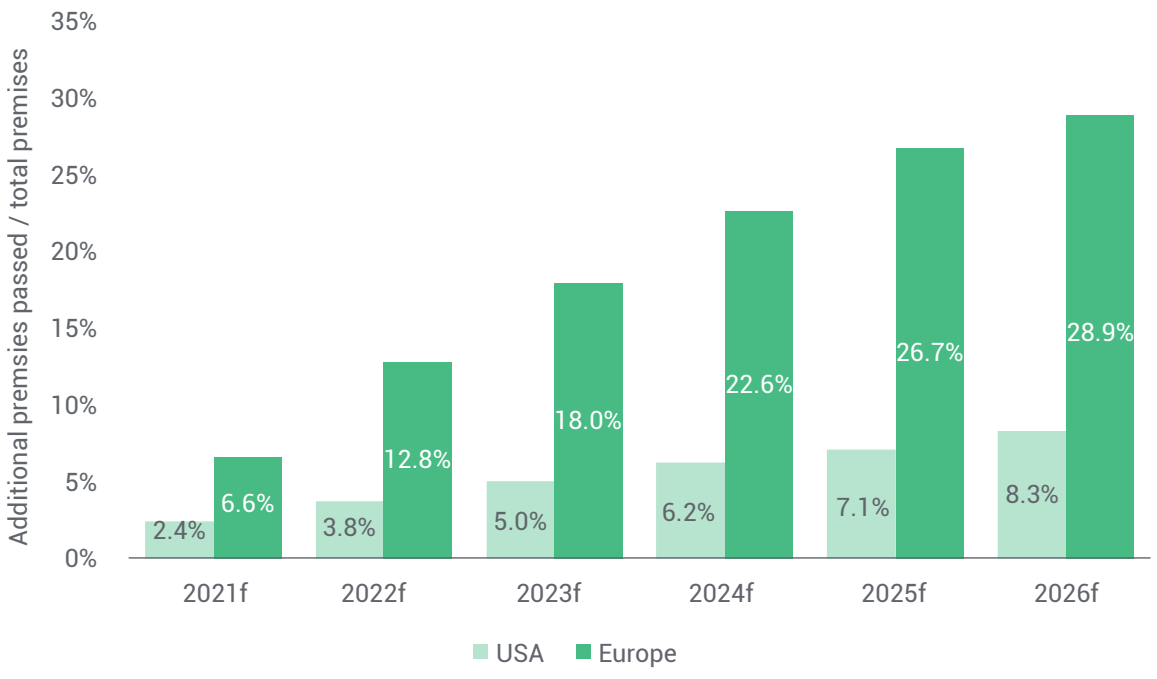
The European Commission has outlined three streams of actions within its Digital Strategy:

- technology that works for people;
- an open democratic and sustainable society;
- a fair and competitive digital economy.

To ensure that technology works for European citizens the strategy is to accelerate the roll-out of ultra-fast broadband for home, schools, and entities throughout the whole EU. In addition, the demand side of the equation is addressed in further support for Europeans in training in basic personal and business digital skills.

VHCN connectivity and in particular FTTP networks are being rolled out significantly faster in Europe than in USA, and this looks set to remain the case for the next six years. Most of this is being achieved on a purely commercial basis, and it is bolstered by the recent interest of infrastructure funds and wealth funds.

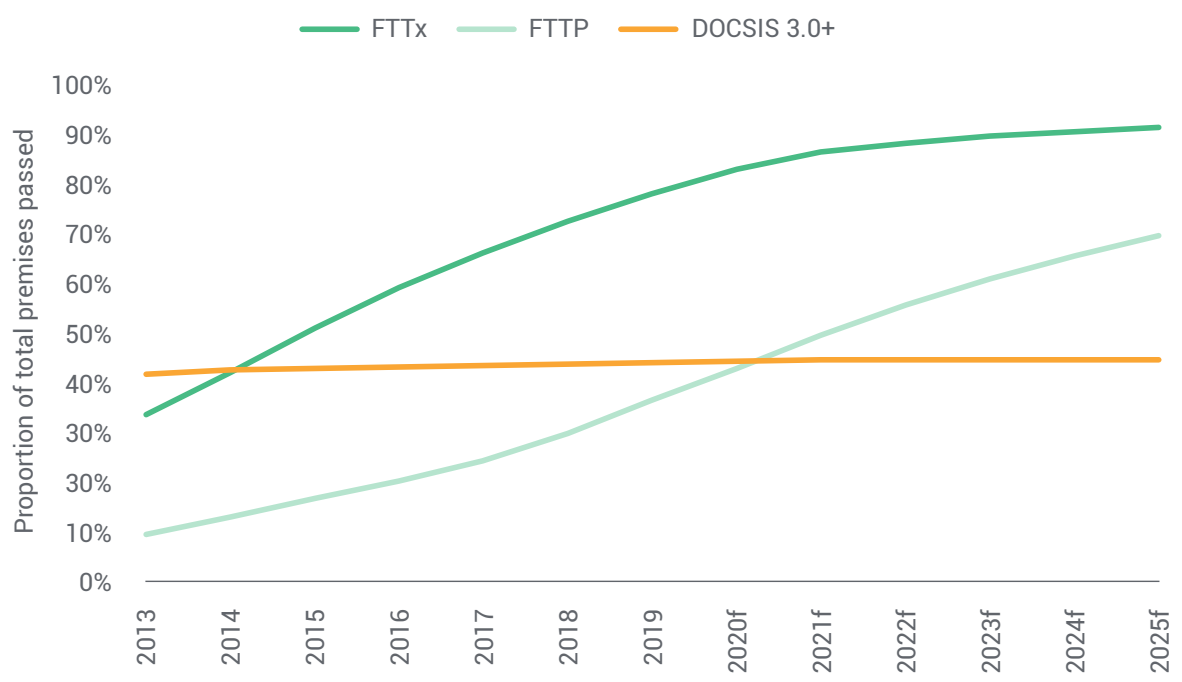
FIG 3-8 : Additional FTTP premises passed, as a proportion of total premises (estimates), 2021-2026f



Source: Analysys Mason, 2020

The good news is that FTTP roll-out is happening faster, and more is being committed to it, than had been assumed a year ago. Much of the FTTP build will overbuild existing cable networks, which are mostly gigabit-capable, and some, mainly urban, areas will have three competing gigabit-capable fixed infrastructures as well as 5G.

FIG 3-9 : Premises passed by FTTx, FTTP and DOCSIS3.0+, Europe, 2013-2025f



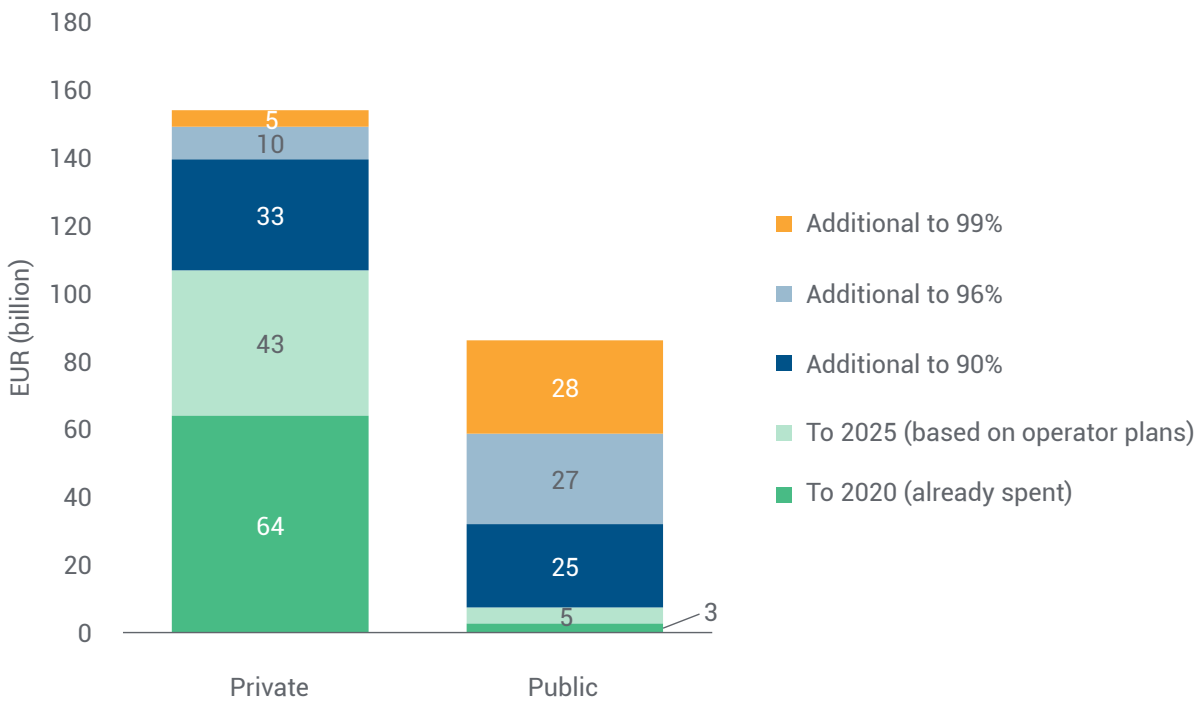
Source: Analysys Mason, 2020

However, European coverage will remain lower than Asia-Pacific markets: in China FTTP coverage is already around 95%. By 2025 it is estimated that about 30% of European properties will not be passed by FTTP services. That is not to say that private investment will not materialise for some of the remaining premises, but it is clear from most modelling that the 10%-20% of properties in the least dense areas are where costs of deploying an FTTP network start to rise very fast. The cut-off point for commercial investment will vary according to local cost factors, but everywhere there is a point beyond which private investors, whether existing operators or infrastructure funds, will not countenance investment without support.

Analysys Mason forecasts that 70% of European premises will be covered by FTTP access and 72% will have either DOCSIS3.1 or FTTP access by 2025, and that over 95% of the total FTTP capex by then (EUR114 billion) will have been privately funded.

If we assume that incentives to increase private investment do not change, and that all the rest of unpassed premises would require subsidy over and above an average private contribution of EUR600 per premises, we conclude that: it would cost about EUR126.0 billion additional capex to reach 99% of premises, bearing in mind that some of the fibre would already be in place (as part of existing FTTC and HFC networks).

FIG 3-10 : Additional cost to reach 99% of premises with FTTP



Source: Analysys Mason, 2020

In fact, 5G represents probably the best way to reach hard-to-reach and/or rural households more economically. In certain respects, 5G falls short of FTTP in terms of performance (uplink, stability and latency), but it is possible to provide a 1Gbit/s downlink on 5G FWA, and a handful of European operators already do so commercially for properties off the FTTP or cable networks. Though less expensive than FTTP for hard-to-reach properties, there are considerable additional costs over and above simple mobile economics:

- the need for engineer-installed outdoor antennas to achieve gigabit speeds;
- the need to upgrade remote cell sites with 5G where the commercial case for 5G mobile is weak, or to build new sites where otherwise they would not be required;
- higher opex than FTTP.

Support for gigabit roll out in this final segment will depend on whether, post-pandemic, policy-makers continue to adopt a largely technology-agnostic approach, and whether they see broadband as a strategic investment or as part of an industry that can largely fund itself.

Levelling up is not simply a matter of equalising supply regionally. It also involves the stimulation of digital literacy and ultimately demand among excluded groups (for example, the elderly, unemployed, those employed but with poor digital skills, vulnerable and or isolated ethnic groups), and among businesses that are not fully exploiting the opportunities and efficiencies that digital life could bring. These programmes have of course been extra important this year, but they highlighted the problem about how to deliver virtually to the very people who are least able to use these tools.

There are many examples of telecoms operators playing a key role here. Some have grown out of internal staff upskilling projects. One example is 'Operazione Risorgimento Digitale' programme, led by TIM and launched in October 2019. Italy has long had rather a stark digital divide, which does not run only on geographic lines. The programme provides free digital education paths on different platforms aimed at excluded people, businesses in particular SMEs, local public sector, schools and youths, with the aim of providing and improving the digital skills for all. In some cases, during lockdowns, this boiled down to partners providing disadvantaged youngsters in rural areas with tablets and SIMs so they could participate in distance learning. However, these are not simply about getting people online, but also levelling up the skills of those that already are.

4. EXPANDING ECONOMIES WITH NEW 5G OPPORTUNITIES

By November 2020, 18 countries in Europe had commercialised public 5G networks. Launching consumer 5G services during a pandemic hindered demand as well as supply, but experience of other generational changes suggests that, in the longer term, consumers are not likely to spend more overall and that capacity increases are met with corresponding price erosion. However, it is not in enhanced mobile broadband for consumers that telecoms operators see the main growth opportunity in 5G.

There is some industry consensus that 5G represents a major opportunity to create new business opportunities and to expand economies through industrial and other enterprise use cases for the network technology. If so, then long-term economic development requires Europe to be a leading adopter of 5G and related / adjacent technologies in order to support industry sectors. For MNOs, future 5G networks promise to be able to offer hugely differentiated services over a common infrastructure and a common expanded core.

There are two main models:

- where the industrial network user deploys a private network using either dedicated local spectrum or unlicensed spectrum, and an operator or vendor might play a role in building, integrating and managing the network;
- where the industrial network user takes a configurable slice of an existing public network. The network slice model can be deployed on 4G and non-standalone 5G networks via software upgrades, but it is an integral part of future standalone 5G networks.

The two models can co-exist so long as the spectrum allocated to the first option is not detrimental to the resources needed for the second.

“Only 1 EU country completed 5G auctions, while 12 countries have not started yet”

There are already many examples of ETNO members leading the development of new industrial networks based on 4G and 5G. These can be summarised in two main categories:

- networks for many verticals including manufacturing, distribution, public transport and transport hubs;
- they include networks that use the future-looking network slicing model as well as ones where the ETNO member partners with a third-party industrial player with its own licensed spectrum.

It remains to be seen to what extent – and through which business model – mobile operators, as opposed to the tech giants or equipment vendors, will be able to monetise the networks in terms of these new industrial services. Some European operators do not currently have the scale or resources to pursue the industrial transformation opportunity and should they wish to pursue it, will need to invest in new capabilities. They need to move quickly to provide public industrial network capability because this is also the focus for non-operator competitors. Their ability to invest depends upon scale, and that hinges on the broader regulation of the sector in Europe.

One particular aspect of regulation that determines the depth of participation in these new opportunities by the largely European-owned telecoms sector is that of spectrum policy and allocation.

4.1 5G spectrum release has been stalled and the approach to allocation is inconsistent

Several 5G spectrum auctions have been delayed in 2020, in part because of the Covid-19 pandemic. European operators, already spending heavily to upgrade infrastructure and suffering from heavy competition as compared to other regions, the motivation (or ability) to roll out 5G fast has not been strong, and so delays in auction processes have not been entirely unwelcome.

Roll-out of 5G in Europe has been patchy, and 5G still represents a low single-digit percentage of total connections in all countries. One factor that holds back the market is slow and patchy releases of spectrum, which often creates an artificially high cost of spectrum. **FIG 3-12** shows the varying speeds at which spectrum has been released across the continent.

FIG 3-11 : State of development of 5G spectrum auctions in European countries, November 2020

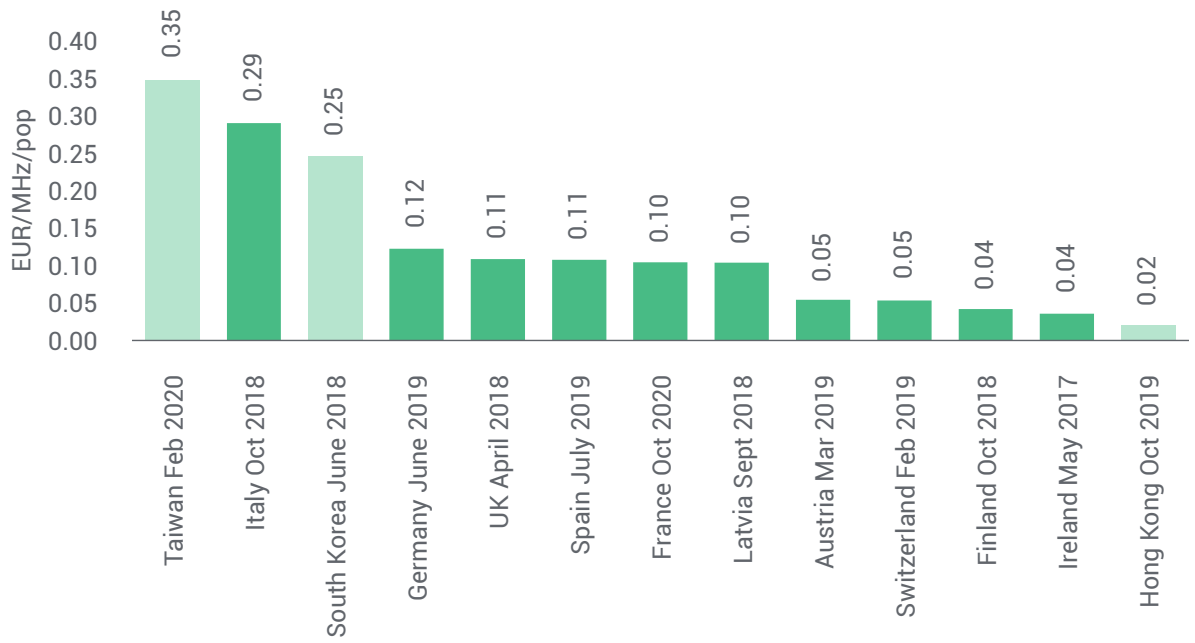
	700MHz	3.4GHz	3.5GHz	3.6GHz	3.7GHz	mmWave >24GHz
Austria	auction concluded	auction concluded	auction concluded	auction concluded	auction concluded	
Belgium	auction announced	consultation opened	consultation opened	auction announced	consultation opened	
Bulgaria		consultation opened	consultation opened	consultation opened	consultation opened	
Croatia	auction announced	auction announced	auction announced	auction announced	auction announced	
Czech Republic	auction concluded	auction concluded	auction concluded	auction concluded		
Denmark	consultation concluded		consultation concluded			
Estonia	consultation concluded	consultation concluded	consultation concluded	auction announced	consultation concluded	
Finland	auction concluded	auction concluded	auction concluded	auction concluded	auction concluded	auction concluded
France	auction concluded	auction concluded	auction concluded	auction concluded	auction concluded	
Germany	auction concluded	auction concluded	auction concluded	auction concluded		
Greece		auction announced	auction announced	auction announced	auction announced	auction announced
Hungary	auction proposed		auction concluded	auction concluded	auction concluded	
Iceland	auction concluded		allocated with no auction	allocated with no auction	allocated with no auction	
Ireland	consultation opened	auction concluded	auction concluded	auction concluded	auction concluded	
Italy	auction concluded	consultation opened	consultation opened	auction concluded	auction concluded	auction concluded
Latvia		auction concluded		auction concluded	auction concluded	

	700MHz	3.4GHz	3.5GHz	3.6GHz	3.7GHz	mmWave >24GHz
Lithuania		consultation opened	consultation opened	consultation opened	consultation opened	
Luxembourg	auction concluded	auction concluded	auction concluded	auction concluded		
Malta	auction proposed					
Netherlands	auction concluded	auction announced			auction announced	
Norway	auction concluded					
Poland	consultation opened	consultation opened	auction announced	auction announced	auction announced	
Portugal	auction announced			auction announced		consultation concluded
Romania	consultation opened	consultation opened	consultation opened	consultation opened		
Slovenia	consultation concluded	auction announced				auction proposed
Spain	auction proposed	auction proposed	auction proposed	auction concluded	auction concluded	
Sweden	auction concluded	auction announced	auction concluded	auction announced	auction announced	auction announced
Switzerland	auction concluded	auction concluded	auction concluded	auction concluded		
United Kingdom	consultation opened	auction concluded	auction concluded	auction concluded	consultation opened	

Source: Analysys Mason, 2020

While 5G, like 4G, is not proving to be the cash bonanza that was 3G, the sums already spent are high. The spend created at auctions per MHz/pop is improbably uneven relative to likely demand or requirements; it is to a large extent a function of the way the auctions are set up. So for example there is insufficient difference on the demand side to explain why 3.5GHz spectrum in Italy commanded a value some seven times higher than in Finland.

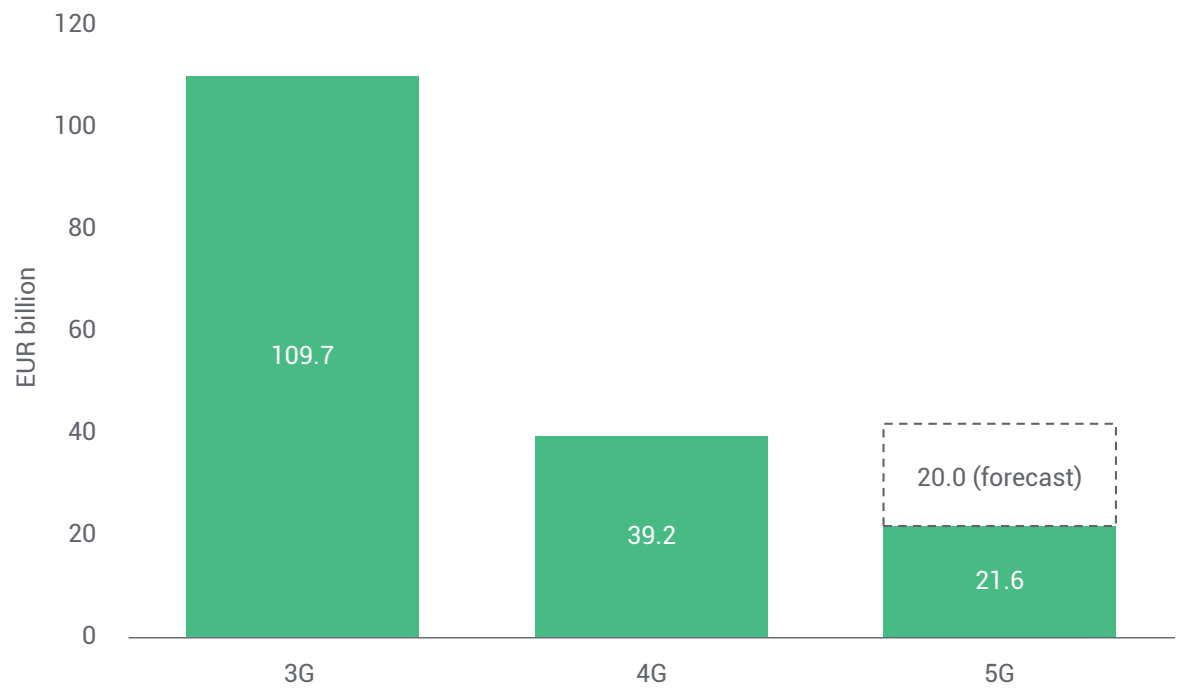
FIG 3-12 : C-band (3400-3800MHz) spectrum prices, normalised, by November 2020



Source: Analysys Mason, 2020

By November 2020, EUR21.6 billion had been spent in Europe at auctions in the principal 5G bands (700MHz, 3.4GHz-3.8GHz and mmWave). At current average values and given what we know about likely allocations the total amount raised is likely to be similar to, or perhaps slightly higher than, that raised for 4G.

FIG 3-13 : Prices paid at auction for 3G, 4G and 5G licences, 2000 –November 2020



Source: Analysys Mason, 2020

Not every country in the world conducts auctions for mobile spectrum. Other advanced economies see communications networks as too strategic. Japan, for example, conducted a 'beauty contest' for 5G spectrum licences in 2019, and China has directly allocated spectrum to operators.

There is little consistency of approach to spectrum across the continent and it requires more harmonisation. Some European jurisdictions do recognise the opportunity cost and have adapted their regimes. For example, in the 'New Deal' approach in France, the renewal of some licences has been granted without fees in exchange for commitment to improved and quicker rural mobile coverage. Other jurisdictions have, however, sometimes appeared to prioritise maximising the monetisation of spectrum, creating a supply-side bottleneck that impacts the roll-out of 5G. While it must be recognised that money raised by auctions goes on important public expenditure, some auctions appear to be designed to extract the maximum bids and appear not give sufficient consideration to the public benefits of new networks. There is an opportunity cost associated with the amount spent at 5G auctions. Spend at 5G auctions has a direct impact on operators' ability to invest in additional fixed or mobile infrastructure, and hence regions where the business-case is more marginal or risky may not benefit from the most future-proof or highest-performance networks.
A further inconsistency has been the application of conditions for mobile market access. Some regulators favour the entrance of a new fourth player through 5G licensing, just as they did when previous generations were introduced, sometimes on discriminatory basis and neglecting the consequential value erosion of the market. This goes as far as setting aside frequencies in the C-band and other lower-frequency bands for new entrants, and to impose new long-term national roaming obligations for the existing MNOs and lighter (or even no) coverage obligations for new entrants. These

moves could lead to underinvestment in 5G both by the new entrant itself, with roaming rights, and by the existing operators that would face more downward pressure on prices. While there are differences in competition levels and prices between European markets, it also has to be borne in mind that telecoms users in just about any European market benefit from lower prices and higher levels of choice and competition compared with the rest of the world.

Due to the level of competition of the mobile market, relying on conventional ex-ante regulation might also appear short-sighted. The evolution of the market with 5G, cloud facilities, virtualisation, will give higher degrees of operational and service autonomy lowering barriers to entry and leading to potential new and more flexible cooperation or partnership business-models.

Another inconsistency is the uneven application of cybersecurity considerations arising from the broad geopolitical pressures on smaller countries. The EU has proven willing, through the application of the 5G Toolbox, to harmonise measures on cybersecurity, but EU member states' practices may still differ from one country to another. For example, a Member State asked companies taking part in its 5G spectrum auctions to remove certain components from their networks by 2025, a time-consuming and costly exercise. This resulted in a successful legal challenge, but the pursuit of outcomes through the courts simply creates further delays. Even after auctions have concluded, there are often bureaucratic hurdles to overcome. Operators can face difficulties getting permits from their relevant local and regional authorities for 5G equipment, and they face an uphill struggle to educate decision-makers, and the public that elects them, about the scientific facts behind 5G.

In a post-Covid world, where public budgets are stretched, policy-makers have a difficult balancing act. On the one hand, some may take a view that telecoms is a business that has been able, by and large, to look after itself during the crisis, that has networks that have proven good enough, and that continues to generate decent margins. On the other hand, some may take the view that the pandemic has created a strategic requirement for excellent, universal and resilient network provision, and that part of economic recovery depends on 5G, so taxation in the form of spectrum licences is counterproductive.

4.2 Industrial and IoT spectrum policies in Europe

Many European governments have given 5G a prominent role in industrial and digital strategy programmes, and it is also likely to be central to some post-Covid recovery initiatives. That will mean building networks differently in the 5G era, to be optimised for low latency, high availability, high density or ultra-low power operations, and not just for generic mobile broadband, in order to enable a wide diversity of enterprise and IoT services.

This has led to regulators evaluating ways to ensure that spectrum regulation facilitates the use of 5G for industrial and IoT applications. These can range from spectrum being earmarked for B2B use or for private networks; to obligations placed on MNO spectrum owners to support industrial requirements such as improved indoor or remote site coverage. In Europe, there have been different approaches taken so far, and many of the world's new regulatory ideas on licensed enterprise spectrum are emanating from Europe. Some regulators are adopting new policies to prioritise mainly C-band spectrum for industrial use, while others are taking a different approach asking the operators to open the slicing functionalities allowing differentiation at the latest in 2023, and still others have assigned the whole of the 3.5GHz band to mobile operators, but with a framework in place to facilitate effective collaboration with industries, to ensure the 5G networks meet their needs.

In all cases, the well-intentioned goal is to lower barriers to deployment of optimised enterprise 5G networks. However, highly diversified spectrum ownership (where industrial and other non-traditional owners have dedicated spectrum band) risks inefficient use and management of spectrum, and this means a lower quality of service for general mobile users. Unlike private networks, the network slicing model allows for multiple and diverse networks to co-exist over a common general-purpose network, reducing unnecessary capital expenditure and optimising the utilisation of network and spectrum resources.

5. PLAYING A LEADING ROLE IN THE EARLY DEVELOPMENT OF 6G

The mobile industry is in the early stages of considering what '6G' may consist of, with their eyes on initial standards work in the late 2020s. Much of the early academic and R&D work has focused on opening up even higher frequency spectrum for mobile usage, particularly in the so-called 'terahertz' range (in cellular terms, from 100GHz to 540GHz). This will support extremely high speed, short range transmissions but it will be challenging to develop radio chips that can be implemented using mainstream, affordable technology.

Some of the early work on future applications using spectrum >100GHz has been carried out in Europe.

- Under the auspices of the EU's Horizon 2020 research and innovation program, the TERRANOVA project envisions to extend fibre-optic systems' Quality of Experience to wireless links by exploiting frequencies above 275GHz, meaning reliable connectivity at extremely high data rates in the Tbit/s range and almost 'zero-latency' for networks beyond 5G". The consortium includes University of Piraeus, University of Oulu, Altice Labs, Intracom Telecom, JCP Connect, PI-Cadvanced and Fraunhofer.
- The same Horizon 2020 program, also supports the iBROW project (innovative ultra-broadband ubiquitous wireless communications through terahertz transceivers), led by the University of Glasgow, UK.
- One of ETSI's Industry Specification Groups, called mWT, was set up to promote the use of spectrum from 50GHz up to 300GHz for present and future critical transmission use cases.
- In September 2019, Finland's University of Oulu published the first 6G white paper. This was produced by the 6G Flagship research programme. The paper tried to set out the initial parameters for a broad view of what 6G might entail, including commercial and technical drivers, R&D requirements, and the key challenges and questions that need to be addressed in mapping out a 6G agenda.
- The French technology research institute CEA-Leti recently demonstrated a radio transmission that reached speeds of 100Gbit/s in the D-band between 110GHz and 170 GHz, which is central to the idea of terahertz or 6G communications. Potential 'beyond-5G' applications it considers include very high capacity backhaul and fronthaul; support for super-high speed services such as holographic communications; and short range device-to-device connectivity with support for vast numbers of end-points. The common feature of these applications is a data transfer speed of above 100Gbit/s per cell or per link, which is not seen as commercially practical for 5G radio or for the lower reaches of mmWave spectrum.

Early leadership in 6G is strategically important for Europe. Geo-political factors, over which European industry as a whole has limited influence, have created a market structure in which European vendors' and operators' partnerships can now have a greater influence on shaping the future of mobile, and reaping the benefits of leadership. Hexa-X, launched in late 2020 as the European Union's flagship initiative for research into 6G wireless networks, is the first official research initiative across the industry ecosystem to accelerate and foster 6G research and drive European leadership in the 6G era. Hexa-X is project-led by European vendors of network equipment and its participants include European operators, other equipment vendors, industry verticals, tech businesses and academia.

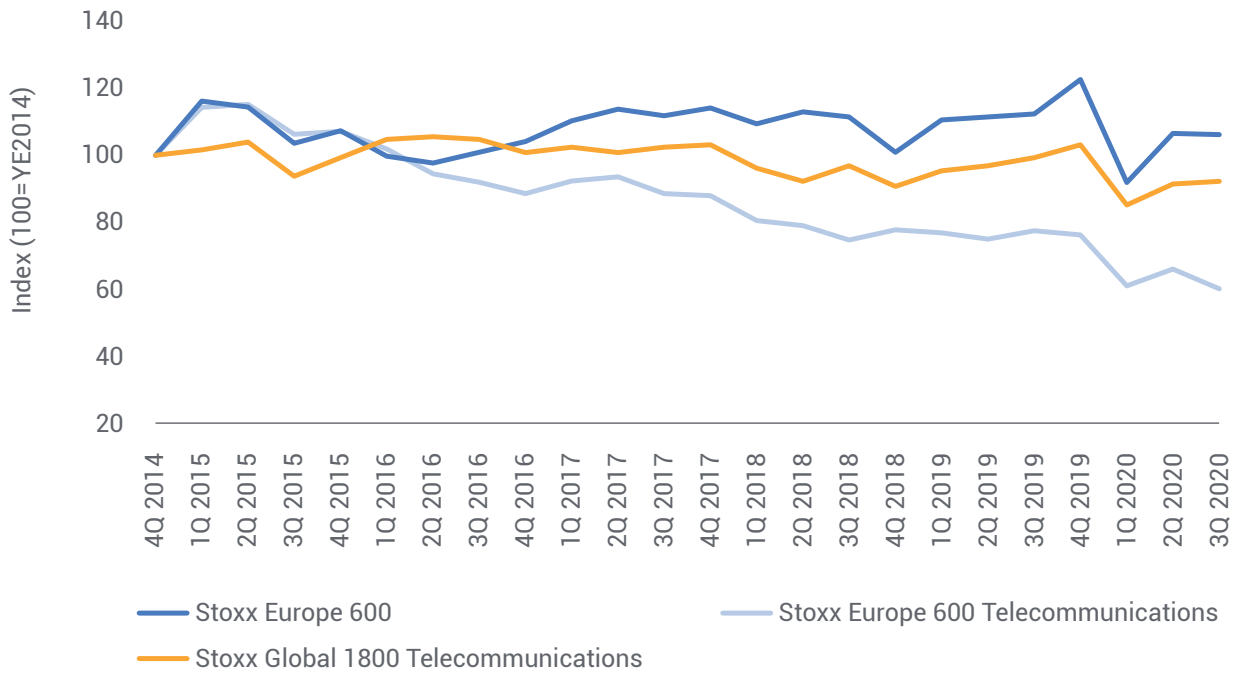
SECTION 4

Key learning points: Networks are vital

The Covid-19 pandemic has shown networks to be, in a literal sense, vital. It has accelerated digital innovation. Society is becoming built upon networks, not simply a user of networks. In this chapter we show that telecom operators have benefitted little from such trends and we explain why, compared to global peers, the European industry was further weakened by the regulatory context.

The pandemic has highlighted an issue that has bedevilled the operator business for many years. Whole countries depend upon telecoms networks for personal and economic continuity, and for their future prosperity and well-being, yet the market continues not to value them. Revenue for some of the services that depend upon networks increases dramatically, yet that of telecoms barely budges, despite huge shifts in demand. Hence in 2020, the share-prices of European telecoms have continued their long downward trajectory.

FIG 4-1 : Stoxx Europe 600 index, Stoxx Europe 600 index for telecommunications, and Stoxx Global 1800 index for telecommunications, 4Q 2014–3Q 2020

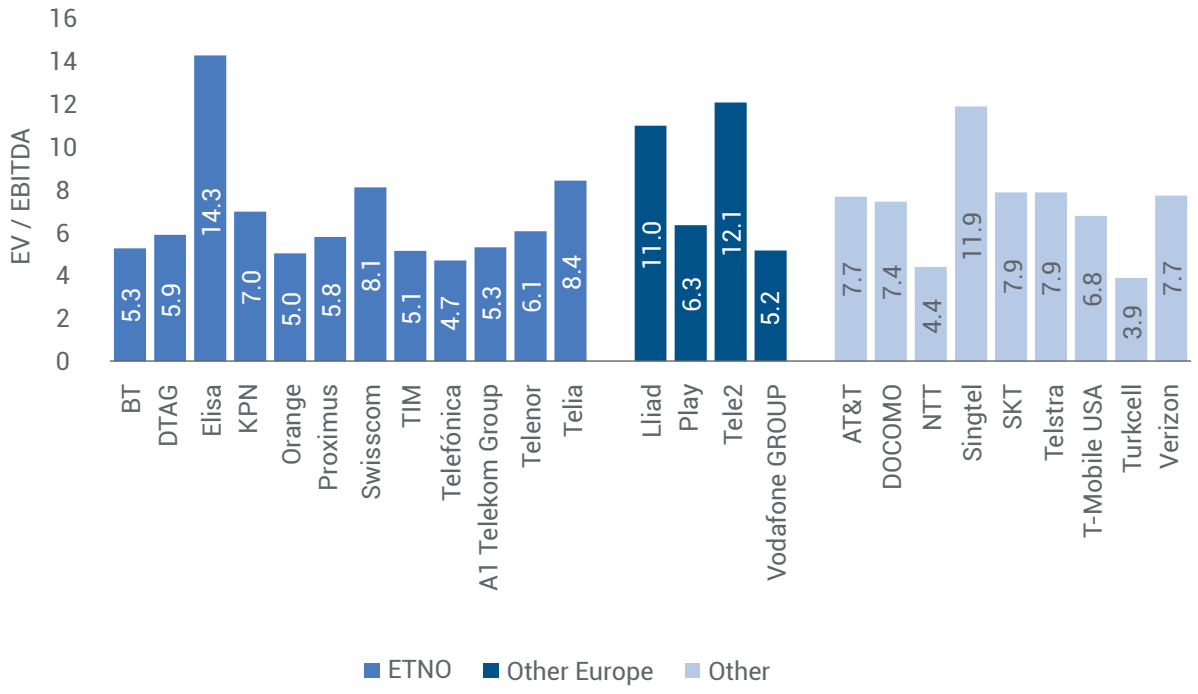


Source: Analysys Mason, 2020

Enterprise value / EBITDA multiples were low again at the end of 2019 reflecting what the market sees as poor growth prospects, but also in part because of a continuing concern that the sum of the parts of European telecoms is worth more than the whole in financial terms. Captive towerco subsidiaries have not made much difference to valuation, although the valuations of these entities when stakes are sold or floated indicate multiples that tend to be far higher than those of the parent companies.

> **“Strengthening the European telecom sector is key to EU digital leadership”**

FIG 4-2 : Enterprise value / EBITDA, ETNO members and others, end of last full financial year



Source: Analysys Mason, 2020

Some of this bleeding of value can be put down to a global trend, the long-term disaggregation of:

- the service/software layer, which has shifted mostly to the cloud, is driven by scale and data analytics, and is dominated by a mere handful of players;
- the physical network layer, the world of fibres, towers, spectrum and antenna investments that are specific to geographic locations.

Operators want a foot in both camps. Perhaps where they overlap the most is in the nascent world of Edge Cloud computing. In a world of competing telecoms networks, no operator is immune from these forces of disaggregation that were set in motion decades ago with the Internet Protocol. The irony remains that although there will be no economic gain without the expense of buying spectrum and deploying physical networks, the entities that have invested most in the network are far from guaranteed a large share of that value. This is a very relevant trend for policymakers, especially at a time in which they ask the European telecoms sector to dramatically increase both the investment capacity and the speed of roll-out.

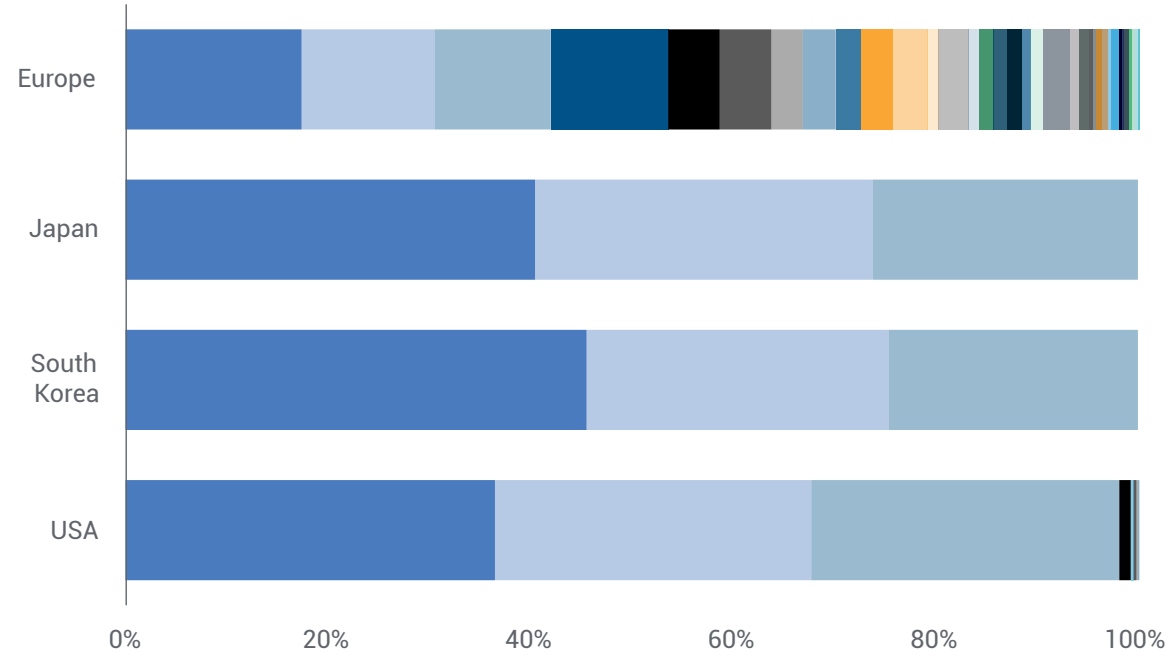
The ceding of value happens at the other end of the value chain as well. Physical assets such as towers and FTTP networks generate safe long-term returns. A new class of player that focuses on physical telecoms assets is emerging from this disaggregation process. These businesses, which have no direct interest in digital services, command far higher multiples than telecoms operators themselves, making sales or partial sales, mostly to infrastructure investment funds, an enticing cash-generating option for operators with constrained cash-flows for future investment. These entities wield increasing market power, are increasing the number of asset-classes they own and are exploring synergies

among them, and arguably they have the potential ultimately to emerge as the corollaries to the cloud based hyperscalers.

Some of the loss of value is a European phenomenon. European telecoms stocks have been losing value faster than telecoms stocks elsewhere. The forces of disaggregation are clearer to behold in Europe than elsewhere. This can be attributed to the fragmented nature of the European telecoms sector. The EU is not a single market yet, and one of its largest economies has walked out and seems ever less likely to adhere to European-style competition or even data protection principles. European telecoms remain heavily regulated, consolidation is difficult, there is still little co-ordination of spectrum policy, and as a consequence the make-up of the market is quite unlike those of similar advanced economies.

The four largest operating groups in Europe (Deutsche Telekom, Orange, Telefónica, Vodafone) account for only around half of total telecoms revenue, and 54% of mobile revenue, and the fixed market is even more fragmented.

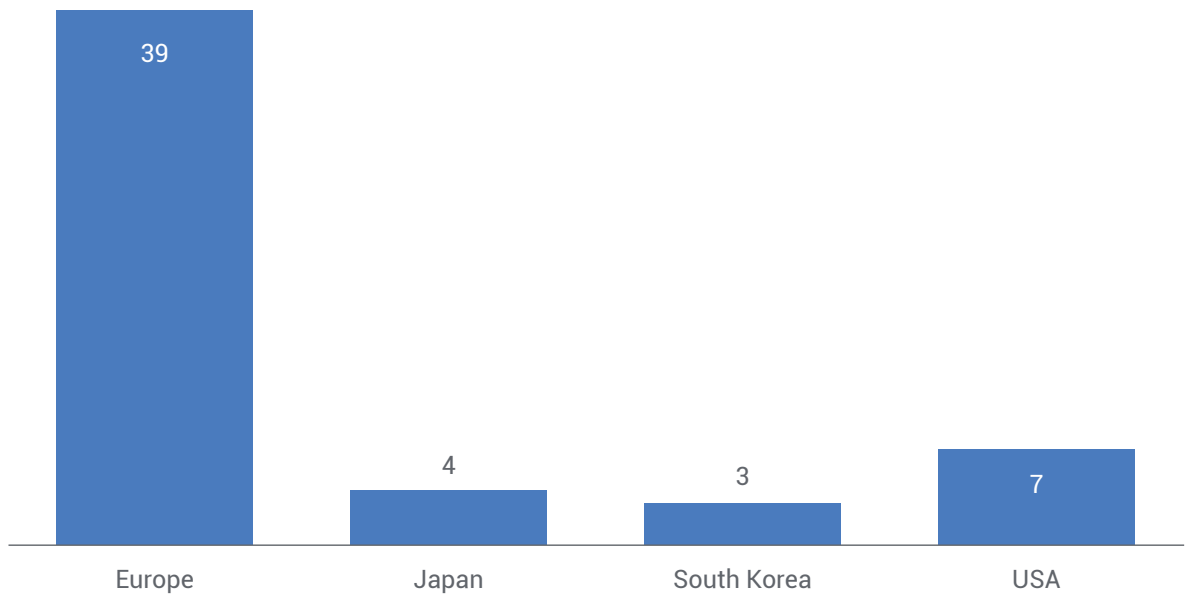
FIG 4-3 : Share of mobile service revenue by operating group, Europe, Japan, South Korea, USA, 2Q 2020



Source: Analysys Mason, 2020

In fact, there were still an astonishing 39 operating groups with over 500 000 mobile subscribers in Europe at 2Q 2020. There has been no instance of in-market mobile consolidation since 2018; most significant consolidation has been cable plus mobile.

FIG 4-5 : Number of MNOs operating groups with over 500 000 subscribers, Europe, Japan, South Korea, USA, 2Q 2020



Source: Analysys Mason, 2020

The recent European Digital Markets Act and Digital Services Act are the first major overhaul of Internet regulation in Europe for two decades, and the acts address large Internet players' anti-competitive and harmful practices respectively. Yet Europe still has an asymmetry of regulation between digital and telco in terms of security, confidentiality, taxation, and transparency. Operators are subject to extra layers of privacy regulation, for example on metadata. This is not only inconsistent with respect to the GDPR, but it also creates an asymmetry in terms of competitiveness.

All of this matters. European telecoms operators are largely in European ownership, and European telecoms operators are some of the largest ICT businesses in the continent. Low valuations of telecoms stock make the sector more susceptible to aggressive M&A and potential hostile approaches from non-European actors. At the same time private equity has never been larger and debt is cheap. Private equity has proven to be valuable for timely co-investment in infrastructure, but they will not typically wish to be involved in building a digital competitive advantage in the EU.

There is now an opportunity to foster a digital world in a European way, aligned with European values, instead of ceding ever more control to large international players and to infrastructure investment trusts. Excess and unevenly applied regulation can restrict the advantages and economies of scale, it can stifle innovation and investment in riskier but potentially higher areas of the digital economy. But it also holds back the speed at which operators can deploy new networks fit for the accelerated demands of the post-pandemic age.

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