etno

Connectivity & Beyond

How Telcos Can Accelerate a Digital Future for All

Research by Boston
Consulting Group

BCG

Our Framework

06 **Energizing the Spirit of European Innovation**
Industrial strategy and cooperation

05 **Advancing the Readiness of Citizens**
Digital skills

04 **Expanding the Reach of Opportunity**
Digitalization of the economy and society

03 **Taking the Lead**
European solutions for data and services

02 **Constructing the Full Foundation**
Networks and connectivity

01 **Our Commitment**
We want to raise the ambition

Executive Summary

Europe's telcos want to raise the ambition. Digital opportunities are big part of the future for the economy and for society. Research shows that 5G alone can generate €113 billion an annual GDP impact and 2.4 million new jobs in 2025 in Europe. BCG analysis shows that €150 billion investment is still needed to achieve a full 5G deployment in Europe. We—the European telecoms sector—call for urgent and swift action to mobilize all the resources needed so that Europe can build on this foundation to do much more. Our ambition, as a sector, is to achieve positive societal impact and support our economies and our societies in the green and digital transitions. Essential services, such as education and health care, depend more and more on digital delivery. Entire industries are digitalizing fast, but the work towards full digitalization is still incomplete. Sustainability and climate change are today top issues for us and for our customers, and we are in a strong position to help.

We have a clear vision. Our own futures as businesses depend on our ability to deliver innovative products and services, built on the foundation of high-speed and secure connectivity, that enable others to do more in a sustainable digital economy and society.

European cooperation is the starting point. Policy makers and the telecom industry have long debated the proper role for, and rules regulating, Europe's telcos. Meanwhile, technologies advance, startups armed with new tech and business models disrupt long-established industries, and consumers embrace new ways of doing things. The COVID-19 pandemic has caused a global reset in how we lead our lives.

Looking ahead to the rest of this decade and beyond, we see big challenges for the European integration project and equally big opportunities for Europe's digital future. Europe needs to up its game. It has the know-how and the resources; it has been a leader in such technologies as cellular communications and semiconductor design. Having opened substantial leads in foundational technologies such as cloud, the US and China are now making rapid progress on the advanced technologies of the future such as artificial intelligence, spatial computing,

and, in time, quantum computing. Europe needs to move forward together, now.

Here are five critical areas in which telcos can make a difference and play a leadership role for the benefit of the whole of Europe.

1. Constructing the Full Foundation | Networks and Connectivity

Europe's telcos are building the infrastructure that is indispensable to digitizing society. This will require an estimated additional €150 billion to upgrade fixed infrastructure to gigabit speeds and €150 billion to build full infrastructure to enable a comprehensive 5G vision (for definitions, see Chapter 1). Our companies are mobilizing massive investment to build digital infrastructures and expand capacity and coverage with the ambition of connecting everyone through high-quality networks. Our purpose is to ensure that all sectors of the economy and society are in the position to benefit from new generation networks and the services they enable. Efficient usage of network capacity, also driven by economic incentives, will be key to align increasing demand with improved environmental standards. Sustainability is today embedded in our decision-making and we embrace the awareness that profitability must go hand in hand with our societal contribution.

Governments and regulators must help to speed the process and increase its impact. Investment in European network roll-out must become attractive again and the long-term sustainability of the telecoms sector fostered: this is a matter relevant to all sectors of Europe's economy and society. Spectrum and other public resources like installation sites should be made available in a timely and cost-effective way, at the right conditions: the common aim should be to reach every European. Building global scale for our telecoms sector and encouraging horizontal cooperation should be shared ambitions, as they enable both global digital leadership and faster roll-out. A fresh, renewed policy attention to the demand side is highly needed: promoting uptake of new digital networks is Europe's way to digitalizing the continent and making it more sustainable.

2. Taking the Lead | European Solutions for Data and Services

It will take shared platforms—born from European values and tailored to Europe's needs—to set a new digital standard, that Europe can rely on because it safeguards data, protects people, and secures connection. Today, 78% of the global cloud market is controlled by the top four players, none of which is European. We must set the ambition higher and be able to take a leadership position also in data and services.

Telcos are taking an increasingly active role in creating and implementing European leadership and standards in areas such as edge computing, Open RAN, and cloud solutions. We will work together in a united and open way with other industrial players to enable scalable solutions where Europe can take a lead and support rollout of an EU-wide solution, for example, via eID, by offering secure identification solutions, such as mobile ID.

Governments and regulators can foster and incentivize **European platforms and initiatives** on RAN as well as cloud and edge computing. **Collaboration** at the network and service levels should be supported. Digitalization of **public services** should be used as a lever to promote broader digitalization of economy and society.

3. Expanding the Reach of Opportunity | Digitalization of the Economy and Society

Europe needs products and solutions to accelerate digitization in areas with the most societal value. Today, 83% of EU SMEs do not use advanced cloud services and over 60% nine-years-olds are in schools which are still not digitally equipped.

Telcos can further develop solutions with the goal of benefitting society, such as by enabling continuity of education, improving the resiliency of small businesses, and enabling other industrial sectors to improve their productivity, innovation potential, and sustainability, while cutting greenhouse gas emissions.

Policymakers can help by developing ambitious **policy targets** for inspiring digitalization across industrial sectors and in the public administration. **Public funding** packages can be directed to create social benefit through digitalization. Also, they can **lower bureaucratic hurdles** to access digital funding.

4. Advancing the Readiness of Europe's Citizens | Digital Skills

Europe needs to upskill and reskill the population and workforce of tomorrow by taking digital literacy to the next level. Today, over 42% Europeans do not have basic digital skills, while over 57% of companies are facing difficulties in finding ICT personnel. The time for doing more on upskilling, reskilling and inclusion is now.

Telcos can further scale up their upskilling and reskilling programs. Today, we are providing training platforms, promoting responsible use of technology and fostering digital inclusion of everyone, including by becoming the partner of reference for promotion of digital skills.

The public sector can collaborate by professionalizing **digital literacy** across the EU to help citizens in obtaining the skills required for work and life in the digital economy, prioritizing **digital upskilling** and reskilling by setting clear targets and incentives for all EU governments, and promoting the importance of digital skills via public institutions.

5. Energizing the Spirit of European Innovation | Industrial Strategy and Cooperation

Fostering development of digital innovation ecosystems can combat some of our biggest challenges, such climate change, and become the engine of invention and advancement for years to come.

Our sector will intensify their active role in orchestrating cross-sector and cross-industry collaborations to develop innovations and new technologies. We invest in new and upcoming technologies and venture capital to strengthen the European tech sector. We can also share investments, resources, and knowledge across sectors and industries to create innovative use cases with a far-reaching impact.

Policy makers should support collaborations and build scale by enabling **entrepreneurial partnerships** beyond infrastructure. They can allow consolidations within and across countries to enable telcos to build more **scalable solutions** and compete on a global level, and they can direct funding towards **startups and venture capital** to support the development of new technologies.
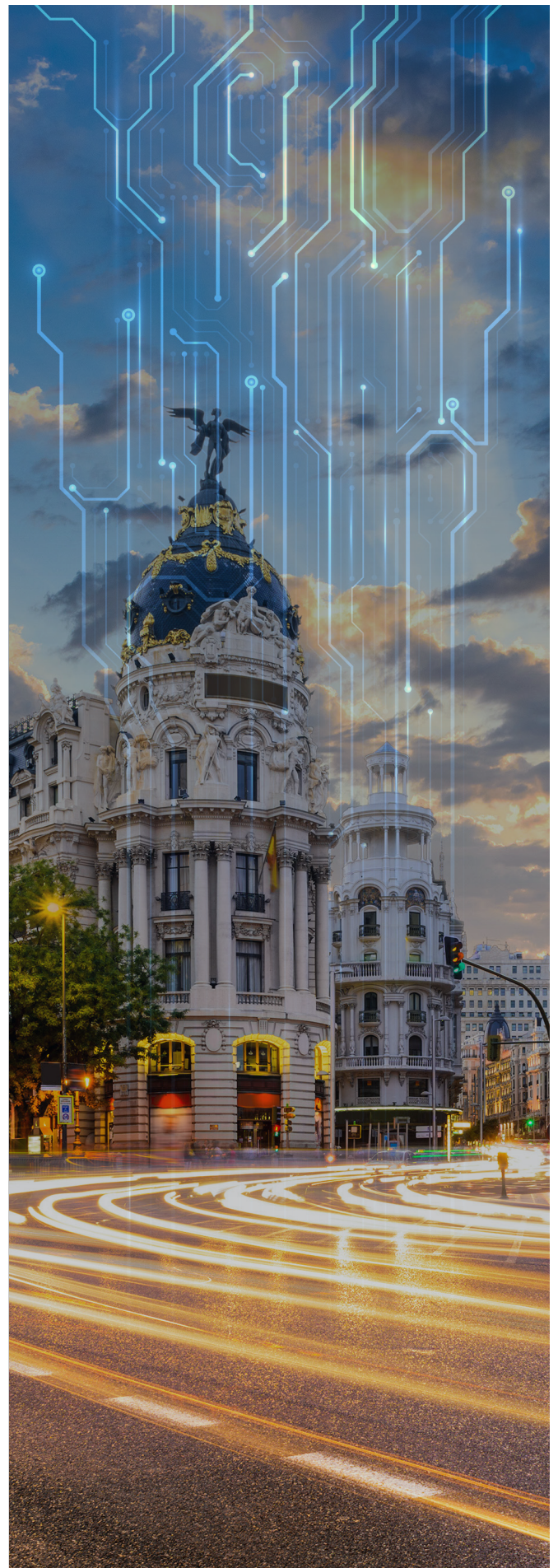
Introduction: We Want to Raise the Ambition

Europe is striving to frame its long-term societal vision for the next decade and digital plans play a vital role in it: from defining its new "2030 Digital Compass" to reviewing its "Industrial Policy" and taking global leadership on digital regulation. 2021 can represent a turning point in positioning the EU and its citizens so that they can fully benefit from the digital revolution.

A vibrant digital economy can enable concrete solutions to Europe's major challenges. The ICT sector stands at the center of the digital economy, of course, and the telecommunications industry is the main enabler of essential digital technologies. European telcos and their partners are uniquely placed to advance solutions that can have an outsize impact of the ability of Europe to push forward economic and social progress.

Given the growing reliance on access to digital services, many of the societal and economic challenges, such as an expanding wealth divide, could be exacerbated when access is not equal or when individuals and businesses do not use the digital tools already available. At the same time, digital opportunities can play a major positive role in the future our economy and society. The efficient delivery of fundamental services, such as education and health care, depend more and more on digitalization. Entire industries are digitizing fast, which has big ramifications for employment, among other things. As many as 20 million manufacturing jobs worldwide will be lost to robots by 2030. Massive training and upskilling programs are needed if people are to find jobs and companies are to meet evolving staffing needs. But the training itself often requires digital access and digital literacy.

While many of these challenges are common across continents, Europe faces some additional challenges. The economic, infrastructure, and regulatory environments have undermined development of a word-class tech sector, which impedes Europe's ability to shape its own destiny and hampers the growth of its digital economy. Europe's own policy standards in terms of protection of fundamental rights (such as the GDPR) cannot be guaranteed if Europe is not on a viable competitive footing with the global tech companies. For example, how does Europe ensure adherence with its privacy standards if global tech players do not always adhere to European rules and values or employ business models that withstand the scrutiny of such rules? The lack of muscular European global tech companies (to compare with the likes of Google, Amazon, and Tencent) and the absence of a strong and growing digital ecosystem, on a par with those in the US and China, tilt the playing field toward the EU's global competitors.

Sustainability and climate change, in particular, have become high-priority topics on many CEO agendas with 99% saying that it will be important for the success of their business. Almost three-quarters of consumers worldwide say they are altering their buying habits with the environment in mind. Some 45% of investors actively consider environmental, social, and corporate governance factors in their investment decision-making.

We—the European telecom sector—want to raise the ambition. We understand that the service we provide is fundamental. We also know that we can build on that foundation to do much more. A company's total societal impact defines its place in the economy and in society. We understand that our own futures as businesses depend on our ability to deliver innovative products and services, built on the foundation of connectivity, that enable others to do more in a sustainable digital economy and society.

We will focus our efforts on five opportunities:

- **Constructing the foundation for access**, building networks and connectivity
- **Taking the lead**, helping European establish leadership in data and services
- Expanding the reach of opportunity, digitalizing the economy and society
- **Advancing the readiness** of citizens, building digital skills
- **Energizing the spirit of European innovation**, working toward an industrial strategy and sectoral cooperation

In the pages that follow, we explore the role that Europe's telcos strive to play and the impact we expect to realize. This report is the result of BCG's research for ETNO, as well as interviews with 20 executives and leaders from tech, telecoms, NGOs and institutions.

Connectivity is still treated as a luxury good in some parts of the world. COVID has shown that connectivity has to be put on par with other basic infrastructure, like electricity and roads.

Doreen Bogdan-Martin, Director of the Telecommunication Development Bureau of the International Telecommunication Union

We can either take a lead in guiding society to digitization or they will go there without us.

Atanas Dobrev, CEO, Vivacom

Telcos have a vital role and a big responsibility in helping to address societal challenges. In five years' time, I would like to see headlines about how digitalization enabled by telcos has allowed economic recovery post-COVID, contributed to greater digital inclusion in all its forms and accelerated the climate transition.

**Allison Kirkby
CEO, Telia Company**

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Constructing the Full Foundation
Networks and Connectivity

The Plan

Invest in building the infrastructure that is indispensable to digitizing society:

- **2.5X:** Total capex required between 2020 and 2027 to unlock the full value of 5G
- **€150 billion:** Estimated costs to upgrade fixed infrastructure to gigabit speeds
- **€150 billion:** To build full infrastructure to enable full 5G vision

The vision of European telcos

- Deploy the high levels of investment for building secure and efficient digital infrastructure that meet current and future needs and expand coverage, so that everyone is connected
- Seize the opportunity of new generation connectivity to develop new telecom business models that empower citizens and businesses
- Think purpose first. Take a longer-term view when making business decisions and put sustainability aspects at the heart of our decision making
- Evaluate and prioritize business cases by putting societal contribution front and center

How Policy Cooperation Can Speed Progress

- Increase the attractiveness of European telecoms investment in network roll-out through a regulatory shift and by supporting the long-term sustainability of the sector
- Ensure availability of spectrum and other public resources (e.g. installation sites) in a timely and cost-effective way, at the right conditions
- Support the development of global scale in the European telecoms sector and enable efficient market structures, refraining from regulatory distortions
- Encourage horizontal cooperation, including for network sharing, faster roll-out and development of innovative services
- Set ambitious policy targets for digital uptake: demand stimulation will positively transform society and, at the same time, strengthen the case for faster roll-out
- Ensure available funding packages (e.g. Next Generation Recovery Fund) are streamlined to complement private investment, so that a larger share of citizens benefit from increased network roll-out

Constructing the Full Foundation—Networks and Connectivity

> **Without networks and digital infrastructure, the discussion about digital inclusion is only theory.**
>
> **—Timotheus Höttges, CEO, Deutsche Telekom**

If digital connectivity is fundamental, then fast, reliable, and robust digital infrastructure is the foundation that must be within everyone's reach.

Europe's telcos have deployed advanced fiber connectivity across much of Europe, bringing high-speed fixed broadband coverage to 84% of households in the EU with speeds faster than 30 Mbps. By 2025, 50% European homes are expected to be reached with speeds way above 100 Mbps and up to 1Gbits by FTTH . Investments in mobile infrastructure have extended reliable 4G mobile internet connectivity to 96% of Europe's population with average download speeds of more than 40 Mbps. The next frontier of super-fast and capable 5G networks is being rolled out now, with almost 25% of the population covered by the end of 2020 .

The reliability of Europe's infrastructure has been tested and proven during the COVID-19 pandemic. A range of network technologies and solutions have proven the resilience of telecommunications throughout the past year: the network upgrades of the past years showed their value during the emergency. Video conferencing kept businesses running as millions suddenly worked at home. Mobile devices enabled remote health care and education and connected millions more with family and loved ones. During this time of unprecedented mobile and online activity (global internet traffic has jumped 50% during the pandemic), no significant decreases in available bandwidth or outages resulting from the increased demand have been reported anywhere in Europe.

European Operators Have Maintained Network Performance Levels During the Pandemic

Mobile network performance

Average download speed in Mbps

| Ramp-up | Stabilization | 2nd wave |

Fixed network performance

Average download speed in Mbps

| Ramp-up | Stabilization | 2nd wave |
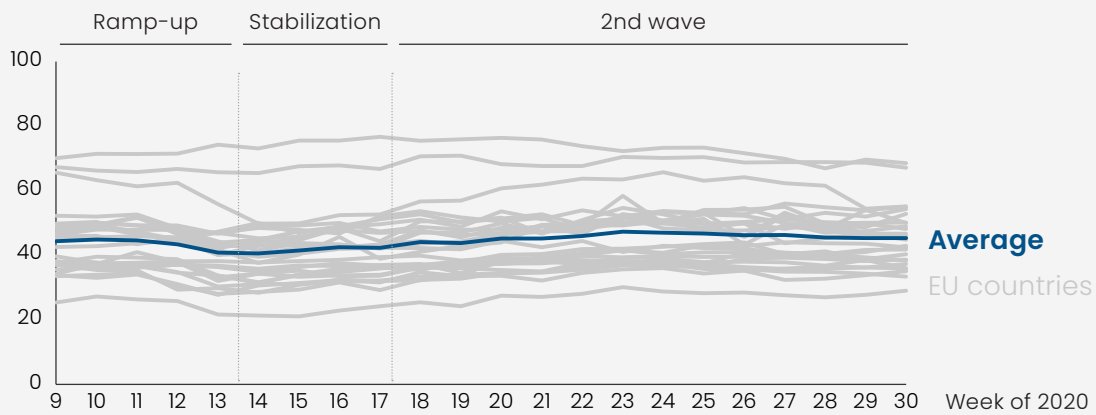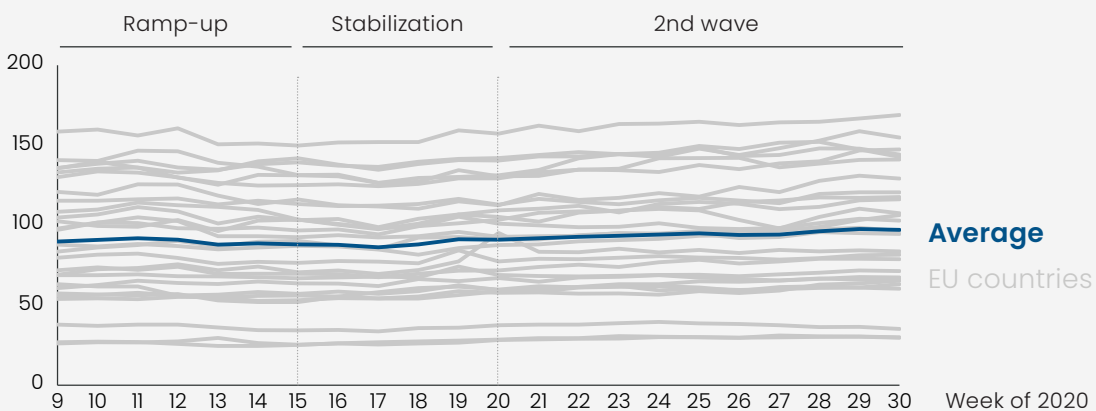
Note: EU countries, excluding. Malta
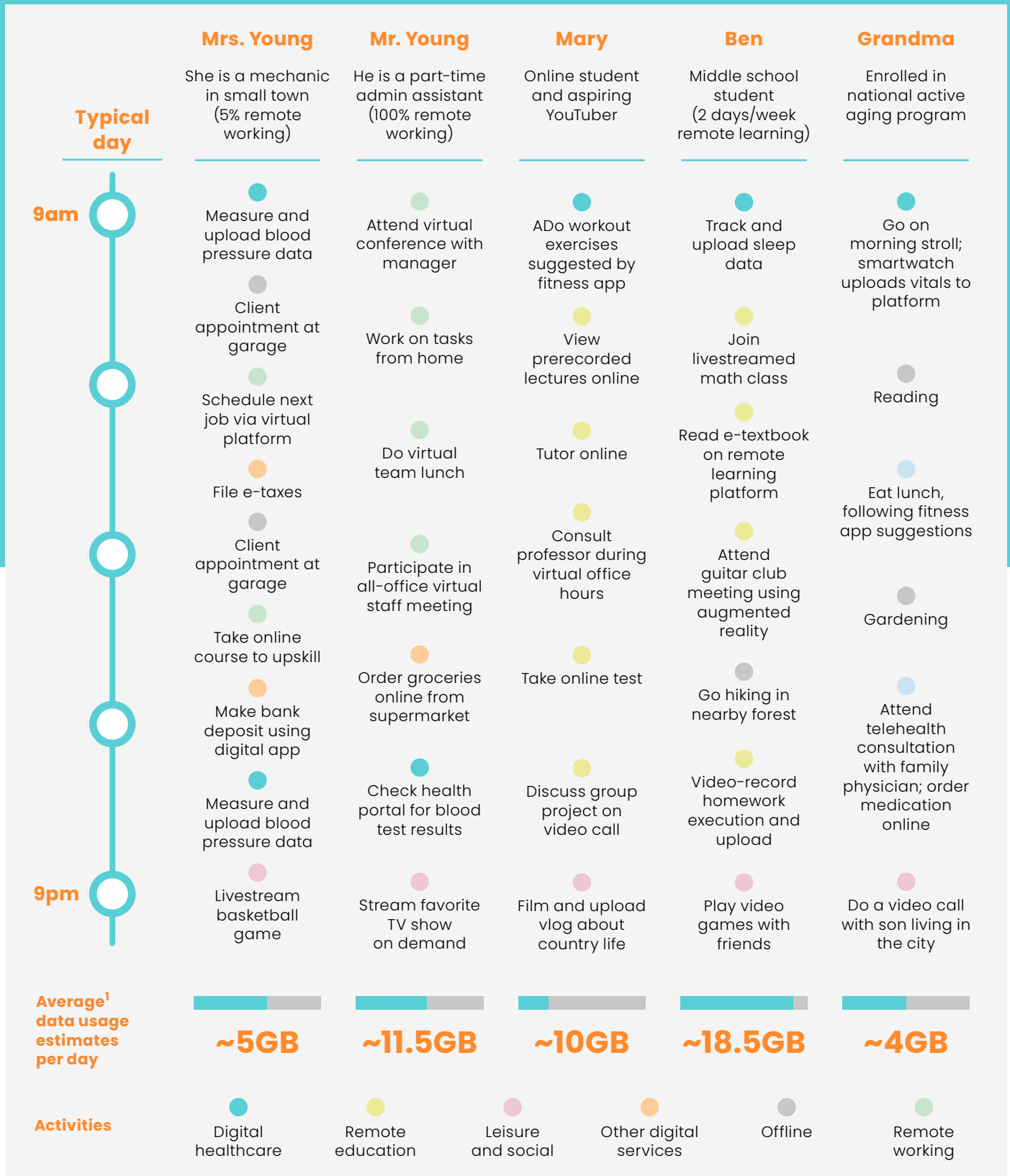Source: Ookla Speedtest; BCG analysis

However, there are challenges ahead for both fiber to the home or office and 5G, which collectively can be referred to as gigabit networks. Europe is still far from achieving full gigabit coverage. Approximately 10% of households are not covered by any fixed network yet. Extending mobile coverage to rural or hard to reach areas has its own challenges. This means that a number of people are still excluded from participating in the digital life. However, when it comes to inclusion, access to network is not the only issue. Uptake of the latest connectivity technologies must also be addressed. According to Eurostat, in 2019, 10% of the EU-27's population had never used the internet, about around one third the level 10 years earlier in 2009. Still, joint solutions are needed to rectify these deficiencies.

More broadly, download speeds of 30 Mbps to 40 Mbps are good enough to meet most of the demand, but rising consumer and business usage and shifting traffic patterns mandate networks and last-mile connections that can handle speeds of at least 100 Mbps. Today, more than 30% of Europe's households do not have access to these speeds. Millions of people now work remotely; they meet and communicate using online tools. A July 2020 survey for the EU by Eurofound showed nearly half of employees working at home during at least some of the COVID-19 pandemic. A third of these people reported working exclusively from home. Schools and health services interact with students and patients digitally. Households that had one, or maybe two, people online intermittently during the day now have three, four or five family members online all the time. These patterns are unlikely to fully disappear, even with the arrival of COVID-19 vaccines. The deployment of a mix of 5G and fiber networks is a priority to cope with this increasing demand.

Connectivity Needs Are Rising in the New Reality

Typical day	Mrs. Young She is a mechanic in small town (5% remote working)	Mr. Young He is a part-time admin assistant (100% remote working)	Mary Online student and aspiring YouTuber	Ben Middle school student (2 days/week remote learning)	Grandma Enrolled in national active aging program
9am	Measure and upload blood pressure data	Attend virtual conference with manager	ADo workout exercises suggested by fitness app	Track and upload sleep data	Go on morning stroll; smartwatch uploads vitals to platform
	Client appointment at garage	Work on tasks from home	View prerecorded lectures online	Join livestreamed math class	Reading
	Schedule next job via virtual platform	Do virtual team lunch	Tutor online	Read e-textbook on remote learning platform	Eat lunch, following fitness app suggestions
	File e-taxes	Participate in all-office virtual staff meeting	Consult professor during virtual office hours	Attend guitar club meeting using augmented reality	Gardening
	Client appointment at garage	Order groceries online from supermarket	Take online test	Go hiking in nearby forest	Attend telehealth consultation with family physician; order medication online
	Take online course to upskill	Check health portal for blood test results	Discuss group project on video call	Video-record homework execution and upload	
	Make bank deposit using digital app				
	Measure and upload blood pressure data				
9pm	Livestream basketball game	Stream favorite TV show on demand	Film and upload vlog about country life	Play video games with friends	Do a video call with son living in the city
Average[1] data usage estimates per day	~5GB	~11.5GB	~10GB	~18.5GB	~4GB

Activities: Digital healthcare · Remote education · Leisure and social · Other digital services · Offline · Remote working

1. Average of min. and max. assumptions behind gigabit consumption per activity
Source: BCG analysis.

The Benefits to Come.

In addition to just increasing broadband speeds, we need to ensure that 5G is available to all. The reason is that 5G brings the concept of connectivity to a whole new level, enabling a range of use cases that can be transformative at both the economic and societal level. At the moment, ETNO/Analysys Mason data show that 24.4% of the population in Europe is reached by at least one 5G network. Robust 5G networks will serve as the foundation for tomorrow's economy, bringing significant direct benefits, including:

- Higher network reliability and instant response
- A better-quality experience for European citizens and businesses
- A smart digital infrastructure that can act as the backbone for future expansion and as a platform for innovative services.

The types of use cases enabled by 5G will be the building blocks of the digital economy.

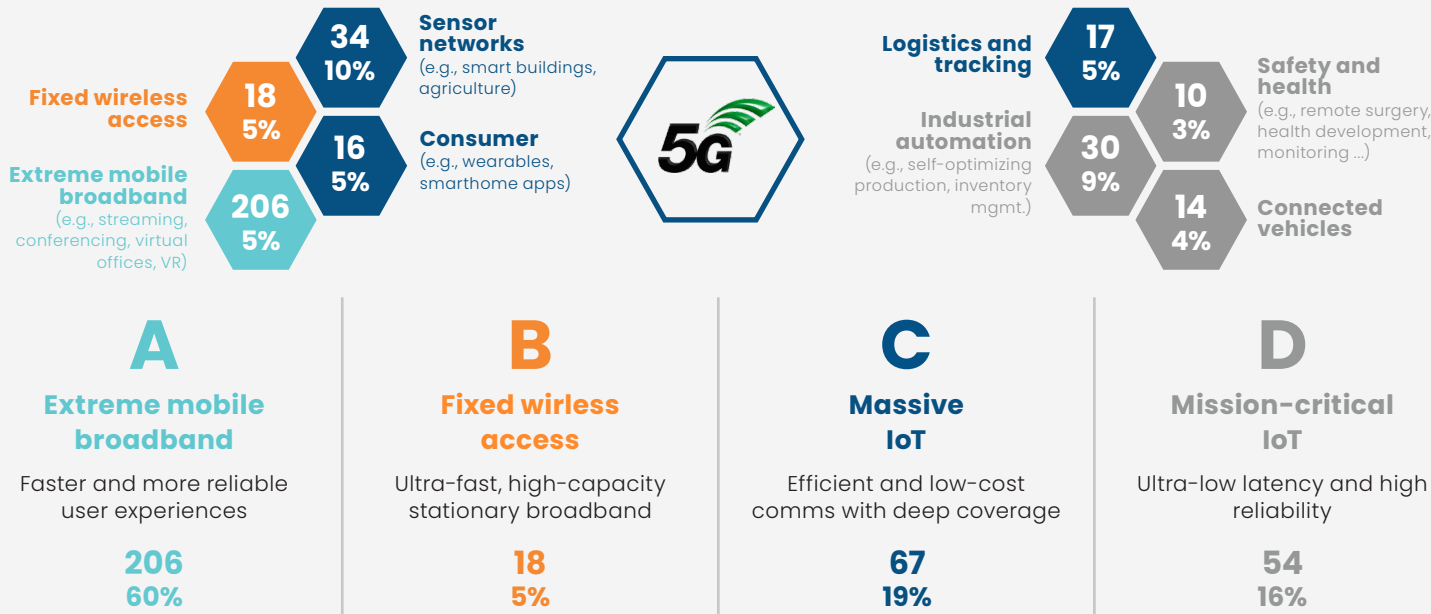For example, enhanced mobile broadband will enable full-service continuity for on-the-go conferencing and remote collaboration. Fixed wireless access (FWA) can take high-quality internet service to rural and underserved areas. Improved tracking of supply chains via the Internet of Things (IoT) will optimize routes and reduce time and inventory requirements. Ultra-low latency with millisecond response will enable exciting applications ranging from high-precision manufacturing to life-saving remote surgery.

Other benefits include improved competitiveness and better health and safety. Automated tracking and digitally enabled machinery lower manufacturing costs, leveling the cost playing field with emerging markets. Augmented reality will bolster employee capabilities by providing on-demand access to complex information and experts. Sensor networks can provide detailed data for such applications as precision agriculture, leading to a higher crop yields and more efficient use of natural resources.

Health care and safety will undergo a revolution. Remote, robotic surgery and telemedicine provide access to healthcare experts in any situation. Autonomous cars will ultimately optimize traffic safety and reduce car and pedestrian accidents.

5G Will Enable New and Improved Use Cases That Will Account for About Two-Thirds of Telco Revenues in 2025

Estimated revenues in EU 2025 (€B)

Sensor networks (e.g., smart buildings, agriculture) **34 10%**

Fixed wireless access **18 5%**

Consumer (e.g., wearables, smarthome apps) **16 5%**

Extreme mobile broadband (e.g., streaming, conferencing, virtual offices, VR) **206 5%**

5G

Logistics and tracking **17 5%**

Safety and health (e.g., remote surgery, health development, monitoring …) **10 3%**

Industrial automation (e.g., self-optimizing production, inventory mgmt.) **30 9%**

Connected vehicles **14 4%**

A	B	C	D
Extreme mobile broadband	**Fixed wirless access**	**Massive IoT**	**Mission-critical IoT**
Faster and more reliable user experiences	Ultra-fast, high-capacity stationary broadband	Efficient and low-cost comms with deep coverage	Ultra-low latency and high reliability
206 **60%**	**18** **5%**	**67** **19%**	**54** **16%**

Note: In brackets % share of use case category of total revenues.
Sources: 3GPP; Qualcomm; NGMN Alliance; IDC; Gartner; ABI; CMI; Omdia; BCG IoT study and estimate.

The Costs Are Substantial—But Worth It.

Providing ubiquitous coverage that is both resilient and secure requires major financial investments. As seen during the pandemic, the upgrades to legacy networks performed in the past years have brought good results. However, as we look at the future and at the longer term, the investment are skyrocketing.

BCG estimates that overall investments of €300 billion by 2025 are necessary to achieve both gigabit speeds and realize the full 5G vision in Europe. About €150 billion will be necessary to achieve broadband speeds of 1Gbit and faster across Europe via fiber to the home or office (FTTX) and 5G FWA. Massive growth in wireless data traffic, especially as the IoT ramps up, will mandate an additional €150 billion to build the infrastructure to enable the full 5G vision for consumers and enterprises in Europe, according to BCG's analysis.

While some of these investments will have a positive impact on telco's return on capital, most will likely meet investors' skepticism —in contrast with the overall positive economic impact—particularly as the fiber rollout extends to semi-urban and rural areas with weaker business cases. BCG experience with the fiber roll-out in various European countries, such as Germany, Austria, and the UK, shows that for rural and/or less affluent areas the ROCE (Return on Capital Employed) for fiber investment would be below the cost of capital for 20-40% of the country with ROCEs falling to -20% or even worse in some areas. Telcos will be investing for the greater good, but the financial returns for individual companies are not necessarily attractive. This cannot be ignored by policymakers.

Fiber coverage in 2020

43%

of European households

Coverage cost across Europe
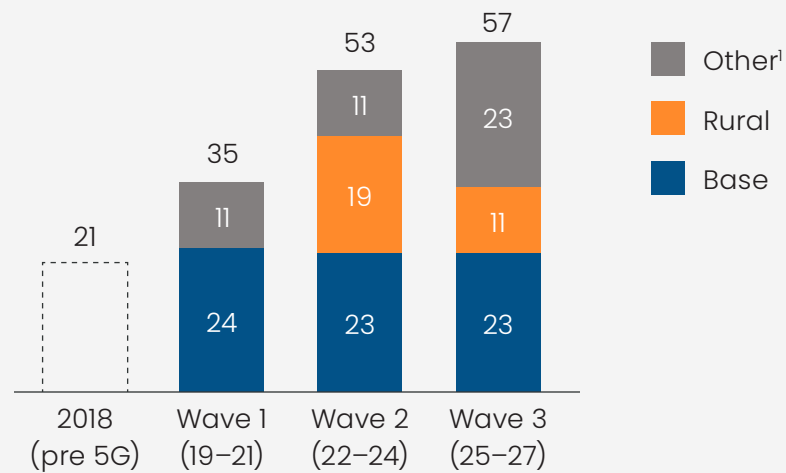
~€150B

for 100% Gigabit networks

BCG experience with the fiber roll-out shows that for rural and/ or less affluent areas the ROCE for fiber investment would be below the cost of capital for 20-40% of the country

1. Very high capacity networks
Note: Upgraded fixed infrastructure refers to networks capable of delivering min 1 Gbps speeds to % of households
Source: HIS Markit; European Commission; ETNO/Analysys Mason study, BCG analysis

Estimated €150B to Build Full Infrastructure to Enable Full 5G Vision

Estimated ETNO CapEx needed for full 5G deployment (€B)

Investment costs

~€150B

for full 5G vision

1. "Full 5G vision/deployment" includes rail coverage and capacity increase, macro- and micro-edge centers, reliability, roads and highway coverage, and capacity increase.
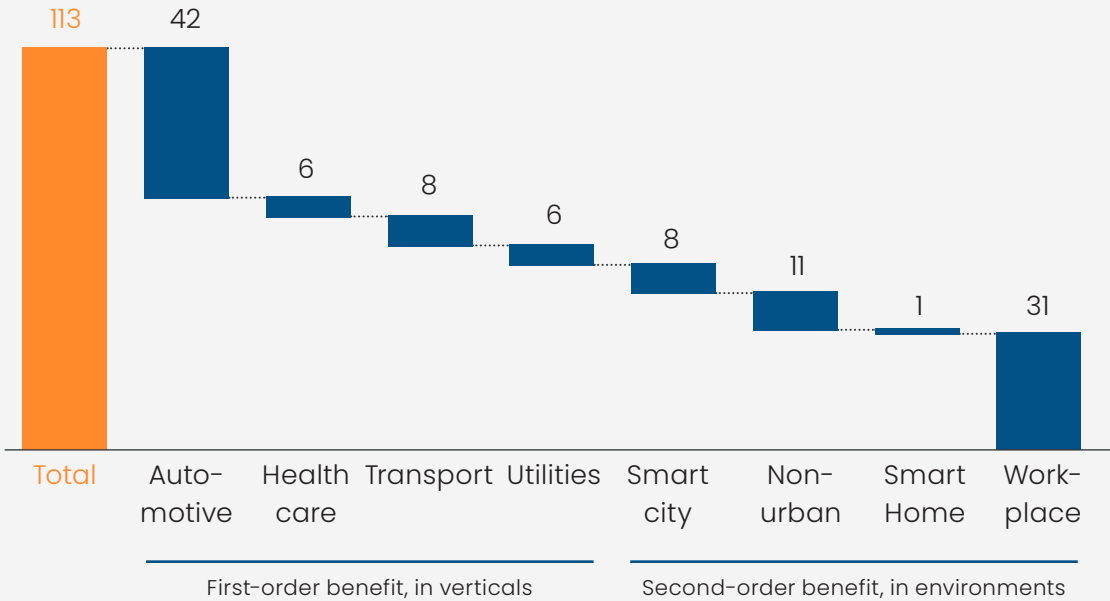Note: mmWave deployment not considered here—it would cost ~10.2B in Wave 2 and ~10.2B in Wave 3.
Sources: ETNO; BCG Shannon; BCG analysis.

But—and this is a very important but—the money does not only flow one way. Deployment of 5G will generate massive economic and environmental benefits, which the EU estimates at €113 billion a year in Europe as well as direct employment of some 2.4 million jobs by 2025. A 2020 study for the Fiber Broadband Association found that communities with more than 50 percent of the population connected to FTTH broadband with speeds of at least 1,000 Mbps had per capita GDP 0.9 to 2.0 percent higher than those without fiber broadband.

5G Can Generate €113 Billion of Annual GDP Impact and 2.4 Million New Jobs in 2025

Annual vertical and environmental benefits in 2025, in €B

Total	Auto-motive	Health care	Transport	Utilities	Smart city	Non-urban	Smart Home	Work-place
113	42	6	8	6	8	11	1	31

First-order benefit, in verticals   Second-order benefit, in environments

Money does not only flow one way.

5G will generate massive economic and environmental benefits

1. Very high capacity networks
Note: Upgraded fixed infrastructure refers to networks capable of delivering min 1 Gbps speeds to % of households
Source: HIS Markit; European Commission; ETNO/Analysys Mason study, BCG analysis

What's Holding Europe Back?

The dilemma facing the telecommunications sector is neither new nor unique to Europe. But it is becoming increasingly acute, especially in light of Europe's weakened and fragmented telecom markets.
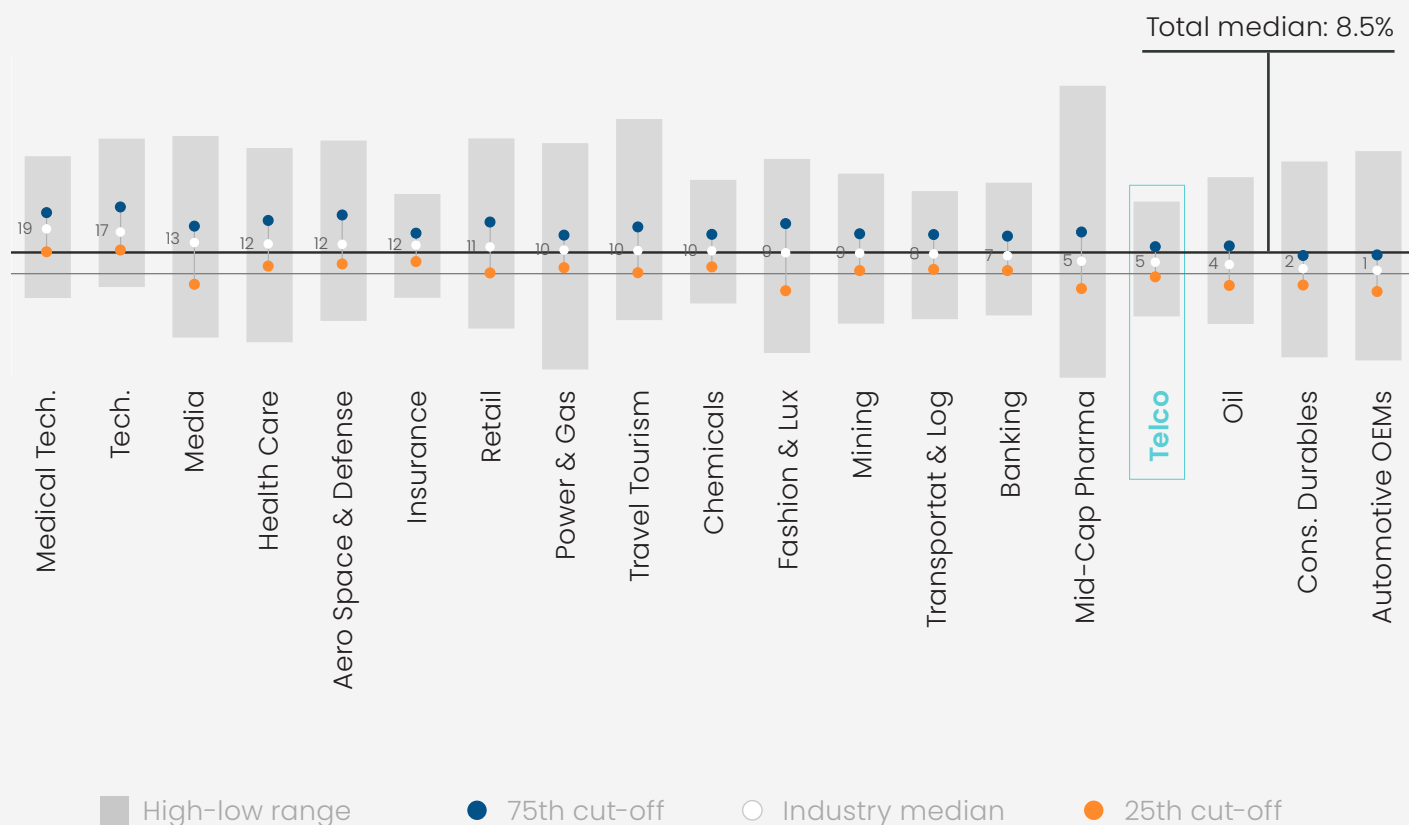
In a nutshell, the industry needs to make enormous capital investments to secure fast, reliable, world-competitive connectivity for all users. But its ability to make the level of investments required is hobbled by its own sub-par performance as an investment vehicle.

Globally, the telecom industry produced an average annual return for shareholders of just 6% between 2015 and 2019, ranking 28th out of 33 industries tracked by BCG. (By contrast, the tech sector, which includes internet players using the telco infrastructure, finished third.)

The situation is even worse in Europe, which has seen considerable value destruction compared with telcos in the US, for example. As Deutsche Telecom's Tim Höttges put it, "We have catastrophic value creation for telcos in Europe. While our revenues are declining, the need for further investments is increasing."

Telco Total Sharholder Return Is Among the Lowest of all Industries …

3-yr. annual average TSR 2016-19 (in %)

Total median: 8.5%

Industries (left to right): Medical Tech. (19), Tech. (17), Media (13), Health Care (12), Aero Space & Defense (12), Insurance (12), Retail (11), Power & Gas (10), Travel Tourism (10), Chemicals (10), Fashion & Lux (9), Mining (9), Transportat & Log (8), Banking (7), Mid-Cap Pharma (5), Telco (5), Oil (4), Cons. Durables (2), Automotive OEMs (1)

Legend: High-low range; 75th cut-off; Industry median; 25th cut-off

Note: n=2,233; companies with Total Shareholder Return of -100% were excluded
Source: S&P Capital IQ; Refinitiv; BCG Value Creators Report 2019; BCG ValueScience® Center

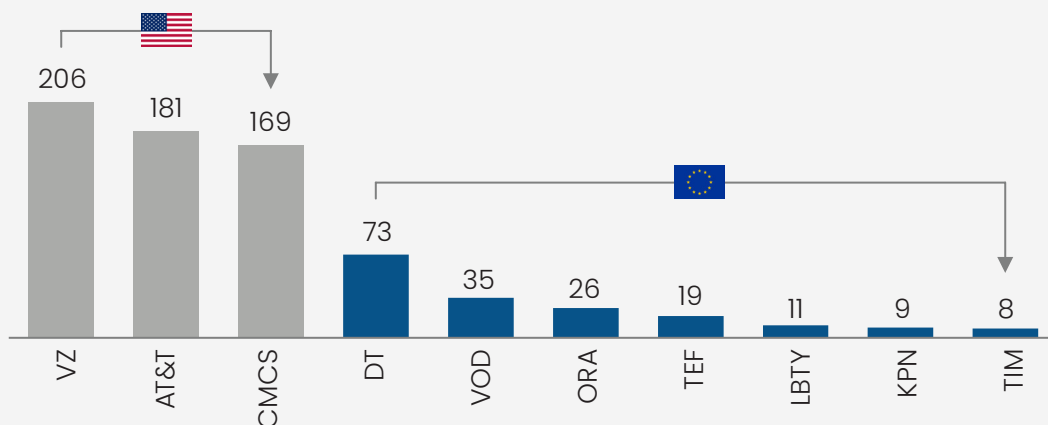# Europe's Telcos Are Destroying Value While Others Thrive

Value creation in the US versus value destruction in the EU

Market capitalization in Telco markets, 2010–2020[1]

+283 MRD.€

EU peak[2]

+213%

+248 MRD.€

~57%

01/12   01/14   01/16   01/18   01/20

—— USA[3]   —— EU[4]
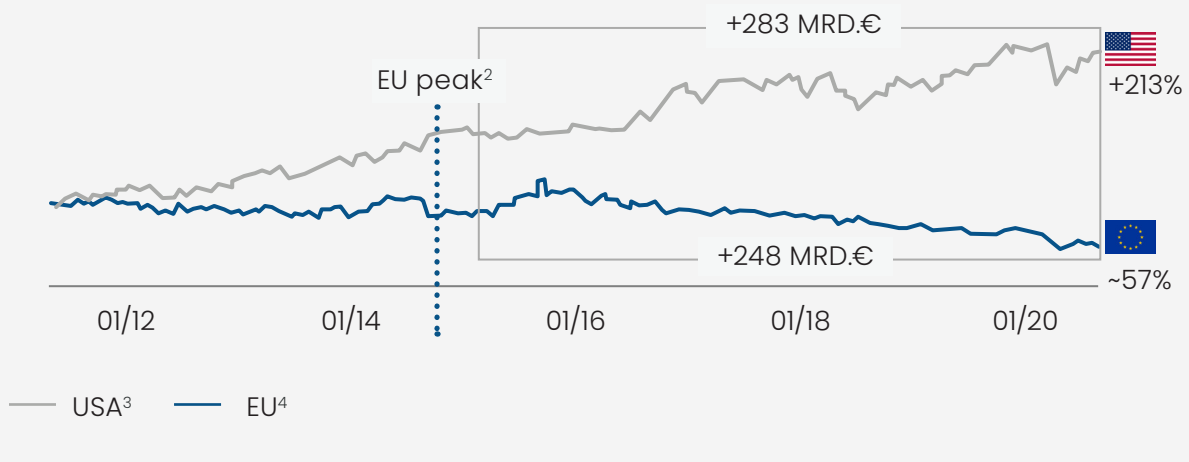
EU Telco players lacking "weight"

Market capitalization as of Aug 15th 2020 (€B)

VZ	AT&T	CMCS	DT	VOD	ORA	TEF	LBTY	KPN	TIM
206	181	169	73	35	26	19	11	9	8

The telecom industry in many markets has been weighed down by such factors as risk aversion, lack of scale, overly national footprints, heavy investment efforts coupled with strong regulatory pressure on returns, the entry of subsidized competitors, and business models that have not changed in a long time. Looking ahead, though, the industry is making efforts to move forward despite the adversities: in Europe, our sector understands its responsibility to extend and improve high-speed coverage and have stepped up investment in fiber and 5G. Telcos have done so because customers and businesses need the connectivity, Europe benefits from state-of the-art telecommunications, and it's good business. Digitization and connectivity have also proven to be key during the pandemic.

Our sector wants to continue delivering better, faster service to all of the EU. To do so, the industry must persuade investors and rethink long-standing strategies and models, a process that is already well underway. Companies are constrained, however, by issues of high-cost spectrum, regulation that affects everything from the ability to scale up, to pressure on revenues, to the cost of capital, and challenges to its ability to innovate in the service and data economy.
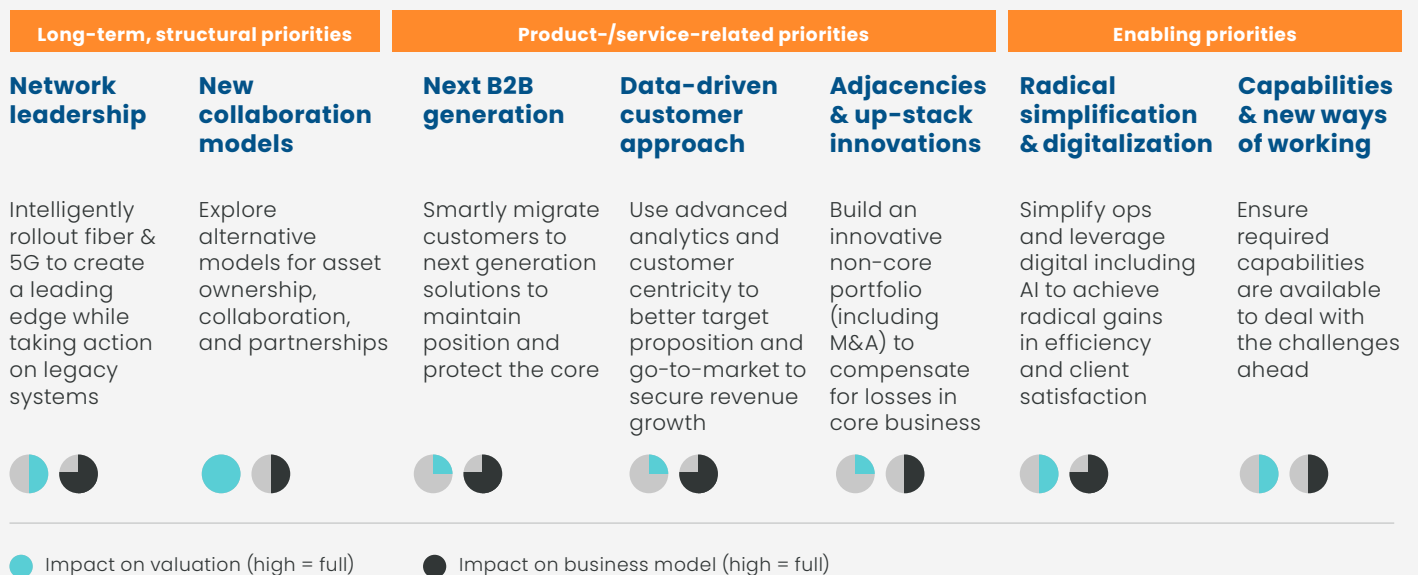
Finances, Strategies, and Models.

Incumbent telcos have invested 18% or more of revenues in capex annually from 2015 through 2018. Globally, the debt of almost half of all telcos is rated below investment grade. Europe needs to take steps to guarantee competitiveness of the EU industry by bringing our finances in line with revenue expectations while we continue to explore new egies and revenue models. One such step is pursuing new ownership models involving voluntary infrastructure sharing, which can allow faster roll-out, reduced overall environmental impact, and increased knowledge transfer among partners. Another is cooperation and co-investments, including various models for new infrastructure such as fiber joint ventures, and 5G active spectrum sharing. In January 2021, the first European co-investment offer at national scale was launched in Italy by TIM. Infrastructure funds have shown significant interest in co-funding passive infrastructure investments through joint ventures and dedicated investment vehicles, and co-investment vehicles between operators and investors have proliferated. Governments and EU institutions can help facilitate these developments with regulatory easing. A third voluntary option is the separation of infrastructure construction and telecommunications services businesses, as has occurred in European and American markets, where operators have used divestitures and IPOs to increase their valuations and reduce debt.

Already today, our sector is pursuing seven distinct avenues for improving valuations and rethinking operating models for both business purposes and broader societal benefit.

Seven Avenues for Increasing Business & Societal Value

Long-term, structural priorities		Product-/service-related priorities			Enabling priorities	
Network leadership	**New collaboration models**	**Next B2B generation**	**Data-driven customer approach**	**Adjacencies & up-stack innovations**	**Radical simplification & digitalization**	**Capabilities & new ways of working**
Intelligently rollout fiber & 5G to create a leading edge while taking action on legacy systems	Explore alternative models for asset ownership, collaboration, and partnerships	Smartly migrate customers to next generation solutions to maintain position and protect the core	Use advanced analytics and customer centricity to better target proposition and go-to-market to secure revenue growth	Build an innovative non-core portfolio (including M&A) to compensate for losses in core business	Simplify ops and leverage digital including AI to achieve radical gains in efficiency and client satisfaction	Ensure required capabilities are available to deal with the challenges ahead

● Impact on valuation (high = full)   ● Impact on business model (high = full)

Our sector is confident it has the right vision and strategies in place to help Europe seize the opportunities that come from the deployment—and uptake—of new generation networks. This offers also strong opportunities of growth for our own sector. At the same time, we cannot ignore one of the big unresolved issues that affect network investment: the lack of monetization of data traffic. The load on our networks keeps on rising, which means an increased pressure on the infrastructure. However, our revenues remain sluggish, both when compared with companies running data heavy activities on top of our networks and when compared with those of non-European telecom companies. This unbalance, over the past years, has already damaged the speed of Europe's roll-out. More delays are foreseeable unless we create the right conditions for growth.

Spectrum.

Governments have a choice in how they set spectrum policy, and they typically consider several competing priorities:

- Maximizing the value of a scarce asset and raising revenue
- Fostering competition, including by sometimes subsidizing new entrants, to keep retail prices low
- Extending coverage
- Enabling competitive mobile broadband infrastructure

Many European governments have mostly favored the first two or three priorities with result that telcos' capital expenditures for spectrum are high, leaving less money available for infrastructure deployment. In addition, most European countries lease valuable spectrum bands to commercial operators, meaning that operators do not own the essential asset and must plan with uncertainty what the asset will cost them in the future.

Contrast this approach with the more investor-friendly regulations in the US, which allows for outright ownership of spectrum, or a market such as Singapore, where the regulator prioritizes different goals and pursues a very different spectrum allocation process. (See the sidebar, Spectrum Allocation in Singapore.) In France, the "new deal" struck in 2018 among the government, the telecom regulator, and several industry players with regard to allocation the 900 MHz spectrum band contains an innovative approach under which spectrum allocations are renewed without fees based on improved coverage.
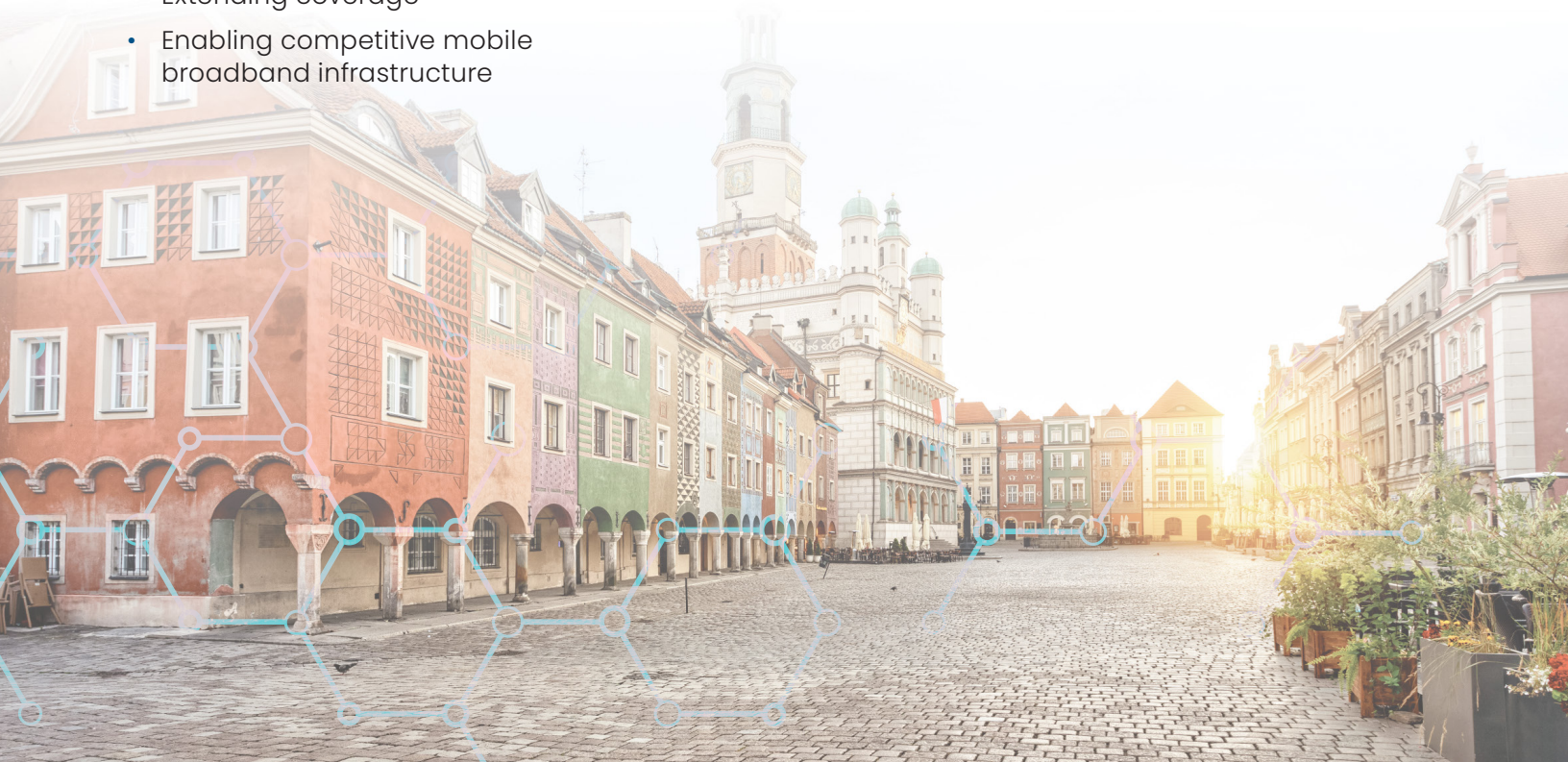
Conflicting objectives require trade-off decisions in setting spectrum policy

Maximize proceeds from spectrum auction

Low consumer prices limit state revenues from industry players

Extra industry taxes impair investments in new infrastructure

Foster competition to enable low consumer prices

Enable competitive mobile broadband infrastructure

Low consumer prices come at the cost of slower network developments
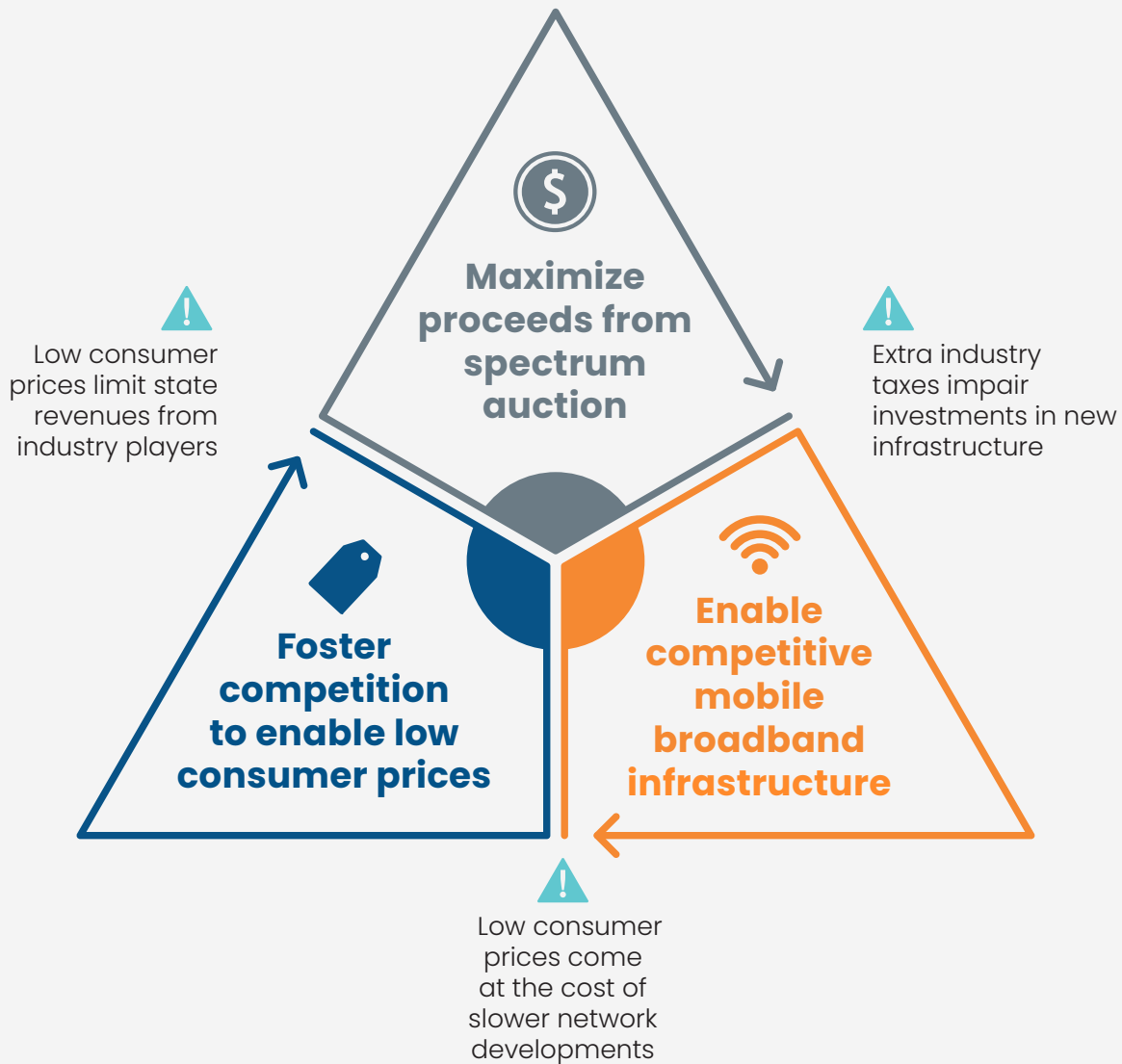
To maximize societal benefits and ensure inclusion, focus should be on rolling out infrastructure

Source: BCG analysis.

Case Study:

Spectrum Allocation in Singapore

Singapore has long been a leader in digital technology. It is the world's second most digitally competitive country according to IMD, and the government sets telecom regulatory policy accordingly. Because of its regional standing as a financial services hub, Singapore prioritizes strong B2B-focused, as well as consumer-oriented, mobile networks and sets specific criteria for such factors as security, resiliency and indoor/outdoor coverage in its spectrum allocation procedures.

When Singapore allocated new licenses in 2019, it eschewed the auction process in favor of requests for proposal involving the country's four main operators. In return for licenses allocated at a set minimum base price, the successful operators were required to extend standalone 5G coverage to 50 per cent of the island by end of 2022, thus furthering the government's coverage goals. Set prices also left winning operators with capital for building out state-of-the art 5G network infrastructure.

Two operators, Singtel and a joint venture between StarHub Mobile and M1, were awarded licenses to build two nationwide standalone 5G networks, and each were allocated 100 megahertz of spectrum in the 3.5 GHz band. The two winners are set to deploy 5G networks starting in January 2021. They will provide coverage for at least half of Singapore by year-end 2022 and scale up nationwide coverage by the end of 2025. Importantly for a market such as Singapore, the 5G networks will deliver full 5G capabilities, including network slicing, high reliability and low latency, and massive machine type communications.
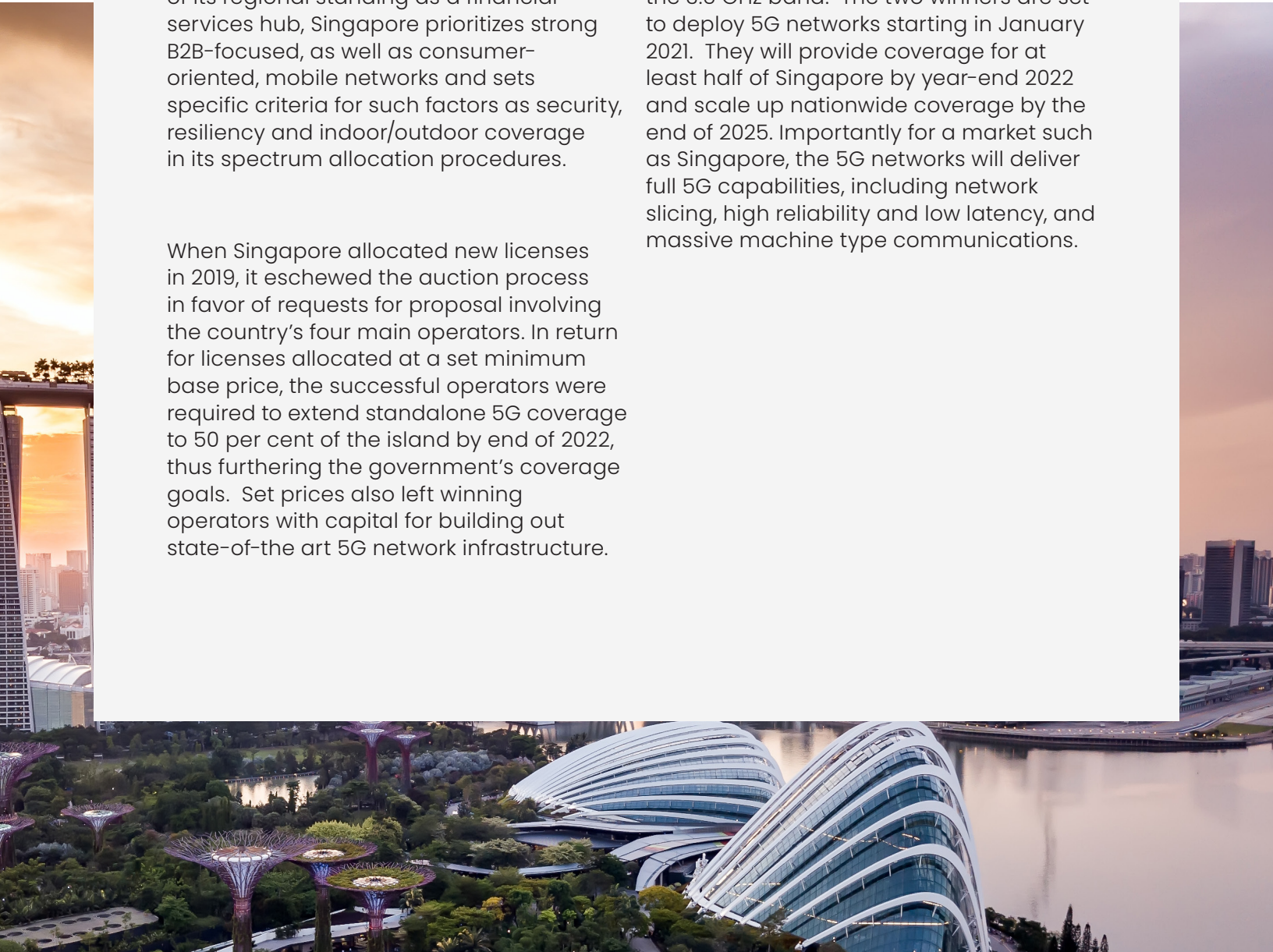
Regulation.

Regulatory roadblocks that constrain the pace of infrastructure deployment can take different forms. One of the most significant for telecommunications infrastructure is the permitting process for new construction since this often involves securing lengthy and complex bureaucratic approvals. For example, in Germany, it takes at least one year to get the necessary allowances from authorities to build and launch a new cell tower site. Europe is estimated to need more than 50,000 new towers in 16 countries by 2023 to support the rollout of 5G. Tower construction is often controversial, particularly at the local level.

Inner-city small cell densification and the cellular coverage of major transit routes (such as highways and rail lines) are additional challenges (and cost centers) for 5G rollout, and here as well, slow approval processes are a hindrance. Some regulators also look askance at shared infrastructure deployment among operators, even for small cells. Regulators and other relevant authorities need to take a broader view of what constitutes available cellular infrastructure, especially in urban areas where fixtures such as streetlamps and benches can be pressed into service and even manufactured to facilitate small cell installation. A high degree of collaboration among the industry, government, and other stakeholders will be a prerequisite to fully extending 5G coverage.

At the same time, the need for investment continues to rise. A September 2020 report by the European Round Table of Industrialists found that many European countries haven't yet allocated sufficient planning and construction permits for cell towers, which is slowing the deployment of 5G. (This is ironic since Europe was an early pioneer in digital-cellular communications and a world leader in making the transition from analog to digital networks in the 1990s.) As a result of slow approvals, operators must put much more financial muscle behind both macro and small-cell deployment. In addition, opposition to 5G rollout can involve dissemination of misinformation or disinformation, and some local authorities can, or are tempted to, delay permits based on mistaken assumptions. Regulatory approaches to electro-magnetic frequency radiation are still not fully harmonized across EU, with some countries imposing extremely low limits, that require the installation of more antennas (instead of fewer) and that are much stricter than the international WHO guidelines without any justification.

Governments can hasten industry investment by loosening restrictions. Make affordable spectrum available on a transparent schedule that facilitates planning. Reconsider whether the goals of competition regulation should be continuing adherence to the idea that more network operators equals lower prices for consumers or the more current need to address a situation in which the ability to invest in advancing higher quality networks and innovative technologies leads to broader benefits for all. Today, Europe still favors a static view of competition, instead of a dynamic one. Regulators can also further look into adjusting the burdensome restrictions and requirements on the deployment of advanced cellular technologies such as small cells.

Business models or approaches that could be incentivized with regulatory changes include:

- Co-investment models and RAN-sharing agreements that require more legal certainty
- Mergers that further growth in domestic markets
- Supporting the migration from copper to fiber
- Vet all regulatory choices to ensure they do not negatively affect investment

Operators Need to Invest Significantly More to Enable the Full 5G Vision

COSTS WITHOUT SPECTRUM PRICES

2.4x

Total capex required between 2020 and 2027 to enable all use cases vs. urban capacity-driven densification and rural DSS

3.2x

Yearly capex required in Wave 3 (2025–2027) compared to pre-5G area

+40%

Additional macros required by 2027 to provide additional coverage and densification

6:1

Small cell to macro ratio by 2027 after massive mmWave densification

New network architectures and sharing of infrastructure can help reduce the investment burden

Source: BCG analysis.

Viable Competitive Footing.

Europe requires the rollout of fiber and 5G to remain competitive with other markets. An economy based on services and data also requires vibrant innovation and competition that also adhere to European standards of privacy and security. We need fit-for-purpose regulation that does not disadvantage telcos or European companies (particularly relative to global tech players) so that Europe's cab help drive innovation and growth of the digital economy. The EU is taking leadership in this regard with the Digital Markets Act (which seeks to address the gatekeeping power of certain global tech players) as well as with the Digital Services Act (which would regulate digital services).

EU telcos are ready to compete, but we need Europe to regulate major tech companies in way that empowers the furthering of European innovation and competitiveness. Policy makers and regulators can provide Europe's telcos with fresh flexibility to effectively compete with the global tech companies. This means allowing the sharing infrastructure and the needed cooperation to build scalable products and services. But it also means fully acknowledging the need of building scale in the European telecoms sector. When we compare the tech and the telecoms sectors today, the main differences can be found in privacy protection, ex-ante regulation, controls of cooperation, acceptable levels of market concentration, and taxation—just to mention a few. Instead of taking a silo-view on the regulations constraining the telecoms sector, we should embrace a horizontal and comprehensive approach to unlock telcos and other European players to develop new business models and especially data-driven business models.

Back to the Future.

If you are world leader in dirt roads, you may only get to build tractors, not fast cars. In the same way, the digital ecosystem will not be built if the infrastructure isn't there to deliver.

—Börje Ekholm, CEO, Ericsson

Putting Europe back on a fast highway to the digital future requires a rethinking of goals and priorities by both the telecom industry and the public sector. All of the opportunities that we discuss in the balance of this report—new platforms and busines models, bringing the power of digital engagement to education and small businesses, advancing digital literacy, and fueling innovation—require a fast, robust, reliable digital infrastructure.

As part of our commitment to raise the bar, the industry is committed to build out the infrastructure, both fixed line and 5G mobile, that Europe needs. Our businesses and futures depend on it. To fund this commitment, the telecoms sector needs to see adequate returns on its investment. Also, as it thinks beyond just average revenues per user, it should be able to develop the new business models and income streams that technologies such as 5G enable.

Our technology and innovation departments are working on enabling new services and new opportunities to empower users. For example, can the industry place itself at the center of services that require data to be stored and shared securely, meaning that the telco would ensure that only authorized users access the data and that the usage of data is logged and traceable? This capability could be applied to a variety of settings, including sharing of school and university grades, medical records, and also business data: all aspects on which trust is paramount and European values must be respected. Can it deploy a digital "toolkit in a box" to small- and medium-sized enterprises (SMEs) that provide a one-stop solution for digital enablement? Can it work in partnership with both private- and public-sector players to rethink critical societal services, such as education and health care, using digital connectivity, resources, and tools?

In the subsequent chapters, we explore a number of the opportunities for the industry to move beyond connectivity and rwaise the bar for the services—and the value—that it provides. The opportunities are real—as are the benefits they can bring for the industry and for Europe. But they have three prerequisites: digital infrastructure, digital imagination, and digital readiness. Without either one, the road ahead is one lane wide and largely unpaved.

Our Framework

06 **Energizing the Spirit of European Innovation**
Industrial strategy and cooperation

05 **Advancing the Readiness of Citizens**
Digital skills

04 **Expanding the Reach of Opportunity**
Digitalization of the economy and society

03 **Taking the Lead**
European solutions for data and services

02 **Constructing the Full Foundation**
Networks and connectivity

01 **Our Commitment**
We want to raise the ambition

Taking the Lead

European Leadership in Data and Services

The Plan.

It will take open platforms—born from our values and tailored for our needs—to **set a new European digital standard**, a standard we can rely on because it safeguards data, protects people, and secures connection.

The vision of European telcos.

- Take an active role on creating European leadership and interoperable, pan-European solutions in edge computing, Open RAN, and cloud

- Work together in a united way with other industrial players and commit to significantly invest into scalable solutions where Europe can take a lead

- Support rollout of an EU-wide e-ID

  by offering secure identification solutions, such as mobile ID

How Policy Cooperation Can Speed Progress.

- Foster and incentivize the use of European platforms such as GAIA-X and the broader alliance for industrial data, edge and cloud—including by using EU funds

- Empower telecom companies to collaborate, share infrastructure and deliver scalable products and services that matter on a global level, while ensuring they compete on a fair playing field with tech companies

- Drive the digitization of public services at the national and local levels

Innovation has to be at the benefit of our clients and society over all, preserving our values and privacy.

**Stéphane Richard
CEO, Orange**

Telcos have been stagnant for about 25 years. They are missing in action on many key aspects on digitization and innovation.

**Cedric Neike
Member of the Managing Board and
CEO Digital Industries, Siemens AG**

The Telco industry has unfortunately not been ground-breaking enough. It needs to rethink the way it is positioned in the wider equation of the economy.

**Sonia Jorge, Executive Director,
Alliance 4 Affordable Internet**

The last few years have been difficult for the global community. Even before the onset of the pandemic, rising geopolitical and trade tensions among the world's leading powers were taxing long-standing alliances and institutions. The future may see more collaboration on global challenges such as climate change and inequality, but recent history is a reminder of how suddenly global alliances and partnerships can come under strain.

For all of its considerable strengths in important industries such as automaking and green technologies, Europe relies for most of its digital capability on the US and China. There is a growing belief at the EU level and among individual governments that Europe must re-establish digital leadership for itself. This requires high quality internet access for, and usage by, all, but it also means that Europe needs to:

- Invest in creating and implementing **European platforms** such as telco edge cloud capabilities, GAIA-X for cloud specification and solutions, and Open RAN for infrastructure

- Drive a real and swift digitalization of the **public sector** in its interactions with citizens and businesses. This can have tremendous impacts on the productivity of the public sector, on its ability to amplify positive societal change and on the economy overall

- Work with the **ecosystem of industrial players** and commit to invest in scalable solutions where Europe can take a lead

Europe can lead in each of these areas and in the process put itself on more equal footing with other countries and regions. As Tim Höttges of Deutsche Telcom said, "We need an Airbus in the telco industry to compete on a global level."

We believe that there are several areas in which Europe can reestablish its digital proficiency. Telcos and European governments and institutions can work together to make this happen. Indeed, it is in the business interests of the former and the geopolitical interests of the latter to do so. Two of these areas are European platforms and the digitization of the public sector.

European Platforms.

There is growing recognition in Brussels and other European capitals of the dangers of overreliance on technologies provided exclusively from abroad and the resulting need for Europe to build its own platforms that rely on open standards and ecosystems. Stéphane Richard, CEO of Orange put it this way: "In a digitalized and data driven economy, cloud computing is becoming essential in terms of innovation, competitiveness, and digital sovereignty."

Such platforms can ensure compliance to fundamental European values (such as privacy and data protection) and EU-wide law (such as GDPR) to ensure a secure and EU-controlled environment. They can also help in building the trust in technology by protecting data and reflecting European fundamental values. Combining forces across Europe to work on innovative solutions and share investments and resources will avoid multi-country fragmentation of effort and contribute to economic prosperity and growth.

Europe should aspire to be a major contributor to innovation in multiple areas, but to do so, it must sew a net of strong global relationships. This is one key to building European digital leadership at the global level. In the wake of the start of a new administration in the US, there may be an opportunity for Europe to relaunch the transatlantic digital partnership as a means to create value-based partnerships on technology, platform, and telecommunications policies that further the economic and strategic interests of both regions.

> **"In a digitalized and data driven economy, cloud computing is becoming essential in terms of innovation, competitiveness, and digital sovereignty."**
>
> —Stephane Richard, CEO of Orange

As European Commission Vice-President Margrethe Vestager put it in a 2020 interview , "Europe has changed over the past 4 years" and became "more geopolitical", which "will allow us to be a stronger partner to the US". In short, EU strategic independence will bring strength to the transatlantic partnership. In this context, in December 2020, the EU issued a "new EU-US agenda for global change" that calls for a "forward-looking transatlantic agenda for global cooperation, centered on areas where our interests converge, our collective leverage can best be used and where global leadership is required." The EU's agenda cites the "growing convergence of views on tech governance between Europe and the United States and the fact we are facing common challenges in managing the digital transition of our economies and societies. These include critical infrastructure, such as 5G, 6G or cybersecurity assets, which are essential for our security, sovereignty and prosperity – but also data, technologies and the role of online platforms." As one of the first steps the EU agenda suggests opening transatlantic dialogue between the EU and the US "on the responsibility of online platforms and Big Tech – starting by working together to find global solutions for fair taxation and market distortions in the digital economy." The proposed Digital Service Act contemplates revision of the EU rules on online platform liability, while the Digital Markets Act aims to take on digital markets that are prone to the development of gatekeeping positions. The socioeconomic role of Big Tech has also taken center stage in the US public debate.

Work on three areas can help put Europe on a more equal footing with China and the US are: Open RAN, edge computing and data storage, and the European cloud. EU institutions should support the creation and the functioning of these platforms through the needed financial and regulatory measures as well as clear political support.

Open RAN.

The network infrastructure equipment market is quite concentrated. By separating hardware and software, Open RAN has the ability to replace proprietary network infrastructure equipment with off-the-shelf hardware components and company-developed coding to control what the hardware does. Open RAN increases supplier choice, improves flexibility and network resilience, and encourage competition and innovation in the vendor ecosystem. It also speeds time to market for new services that telcos can offer enterprise customers and consumers. What is more, it is expected to make investment more efficient and reduce costs: both are welcome features, in light of the investment effort ahead.

In Europe, at the beginning of this year, Orange, Deutsche Telekom, Telefónica and Vodafone launched a Memorandum of Understanding on Open RAN, which was joined recently also by TIM. In Japan, Rakuten Mobile has deployed a 5G Open network across the country that has been found to deliver performance on key metrics that is as good or better than leading operators in the domestic market and globally, despite Rakuten having only one-sixth the spectrum holdings of its main competitor. Vodafone is planning to use the technology in the UK. Telefónica signed an MoU with Rakuten to promote research and conduct lab tests and trials to support OpenRAN architectures, including the role of the AI (artificial intelligence) in the RAN Networks. Telefónica has also announced an agreement that it is driving a strategic ecosystem collaboration with Altiostar, Gigatera Communications, Intel, Supermicro and Xilinx, to foster the development of Open RAN technologies in 4G and 5G. Deutsche Telekom, on its side, is planning to establish an Open RAN laboratory by the end of 2021 – it will be aimed at testing and certification, as well as a real life testbeds for Open RAN.

Open RAN is both open source and open interface. The work to boost innovation through Open RAN is accelerating, and trials are tackling a wide range of features such as operation in high-density areas as well as ensuring top-notch security. As The Economist observed in November 2020, governments can help speed this process by encouraging investment in development and testing of Open RAN equipment, promoting compliance with Open RAN for equipment makers and network operators, and developing common standards for security. It is of the essence that the EU supports the development of a European ecosystem of Open RAN hardware and software providers.

Edge Computing and Data Storage.

Rising numbers of connected devices and volumes of data traffic (Ericsson projects that that the number of IoT-connected devices will more than double from 11 billion in 2019 to 25 billion by 2025) as well as evolving network needs (such as faster speeds, lower latency, and greater reliability) are leading to major changes in network design, construction, and use. Greater use of AI and advanced analytics for such use cases as switched digital video or advanced manufacturing often requires proximity of computing power to the application. These needs are causing an increase in so-called edge computing and data storage, tech-speak for computing and data storage centers built close to where the computing takes place and the data is used, primarily to guarantee ultra-low levels latency. Gartner predicts that 75% of enterprise-generated data will be created and processed at the edge by 2025, up from just 10 percent in 2018. Market intelligence firm IDC expects that the edge will become an important new source of revenue for telcos as well as for internet companies and their ecosystem partners.

Global tech players are already building substantial businesses around the world constructing edge data and computing centers, virtual private networks, and applications for enterprise customers. This growing business offers a big opportunity for Europe's telcos as well, especially since many are already trusted business partners of European companies. At the same time, Europe can build its own edge ecosystem, one where there is space for different forms of partnerships and for independent and interoperable solutions alike.

Today, telcos are steering partnerships to federate their edge computing and telco edge networks so that new services based on European technology, infrastructure, and providers can be made available to businesses and administrative bodies everywhere in Europe, reducing their dependency on technology from other regions. Financial support from the National Recovery and Resilience Plans and other EU programs will be critical in this endeavor as well as for other potential IPCEI (Important Projects of Common European Interest) for cloud technology in Europe.

European telecom operators are also developing their vision of a multi-operator, multi-access edge infrastructure to enable a European ecosystem of services and applications that are not possible with traditional cloud architectures and that will be key in digital transformation in the coming years. Deploying the next generation of cloud capabilities for the public and private sectors could provide a platform that will allow customers in Europe to develop and deploy their edge cloud applications across the whole region using a single interface. Providing federation mechanisms will enable the participation of European companies in the provision of cloud computing services.

The use of open-source, inclusive telco and cloud standards will facilitate the federation of telecom operators within and outside of the region as long as they commit to deliver edge computing services in their respective footprints. This initiative would be a complement to other projects in the region, such as GAIA-X, that promotes the creation of data spaces (innovation ecosystems with data producers and consumers from different sectors), to which telecom operators could provide the edge infrastructure layer.

A number of European telcos are active in edge computing, and the European Telecommunications Standards Institute has been leader in developing the framework for multi-access edge computing. While business models are still in development, IDC cites a number of strategic collaborative partnerships being formed in all major regions to explore edge opportunities.

European Cloud.

One of the most notable initiatives in European cloud, today is GAIA-X. In the words of the German Federal Ministry of Economic Affairs and Energy, a primary sponsor, the goal of GAIA-X is "to create a modular, secure, trustworthy and user-friendly system, that – in the first step – brings together existing cloud providers and their services and in which data and applications can be handled in a way, that ensures full control over these." The reason for this, as French Economy Minister Bruno Le Maire put it, is to materialize "our ambition in terms of data and cloud sovereignty. Data sharing is key to develop innovation in the industry." The 22 founding members of GAIA-X include telecom operators such as Deutsche Telekom, Orange, TIM and Proximus, and a wide range of industrial and tech players who are representative of Europe's most innovative ecosystems have signed on.

GAIA-X has several potential benefits. It would be a big step toward data sovereignty for Europe. As Stéphane Richard of Orange, put it: "This is why we decided to be a founding member of GAIA-X whose aim is to gather cloud offers aligned with our EU values." GAIA-X would ensure trustworthy and secure data availability so data users can tap into the economies of scale of large data sets in Europe. And GAIA-X can be the basis for a digital ecosystem that enables the development of innovative products that further the competitiveness of European businesses while ensuring security and high level of protection of EU values.

GAIA-X is an admirable and necessary undertaking of the type that the telco industry can put its considerable resources behind. The governments of Germany, France and the EU deserve credit for recognizing the need and pushing its development. The industry can also benefit from the use of European secure and high-performance cloud solutions for our products and services. For example, in September Deutsche Telecom and OVH Cloud announced a cooperation agreement following the Gaia-X principles. ETNO joined the GAIA-X association in November 2020 and will contribute to the work

of GAIA-X by promoting policies for a secure and interoperable framework for data sharing in Europe.

For their part, governments can foster and incentivize the use of European platforms and services, such as GAIA-X. This project fits within the broader Data Strategy of the European Commission and with the aspirations of the EU Member States expressed in the Cloud Declaration signed in October 2020, which provides the collaboration and commitment framework to develop a European Cloud Federation. The European Alliance for Industrial Data, Edge and Cloud to be created in the first quarter of 2021, will play a leadership role in integrating all European industrial sectors with the Member States and setting the framework to promote the different cloud initiatives, including GAIA-X and the IPCEI for the Next Generation Cloud Infrastructure and Services.

Pan European Digital ID.

European governments are still struggling with the transition to digitization. Most have yet to implement the widespread ability for citizens and companies to conduct transactional digital services. Only 67% of EU citizens submitted a form online in 2019 while 83% of UN member states provide at least one transactional service online.

The limited digitization of governmental processes and services leads to cumbersome interactions between public administration and citizens and slows the ability of governments to respond to sudden challenges (such as identifying the chain of infections in the COVID-19 pandemic). In addition, governmental action constitutes an important part of Europe's GDP: a real pan European movement to digitize public administration via eIDs could have major transformative impacts across sectors of the economy and of the society.

CONNECTIVITY AND BEYOND   35

At the center of public sector digitization is a strong eID system that enables citizens to perform important tasks digitally instead of having to physically visit government agency offices or service centers. Identifiers are used extensively in the EU, but each country has its own ID system, leading to a fragmented use and capability.

A pan-European eID system will simplify the lives of citizens and contribute to the EU economy. Citizens in Estonia and Denmark already conduct more than 450 eID transactions per person per year. The EU has estimated that electronic public services (such as tax invoicing) could save member governments €53 billion a year. But there is substantial market fragmentation and a strong dependency on global players, such as device manufacturers and OS vendors that deploy their own technology and promote their own services.

The competitiveness and sovereignty of the EU are at risk. EU players could fall behind in the development of secure mobile services, and member states could be forced to rely on technological solutions and identification systems that were neither developed nor controlled within the EU.

European Council President Charles Michel has clearly defined the benefits of a European eID as simplifying the lives of citizens, especially in dealing with public authorities and businesses, and nurturing more cross-border transactions and advancing the integration and attractiveness of the EU internal market. Three of the key elements of such a system are:

- An electronic identifier. This is the basis for a simplified electronic authentication, data exchange, seamless processes and the "once-only" principle" when it comes to basic functions such as registration. The electronic identifier guarantees a one-to-one link between physical and electronic identity. Today, 22 of 27 EU countries have an identifier, but they are administered separately and unconnected.

- Electronic authorization. This is secure electronic proof of identity and the basis for use of sensitive services online.

- Electronic signature. This is required for electronic submission of legally binding declarations and simplifies conducting legally binding transactions online. Estonia saves 2% of GDP each year by using digital signatures.

In addition to providing the infrastructure (fiber and broadband) and secure platforms, telcos can play a central role in rolling out an EU-wide eID system by providing central hubs for identities, which establish neutral alternatives to the de facto oligopolies of internet companies for digital identities. These identities can then be used for a range of different services requiring authentication of users, such as banking, travel and hotel check-in, and public and private sector online services. If telcos make it easy for their business customers to provide ready access to such IDs in the services they offer, this will facilitate the change. One solution developed by Orange and others is a secured element in mobile devices that is divided into multiple "domains" (such as identity, health, and transport) where all relevant service providers would be hosted.

The oft-cited case of Estonia, which has long been both an eID and e-government leader, shows how public-private partnerships can lead to an advanced mobile ID and e-government service. (See the sidebar, Estonia's e-Government Evolution.)
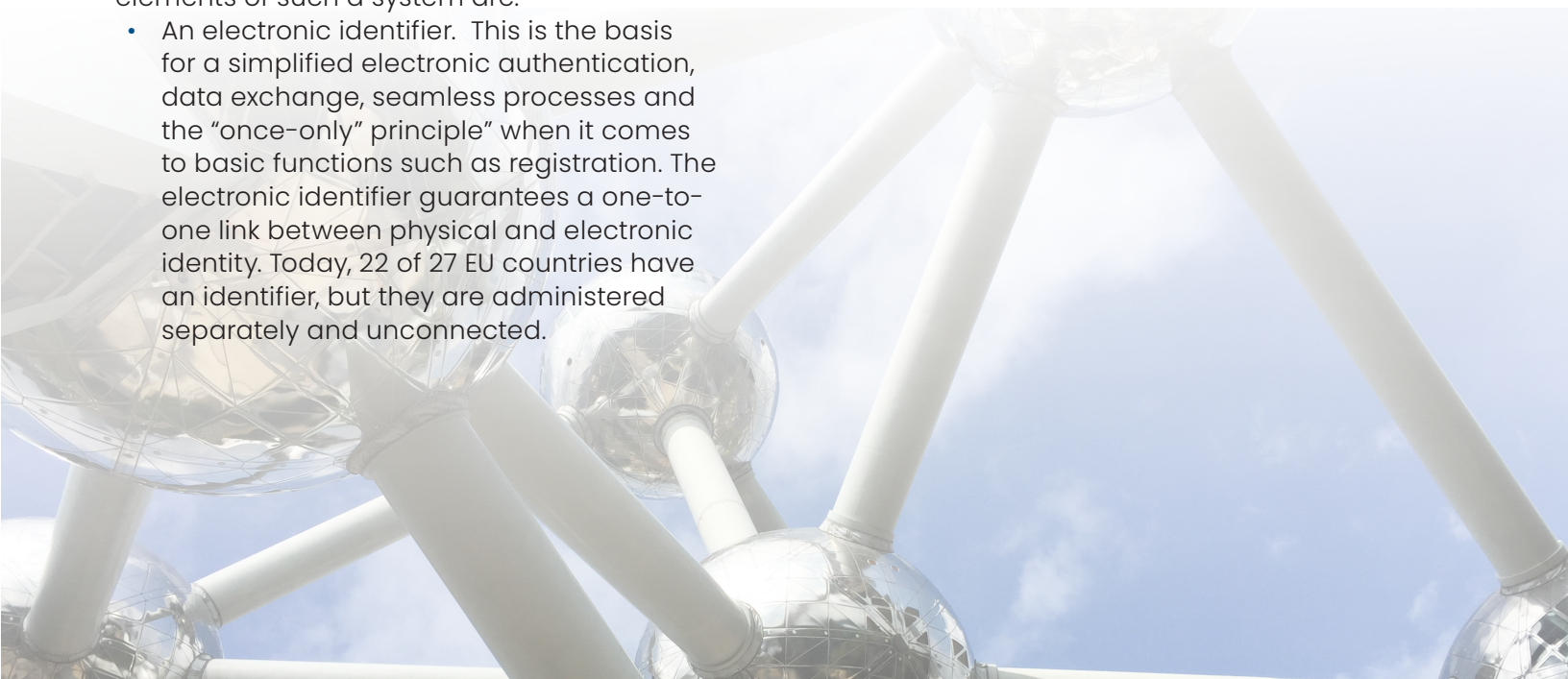
Case Study:

Estonia's e-Government Evolution

Estonia was an early mover toward establishing e-connections with its citizens and bringing as many governments services as possible to laptops and mobile devices. In the early 2000s, following adoption of the country's digital agenda, the government began providing electronic public services. Initially, the private sector's involvement was limited to manufacturing SIM-cards and card readers supporting public key infrastructure (PKI). In 2007, mobile operators began offering mobile authentication services to promote the development of electronic banking and other services. In 2011, the government and mobile operators reached an agreement to integrate mobile authentication into public services.

Today, Estonians can get their mobile ID from their network operator. Without installing any hardware or software, they can affix their signatures by simply typing PIN codes on their mobile phone. More than three quarters of the population has signed using their digital ID. Public and private players can access the same data-exchange system (called X-Road), enabling truly integrated e-services. Public services include a population register, a health insurance register, vehicle registration. Private companies from the energy, banking, and telecom sectors offer e-registration and services. Estonia has initiated a cross-border project with Finland to create an innovative database with multinational access. Estonia and UAE were the only countries to offer nationwide internet voting as early as 2013, and in Estonia online voting has accounted for a quarter of all votes.

E-Government Result in Estonia
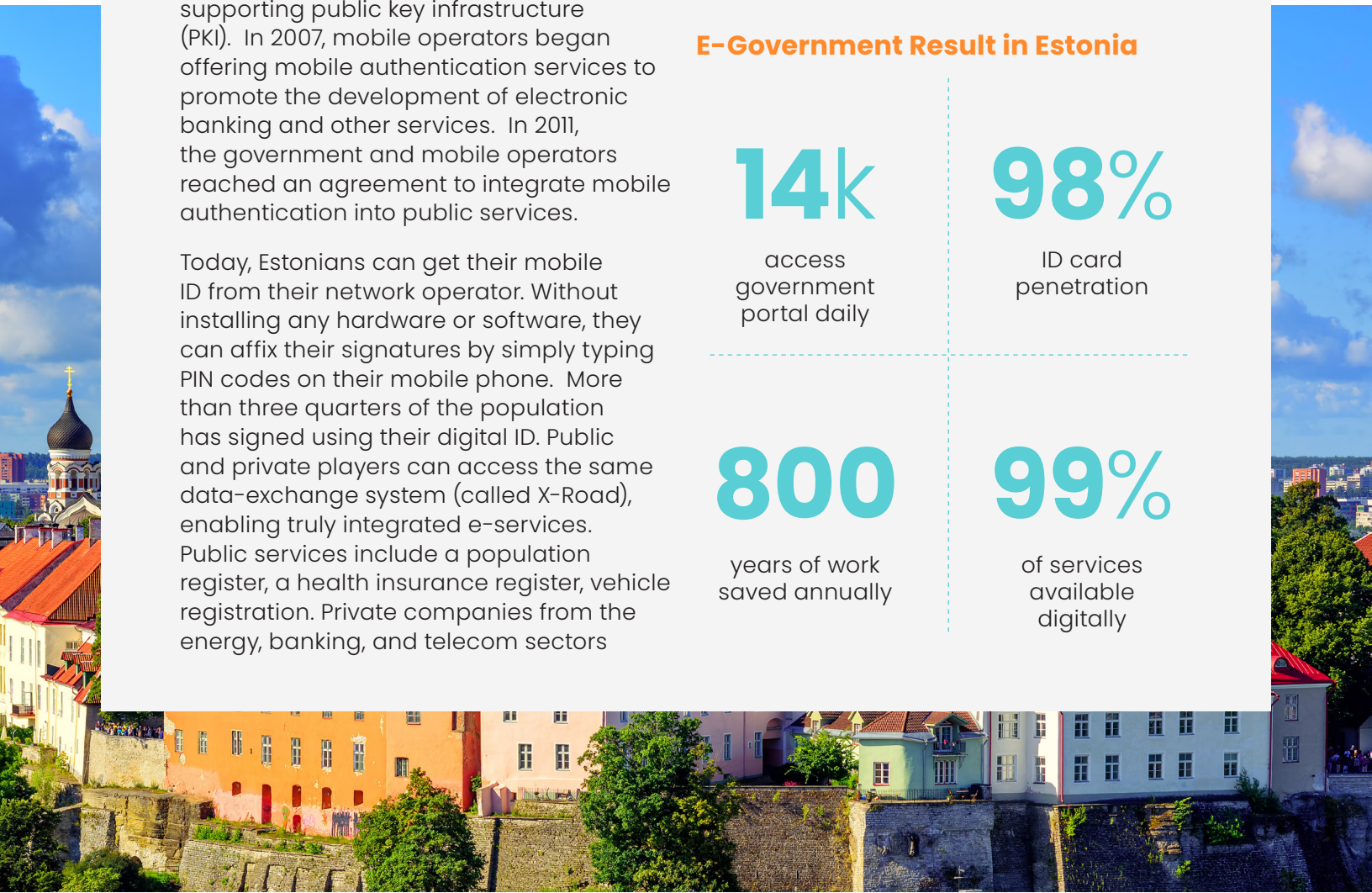
14k
access government portal daily

98%
ID card penetration

800
years of work saved annually

99%
of services available digitally

The EU's eIDAS (electronic Identification, Authentication and trust Services) regulation aims to ensure the interoperability of the different national systems, allowing individuals and businesses to use their national eIDs to access online public services available other EU countries. In addition, eIDAS creates a European internal market for "trust services," such as electronic signatures, electronic seals, time stamps, electronic delivery services and website authentications, by ensuring that these services work across borders and have the same legal status as paper-based equivalents.
Telcom companies have an important role to in the development and functioning of a new eco-system for digital identities, for example this can be done as follows:

- Solutions for the **technical infrastructure:** safe storage of digital e-IDs in secure elements (smartphone or SIM card), eID Security as a Service

- **Authentication** services for other sectors

- **Industry Use-cases** for telco-specific or cross-sector applications

There are other strong functional models for how governments and telcos can cooperate to further adoption and use of eIDs. Mobile operators serve as central hubs of identities for online commerce, banking and insurance, e-government, apps, IoT, APIs, or anything digital that requires authentication of users or entities. While new solutions are under development (based on secured elements), the basic approach involves mobile operators issuing users with a mobile ID-enabled SIM and then facilitate the customer relationship when people use a digital signature to authenticate themselves for e-gov or other online services. The SIM cards are usually issued by a certification authority and sold to customers by their respective operators as part of their existing mobile phone contract. Digital authentication goes through the mobile operator, based on a global standard for eID called Mobile Connect SSI . To access an electronic service through a mobile phone, two-factor identification is used without any additional hardware.

End-user data is stored in the country's population registry. Mobile operators check their customer data against registry to provide the authentication service. Operator send requests to the government server and receive a positive or negative response; they do not have a direct access to the registry or other citizen data.

Providing e-Government services through an eID system gives citizens easier access to public services, improves their digital skillsets, foster cross-border transactions and lower costs for governments.

Our Framework

06 **Energizing the Spirit of European Innovation**
Industrial strategy and cooperation

05 **Advancing the Readiness of Citizens**
Digital skills

04 **Expanding the Reach of Opportunity**
Digitalization of the economy and society

03 **Taking the Lead**
European solutions for data and services

02 **Constructing the Full Foundation**
Networks and connectivity

01 **Our Commitment**
We want to raise the ambition

Expanding the Reach of Opportunity
The Digitalization of the Economy and Society

The Plan.

Create solutions to accelerate digitization in areas with the most socio-economic value

- **End-to-end solutions**: Push development of concrete solutions and products that can accelerate the digitization journey of private companies (e.g., SMEs) and the public sector (e.g., education).

- **Societal challenges:** Create value for society beyond profitability by tackling sustainability and societal impact challenges

- New business models: A stronger focus on end-to-end products and solutions across vertical use cases that help the telco industry to transform its business to become less dependent on digital infrastructure provision alone, opening up new revenues pools and collaboration models

The vision of European telcos.

- Taking the lead in developing solutions with the main goal of benefitting society, e.g., by allowing continuity of education, improving the resiliency of small businesses, and enabling other companies to improve sustainability and cut greenhouse gas emissions

- Create solutions that simplify the switch to digital processes by integrating infrastructure, applications, security and administration functionalities

- Partner with other industrial players to provide devices, content, collaboration and communication tools

How Policy Cooperation Can Speed Progress.

- Develop ambitious policy targets for digitalizing industrial sectors and public administration at large, including in healthcare, energy and transports

- Direct public funding packages towards solutions that create societal benefit, such as in schools

- Lower bureaucratic hurdles, e.g., simplify and shorten application and allocation process for public funding

Telecom operators are accelerators of the green transition. 5G and fibre networks as well as our products and services are what will enable our customers – small and big – to considerably reduce their footprint, while increasing productivity.

Guillaume Boutin
CEO, Proximus Group

At the heart of systemic inequality and disadvantage are lack of access to education, to financial capital and to healthcare. Governments aside, there are no other institutions like the tech titans who have the power and innovative capability to fundamentally change the course of inequality along those dimensions.

Andrea Jung, President, Grameen America, and Director, Apple Inc.

>60%

Of nine year-olds in the EU are in schools which are still not digitally equipped

3

EU countries only in which more than 50% of teachers used ICT in their lessons on a daily basis pre-COVID-19

>70%

of university teachers in Germany had to use private devices for digital teaching during the pandemic

56%

of countries in which schools were closed during the pandemic had to create national education platform

The screens of our laptops and devices are the doors to the digital world. Childhood development, education, health care and business today are increasingly digital endeavors. COVID-19 has accelerated this reality.

Telcos can speed the digitization journey for both private- and public-sector players with new products and solutions—which they are already doing. Small businesses and schools need more digitization. Telcos can help speed digitization in these sectors with a combination of standardized solutions that are easy to adopt and use and their local market presence. Part of this is the course of normal telco business. Part will involve additional programs and public-private initiatives.

Digitization of Education.

The COVID-19 pandemic shone a bright spotlight on the shortcomings of the education system in countries around the world. Europe did not escape exposure. As schools were closed, administrators scrambled to mobilize alternative channels for remote learning. There were plenty of hurdles. For example:

- More than 60% of nine-year-olds in the EU are in schools that are not digitally equipped
- There are only three EU countries in which more than 50% of teachers used ICT tools in their lessons on a daily basis pre-COVID-19
- More than half of countries in which schools were closed during the pandemic had to create national education platforms

Against this backdrop, the EU's existing Digital Education Action Plan (2021-2027), which includes such goals as enforcing strategic dialogue, improving connectivity in schools, encourage women in STEM (science, technology, engineering, and mathematics), and having less than 15% of students underperforming in ICILS (International Computer and Information Literacy Study) by 2030, comes up short. It lacks tangible quantitative KPIs as well as a strong focus on the main protagonists—students, parents, and teachers.

Telcos' Ambition for Digitally Equipped Schools & Trained Teachers

100%

Schools in the EU equipped with digital infrastructure by 2025

100%

Students and teachers in EU are digitally equipped to study remotely by 2025

Source: BCG analysis

They are attainable. A BCG global study found that insufficient digital infrastructure is the number one barrier preventing the development of a digital culture in school. With cooperation from government at various levels on the non-technical issues, telcos can make the technology happen. We can provide infrastructure and access, ensuring continuity of education delivery by leveraging existing technology or developing new solutions, effectively addressing access issues for all students.

Specifically, the telco "school in a box" solution covers the infrastructure, hardware, and software for a digital ecosystem covering all essential functionalities:

- Hardware (such as laptops and tablets) for teachers and students
- Targeted LAN solutions for schools
- High-speed internet connections
- School domains and e-mail addresses
- Cloud-based communication packages
- Additional services for troubleshooting and other needs
- School platforms for digital learning

Telcos intend to be central in the digitization of schools by providing the end-to-end solutions necessary to bring all educational stakeholders online. Telcos would provide the infrastructure, including high-speed internet (more than 100 Mbps) connectivity, WiFi routers, school domain and email addresses, ID management systems to administer user rights, and secure data storage hubs. Partner companies with the relevant products and expertise would deliver hardware and applications, including laptops and tablets in classrooms, cloud-based application packages, and troubleshooting support.

BCG estimates the costs of connecting all schools in the EU (excluding the physical infrastructure and fiber network) at about €14 billion a year, which includes technology equipment, network requirements, professional development of teachers, and access to content for primary, lower secondary and upper secondary education. Will this be enough? Just to get an idea of the magnitude, consider that this amount is equivalent to 1.8% of the €750 billion "Next Generation EU" recovery plan launched by the European Commission: while Next Generation EU is an extraordinary fund, this figure helps us put things into perspective.

Digitization of SMEs.

The current numbers are not good.

Given that small businesses make up 99% of businesses in OECD countries and more than 60% of the workforce, the lag compared with larger companies in ICT adoption and maturity is cause for substantial concern.

>24%
of EU companies with 10 to 250 employees do not use a website

10–20%
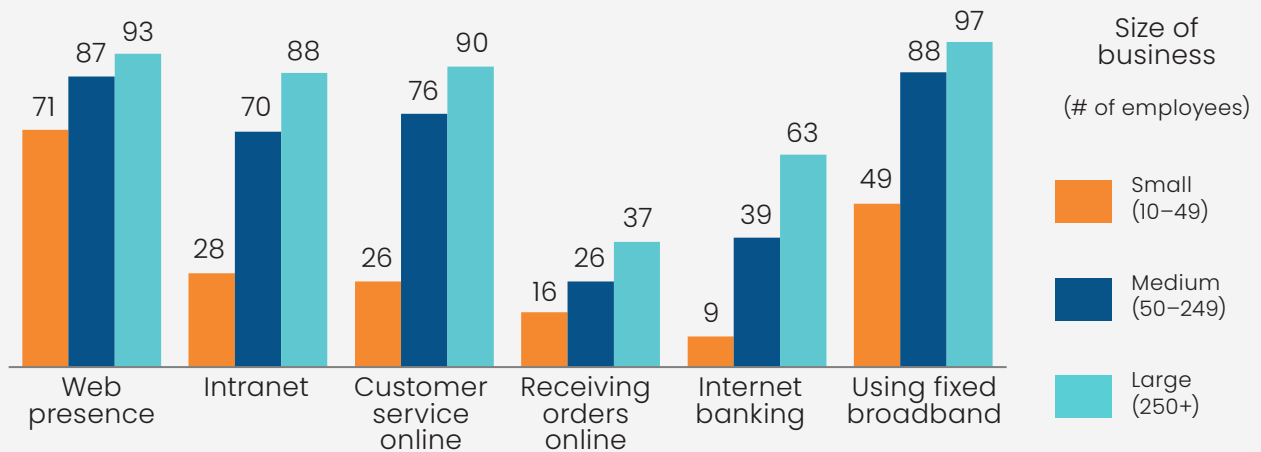of SME employees have been able to work remotely during lockdown compared with 50% of large company employees

83%
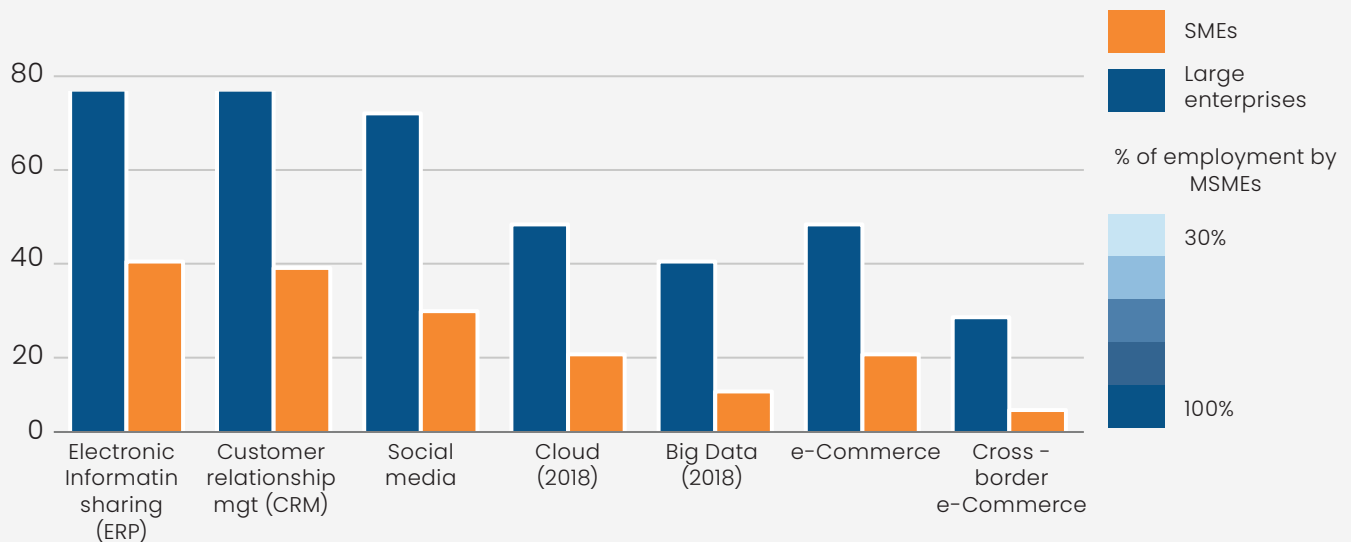of EU SMEs do not use advanced cloud services

Source: BCG analysis

SMEs Lag Behind Large Companies in Digital Tools and Capabilities

Businesses engaging in digital activity (%)

Only ~50% of SMEs have plans for digital transformation (vs. 98% of larger ones)

Bar chart "Businesses engaging in digital activity (%)":

Category	Small (10–49)	Medium (50–249)	Large (250+)
Web presence	71	87	93
Intranet	28	70	88
Customer service online	26	76	90
Receiving orders online	16	26	37
Internet banking	9	39	63
Using fixed broadband	49	88	97

Size of business (# of employees)
- Small (10–49)
- Medium (50–249)
- Large (250+)

Adoption of digital technologies (% enterprise), 2019

Bar chart legend:
- SMEs
- Large enterprises

% of employment by MSMEs: 30% — 100%

Lack of digitization of small and medium businesses means that crises such as COVID have an outsize impact on the economy and employment. For example, an April 2020 survey in Germany found that 58% of SMEs experienced a 50% average drop in turnover. In May in the UK, 37% of firms were considering, or had already made, redundancies. In France, SMEs account for nearly all partial redundancies (93%). More than a third of Portuguese small businesses had experienced a drop in production of more than 50% as of April. A survey in Italy in October 2020 predicted that the annual turnover of SMEs would drop by 11 percentage points (and up to 16% in the event of further lockdowns). Gross profitability would fall by 19%.

A survey by Vodafone found that during lockdowns companies that are digitized had have identified new business opportunities at double the rate of the ones that are less digitized. It also found that the more digital tools used by SMEs, the more opportunities they realized during the COVID-19 crisis.

Nick Read, Vodafone's CEO

"For the €750 billion EU recovery program, we need to think about where we can make a difference, the vulnerable parts of society. We as telcos can play a part in accelerating digitization of SMEs."

According to the European parliament, only 17% of SMEs have so far successfully integrated digital technology into their businesses. They need support to make use of innovation opportunities and to maximize synergies with EU programs. Nonetheless, Europe does not have a comprehensive strategy for advancing the digitization of small businesses (although some telcos, such as TIM in Italy have mounted programs). It's time to put a comprehensive plan in motion. Our analysis indicates that 80% of SMEs in EU could have their key business processes digitized by 2025 and that 90% could enable employees to work remotely via digital infrastructure over the same time period.

As with schools, telcos can support small businesses by providing an end-to-end "digital SME in a box" solution that enhance their competitiveness, especially against larger companies, and in the process give SME managements more time to focus on running their businesses. Digitizing small businesses involves multiple components:

- **Connectivity.** Telcos can lead providing connectivity to SMEs and their employees
- **Devices.** Telcos can partner with device manufacturers to provide devices for remote work
- **Other infrastructure.** Telcos can lead providing essential platforms such as cybersecurity, cloud storage and private networks
- **Solution and applications.** Telcos can partner with software companies to provide a full range of applications for productivity, ecommerce, and e-banking
- **Financing.** Telcos can support SMEs in applying for governmental subsidies to make digitization more affordable
- **Education.** Telcos can partner with existing learning platforms to educate and train staff

A package for SMEs could include 1 GBit/s fiber connectivity, website hosting, an ecommerce platform, devices (phone and tablet); productivity solutions; and CRM and payment applications. For sake of comparison, we estimate the total cost of digitizing Europe's small businesses (companies with fewer than 250 employees each) at about €26 billion a year or the equivalent of 3.5% of the €750 billion "Next Generation EU" recovery plan.

The payback comes in multiple forms. Small businesses and their owners get easy setup and access to digital services such as ecommerce that enable them to continue to serve customers despite restrictions. Jobs across the EU are protected by helping that SMEs survive in face of adversity. More employees can work remotely using digital collaboration tools. Digitization fosters innovation at the small business level, and it helps drive diversity and inclusion since small businesses represent the long tail of companies targeting niche markets and catering to a diverse customer base instead of the mass market.

Alexandre Fonseca, CEO of Altice Portugal,

"I label myself as CEO of a global solutions provider, not as a telco CEO. Besides voice and data, we want to provide the right solutions to drive the digital transformation of businesses."

> **Telecom operators are accelerators of the green transition. 5G and fibre networks as well as our products and services are what will enable our customers – small and big – to considerably reduce their footprint, while increasing productivity.**
>
> **Guillaume Boutin**
> **CEO, Proximus Group**

Improving Environmental Impact and Sustainability with Smart Technology.

The role of ICT in the global climate struggle is clearly captured in the following numbers. On the one hand, the whole sector amounted to 2.6% global CO_2 emissions in 2020. On the other hand, an extensive and network-enabled uptake of smart digital solutions across sectors can enable a 15% reduction of the global CO_2 emissions. This means that there are two fundamental sides to the story: clearly, the ICT sector must reduce its own footprint; however, policymakers cannot to miss out on the sector's ability to enable carbon neutrality at the systemic level. It would be a waste of unimaginable proportions.

Telcos can—and have been—reducing their own power usage and emissions. Numerous telcos have long sourced energy from renewable sources: ETNO/Analysys Mason data from 2021 shows that European telcos have increased their use of renewable energy by 24% in one year. Many operators across Europe have reduced CO_2 emissions and pledged or achieved climate neutrality in their operations. The greater energy efficiency of 5G (which is almost 90% more efficient per Mbps than 4G) and fibreoptic cables are steps in the right direction. When looking at decarbonisation and connectivity, of course, networks are not the only factor: what happens inside households, factories and offices is a significant part of the issue. Among others, the role of end users' hardware is a major factor to be taken into account.

When we zoom to the larger supply chain, the bigger areas for contributing to carbon reduction involve enabling customers to cut their greenhouse gas emissions, including:

- **Smart cities and buildings:** Up to 30% emission savings
- **Transportation:** Up to 30% emission reduction
- **Industry IoT and blockchain applications:** Up to 11% emission avoidance
- **Energy** (such as smart grids): Up to 7% avoided emissions

The far larger impact is the effect telcos can have by enabling other sectors of economy to reduce their carbon footprints through adoption of digital tools. Developing products and solutions for others could reduce carbon emissions by up to 10-15%. As Cedric Neike of Siemens put it, "Resources are finite, data is infinite. The challenge is how to use data to make resources go further. Telcos are in a good position to offer products to reduce CO_2 emissions, such as traffic optimization and smart buildings."

As we shift from the concept of sustainability to the broader concept of purpose, it is clear that what is good for the planet is also a sound business strategy. BCG has estimated that there is a $3.5 trillion opportunity for telcos if they put a total societal impact (TSI) strategic lens on their business, assessing the benefits to society from the company's products, services, operations, core capabilities, and corporate social responsibility initiatives, including the explicit decisions a company makes to adjust its core business. There is also potential for telcos to influence how they are valued by redefining the ways in which capital markets—applying a TSI lens—view them, their industry, and their role in business and society.

Setting Demand Goals as Key Progress Indicators.

Perhaps Marco-Alexander Breit of the German Federal Ministry of Economics and Energy sums it up best: "Digitization has three main goals. One, making knowledge accessible to every student in the world, regardless of where he/she lives. Everything else is a waste of resources. Two, contributing to a carbon neutral and sustainable future, such as the resources needed to run servers, 5G, and the IoT need to be compensated by targeted initiatives. Three, creating equal access to connectivity across the world."

60%
of general practitioners do **medical video consultations on regular basis** by 2025

75%
of **trucks/buses** and 25% of cars **use advanced technologies** (e.g. C-ITS, CCAM, SoL)

100%
of students and teachers are **equipped and enabled for remote schooling**

Demand-side Goals for 2025

Source: BCG analysis

Access is one thing—uptake is another. In the wake of the COVID-19 experience, when connectivity and digital capability provided resilience in the face of the pandemic, the European Commission, ETNO, and others have talked about setting goals related to demand for and use of digital services (in addition to goals for infrastructure). This idea bears more exploration, but we can see the benefits of having formal targets for the use of key digital capabilities and services across Europe. Such goals would drive the EU's use of advanced technology, increasing its competitiveness, and also give additional comfort for those investing in digital infrastructure and innovations. If such an effort is to be taken seriously, the specifics of the targets require substantial and thoughtful analysis, but as food for thought, potential demand goals and constituent groups could include the following:

- **SMEs:** Percentage of small businesses with websites, mobile apps, and offering products and services via e-commerce channels. Percentage of SMEs that use digitally enabled production processes

- **Large manufacturers:** Percentage of big companies employing IoT devices to improve operations or customer service or launch data-based services

- **Transport:** Percentage of trucks equipped with sensors tracking speed, fuel use, and emissions. Percentage of transport companies that adopt data-based analytics for improving logistics.

- **Energy use:** Percentage of homes and commercial buildings equipped with sensors tracking energy use and efficiency. Number of energy companies that deployed fully digitized energy systems.

- **Education:** Percentage of students regularly using digital devices for learning or participating in online or mobile classes or programs

- **Health care:** Percentage of physician consultations taking place using e-medicine tools as opposed to physical office or clinic visits

Setting such targets as these will require careful consideration by the Commission of the economic and societal benefits for each sector. These targets can then be applied, with some urgency, to help direct allocation of recovery funds to digital opportunities for optimal impact.

Upgrading digital infrastructure of all European schools would require €14bn/year, or 1.8% of Next Generation EU Fund

Digitalizing all European SMEs would require €26bn/year, or 3.5% of Next Generation EU Fund

Our Framework

06 **Energizing the Spirit of European Innovation**
Industrial strategy and cooperation

05 **Advancing the Readiness of Citizens**
Digital skills

04 **Expanding the Reach of Opportunity**
Digitalization of the economy and society

03 **Taking the Lead**
European solutions for data and services

02 **Constructing the Full Foundation**
Networks and connectivity

01 **Our Commitment**
We want to raise the ambition

Advancing the Readiness of Europe's Citizens
Digital Skills

The Plan.

Upskill and reskill the population and workforce of tomorrow by taking digital literacy to the next level

- **Upskilling:** Upskilling the EU population so that everyone has the basic skills they need to function in a digital world is a prerequisite for a digital society and economy

- **Reskilling:** Facilitating the training and retraining necessary for workers to function effectively as advanced technologies such as machine learning and artificial intelligence reshape labor markets in the coming years

- **Inclusion:** Target entire population and ensure that everyone is aware of, and has access to, education and training by leveraging telcos' existing access to households and companies

The vision of European telcos.

- Supporting the execution of upskilling and reskilling by providing training platforms

- Promoting responsible use of technology and fostering digital inclusion of everyone

- Becoming the official partner and promoter of digital skills by leveraging direct access to all households and creating awareness across the entire population

How Policy Cooperation Can Speed Progress.

- Taking the lead in creating a standard definition and certification framework for digital skills in the EU, similar to the CEFR1 levels for languages

- Professionalize digital literacy across the EU to help citizens in obtaining the skills required for work and life in the digital economy

- Prioritize digital upskilling and reskilling by setting clear targets and incentives for all EU governments

- Promote importance of digital skills via public institutions

The digital divide is also a problem on the demand side. COVID has shown how important digital literacy and skills are amongst educators, parents and kids. Telcos can play a significant role in offering training programs… 42% of Europeans don't have basic digital skills.

**Doreen Bogdan-Martin,
Director, ITU**

Today, human capital is intertwined with our ability to advance digital upskilling. Telecom companies have a major role to play in this historic effort to achieve digital empowerment.

**Luigi Gubitosi
CEO, TIM**

42%

of Europeans don't
have basic digital skills

57%

of enterprises are
facing difficulties in
filling vacancies when
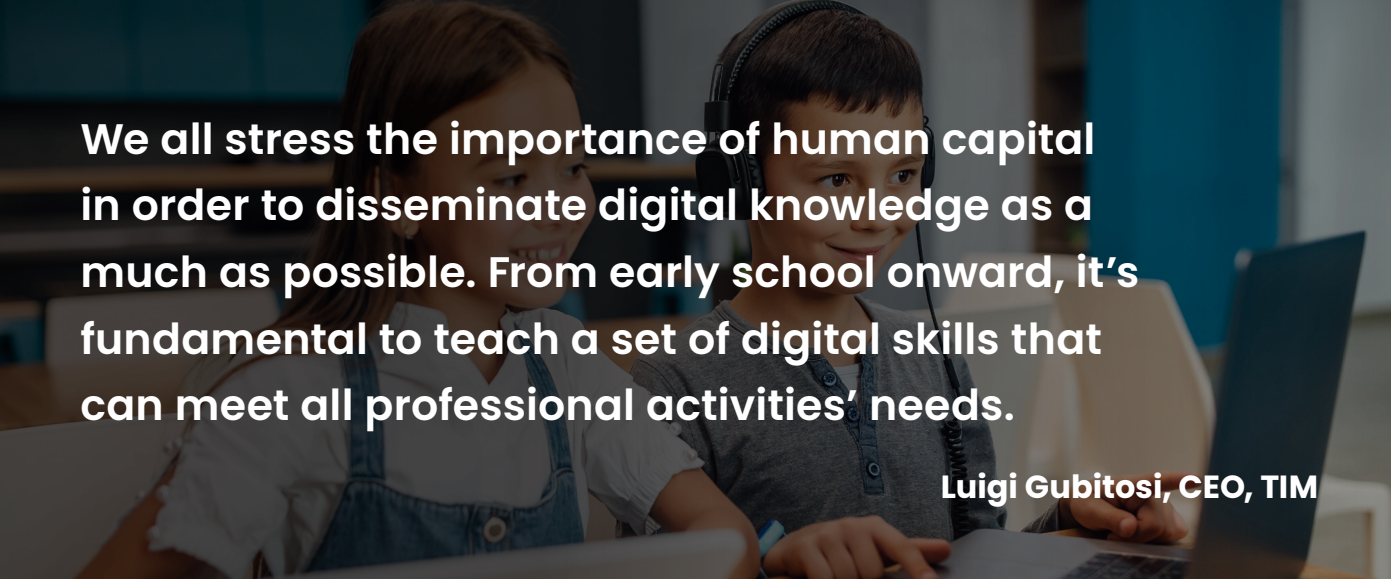recruiting ICT personnel

9.5%

of EU citizens have
never gone online

65%

of first graders will
work in a job that
doesn't exist today

Source: BCG analysis.

Welcome to the brave new digital world. The problem is, we aren't ready. Digital skills have become basic to just about all aspects of life. Luigi Gubitosi, CEO of Italy's TIM puts it this way:

> **We all stress the importance of human capital in order to disseminate digital knowledge as a much as possible. From early school onward, it's fundamental to teach a set of digital skills that can meet all professional activities' needs.**
>
> **Luigi Gubitosi, CEO, TIM**

There are two fundamental issues: Upskilling and reskilling.

Upskilling.

Many people don't have the basic skills to function in a digital world, a problem that is often more prevalent among vulnerable populations, which increases their vulnerability even further.

The increasing number and array of smart devices make technology omnipresent and require that everyone understands how to use these tools. The presence of technology is growing in every corner of the home. Children are growing up in a much more digitized environment where they are to risks and challenges at a much younger age. Skilling up the population is inevitable to ensure that everyone can access essential services and function safely in an online world. Establishing clearly defined levels of digital literacy enables us to identify areas for improvement and set targets for raising the bar.

According to the European Commission, only 58% of EU citizens have at least basic skills, meaning that more than 40% do not. There is also wide disparity among countries in terms of digital skills.

Upskilling the EU population is the most essential prerequisite for a digital society and economy.

As Ankur Vora, Chief strategy officer of the Bill & Melinda Gates Foundation, said,
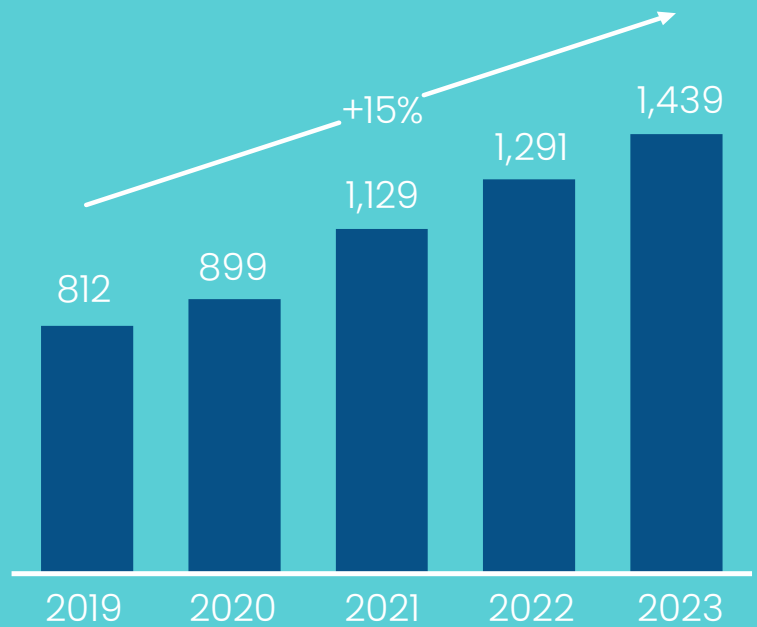
"Digital inclusion is now much more relevant than ever. COVID has shown how aggressive crises can be."

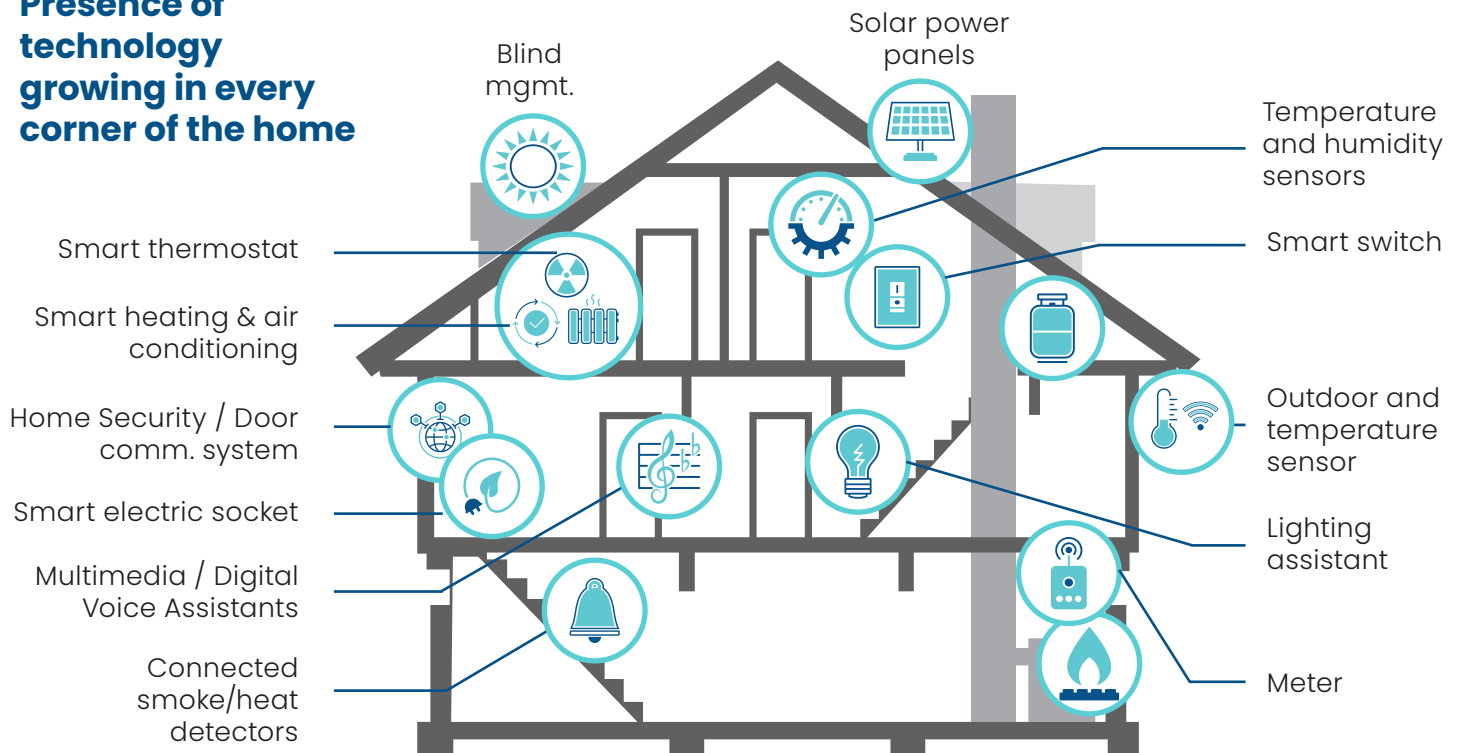# Increasingly Omnipresent Technology Mandates a Basic Set of Skills for Everyone

Global increase in number of smart home devices expected to accelerate

# of smart home devices (in M)

+15%

2019	2020	2021	2022	2023
812	899	1,129	1,291	1,439

Presence of technology growing in every corner of the home

Blind mgmt.

Solar power panels

Temperature and humidity sensors

Smart switch

Smart thermostat

Smart heating & air conditioning

Home Security / Door comm. system

Smart electric socket

Multimedia / Digital Voice Assistants

Connected smoke/heat detectors

Outdoor and temperature sensor

Lighting assistant

Meter

Sources: Gartner, "Forecast: Internet of Things—Endpoints and Associated Services, Worldwide," 2016; IDC, "Worldwide Smart Home Device Forecast," 2020.

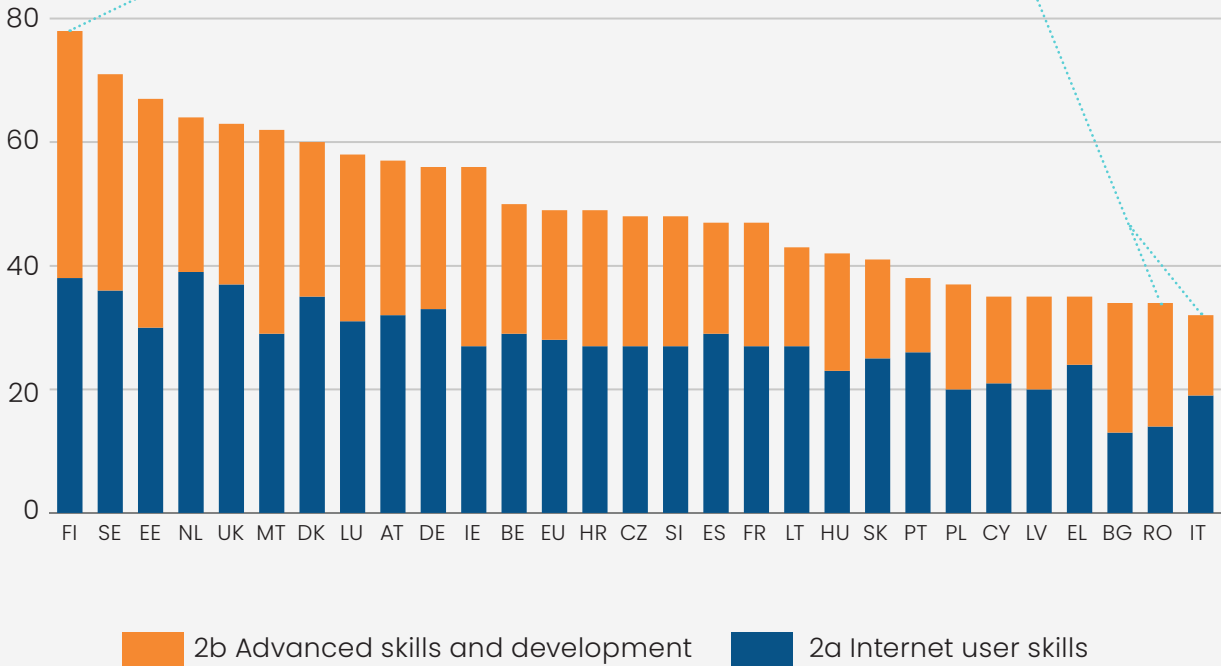# The Inequality of Digital Skills Highlights the Need for a Standardized Digital Literacy Platform

**Human capital dimension
(Score 0–100), 2019**

‹3/4

Finnish citizens having highly advanced digital skills

‹35%

sufficient digital skills ranking Italy and Romania the lowest

■ 2b Advanced skills and development   ■ 2a Internet user skills

Note: 2a indicates at least basic digital skills; 2b represents ICT graduates and specialists.

Source: DESI 2020 European Commission.

Reskilling.

Ensuring that everyone achieves certain levels of digital literacy facilitates the training and retraining necessary for workers to function effectively as advanced technologies such as machine learning and artificial intelligence reshape labor markets in the coming years. More than 40% of people without digital sills are unemployed. By 2022, 42% of the core skills required to perform existing jobs are expected to change. More than 139 million new jobs will be created and most of these will require some level of digital competency.

Getting Ahead of the Problem.

Telcos have already launched a number of initiatives. ETNO, for example, funded by a grant from the European Commission, has launch a project called Digital Upskilling For All! that aims to develop best practices and create recommended pathways for digital upskilling, inclusion and diversity within the workforce of the European Telecoms sector. In the ecosystem, tech companies have also recognized the need for both upskilling and reskilling and are providing their version of solutions.

Telcos can further contribute to the reskilling and upskilling of Europe at scale in at least three ways: creating awareness, offering training platforms, and support the development of certification standards.

Telcos can partner with a variety of institutions (such as schools, chambers of commerce, and job centers) to maximize awareness of the need to acquire and improve digital skills. This kind of effort can point people toward online platform offering training courses that provide digital classes covering the most essential skills. Telcos can work with existing online learning platforms to develop these digital upskilling classes and make them available via their own websites or pre-installed apps. Working with EU and national government ministries of labor and education, telcos can help develop a standardized EU-wide certification program that includes an EU-wide reference framework for various proficiency levels and a European "digital skills passport" that helps equal ensure opportunities for cross-border employment and inclusion of different demographic groups.

TIM in Italy has launched Operation Digital Renaissance to provide training courses to encourage the adoption of new technologies and increase the level of digital skills of students, SME employees, and those working in public administrations. The program, which involves the collaboration of the European Commission and about 40 partners, is supported by Italy's Minister of Innovation, Minister for Public Administration, Minister for Regional Affairs and Autonomies, and the Special Commissioner for the implementation of the Digital Agenda.

Orange has announced plans to invest more than €1.5 billion in a skills development and retraining program to "strengthen, adapt or refresh the skills of all Group employees, while simultaneously addressing new external audiences to help build the talent pools of the future."

More than one million people in Sweden today lack the knowledge, ability and technology to take part in the digital world. Telia's Mer Digital (More Digital) program in Sweden and Norway partners with municipalities to bring basic digital skills to the elderly. It brings in young people to train the elderly in basic skills such as using email, digital banking ID, and video calls, also creating a sense of community. The program has supported more than 10,000 elderly since it started and is now being extended to offer basic training in digital skills to the SMEs.

Telcos can also take the lead in creating a standard definition and certification framework for digital skills in the EU, similar to the CEFR1 levels for languages. They can become official partners and promoters by leveraging their direct access to households and creating broad awareness of the need for building digital skills. They can support the execution of upskilling and reskilling by providing training platforms and promoting responsible use of technology and foster digital inclusion of everyone. Deutsche Telekom has an extensive online learning platform for empowering its employees, which it uses to encourage knowledge-sharing and organizational learning. In addition, it is partnering with major academic institutions to deliver free access to courses and top-notch learning resources. Similarly, Vodafone is working with online course provider Udemy to make available a more than 150 free online video courses covering business and productivity, technology, personal development and wellness. Vodafone customers also have six weeks free access to Perlego, the world's largest online academic and professional library, with a library of more than 300,000 titles from the leading educational publishers.

Policymakers can help by professionalizing digital literacy across the EU to help citizens in obtaining the skills required for work and life in the digital economy. They can prioritize digital upskilling and reskilling by setting clear targets and incentives for all EU governments, including prioritizing digital inclusion funding in their recovery plans and promoting the importance of digital skills via public institutions.

Our Framework

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Industrial strategy and cooperation

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Digital skills

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We want to raise the ambition

Energizing the Spirit of European Innovation

Industrial Strategy and Sectoral Cooperation

The Plan.

Foster the development of **digital innovation ecosystems** that can help us meet some of our biggest challenges, such as climate change, and become the engines of invention and advancement for years to come.

The vision of European telcos.

- Take an active role in orchestrating cross-sector and cross-industry collaborations to develop innovations and new technologies

- Invest in new and upcoming technologies and venture capital to strengthen the European tech sector

- Share investments, resources and knowledge across sectors and industries to create innovative use cases with a far-reaching impact

How Policy Cooperation Can Speed Progress.

- Design strong industrial strategies that encourage private action and shape long-term industrial policies that foster digital ecosystems

- Support collaborations and build of scale by enabling entrepreneurial partnerships beyond infrastructure

- Direct funding towards startups and venture capital to support the development of new technologies

> **If Europe wants to become a digital leader, we need to invest more in startups and the launch of new companies and technologies.**
>
> **Nicolas Gisin, professor, University of Geneva**

When it comes to digital innovation, Europe lags the two leading regions of the world: Silicon Valley and China's "Gold Coast." There are exceptions, of course: ARM is a world leader in semiconductor design (and now being acquired by NVIDIA) and Spotify has been a big disruptor of the media services market and a global role model for adopting agile ways of working outside of software development. But broadly speaking, Europe has ceded tech innovation to others.

Why Europe Lags Others.

Experts (and critics) see several reasons. Some argue that Europe lacks a culture that fosters innovation while countries in Asia and elsewhere are quick to embrace new technologies such as 5G. There is also the issue of fragmentation: Europe is a highly fragmented market for telecommunications services, leading to a high cost of doing business. Larg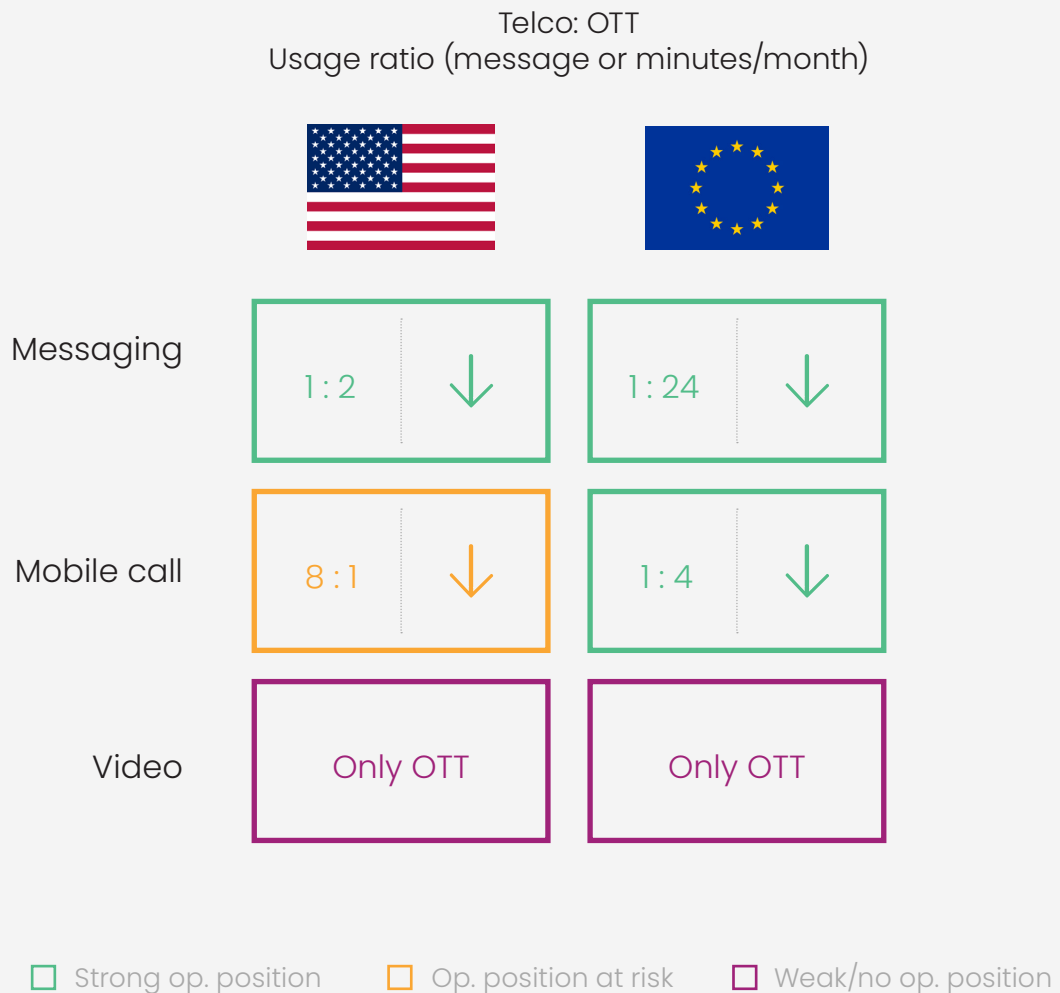er, more unified markets enable diversification, specialization, and innovation. This is true also of the telecoms ecosystem.

Meanwhile, the overall communication market is increasingly led by global internet platforms with their bundled offers. For example, Facebook (including WhatsApp) fully integrates messaging, voice and video, financed primarily by advertising and or cross-subsidized B2B offers. Microsoft, Cisco, and Google are offering fully fledged B2B collaboration solutions, which include messaging, voice and video, for a single monthly fee.

As we explained in previous chapters, this is a complicated story. It starts with specific regulatory choices focused on price rather than quality, limited returns on investment compared to other geographies, lack of a true single market across the EU and a general climate in which bullish approaches to innovation are not encouraged.

Europe's Telcos Are Losing in New Communications Environment

Communications[1] market day

Telco: OTT
Usage ratio (message or minutes/month)

	🇺🇸	🇪🇺
Messaging	1 : 2 ↓	1 : 24 ↓
Mobile call	8 : 1 ↓	1 : 4 ↓
Video	Only OTT	Only OTT

☐ Strong op. position   ☐ Op. position at risk   ☐ Weak/no op. position

Reading aid 1:2 describes relation Carrier to OTT (e.g., messaging DE 1:222, for every carrier message, a customer writes 222 OTT messages)

1. Communications including messaging (including SMS/RCS), fixed and mobile call and video telephony
Note: Heatmap generated automatically from the underlying model
Source: Deutsche Telekom

Looking Ahead.

We think the critical question is not so much how Europe came to its present state, but what should be its posture going forward. The previous chapters offer a concrete vision from our sector, but also clear indications as to what policymakers can do, now, to help.
Innovation is the lifeblood of business; it drives the advancement of society and the growth of economies. It is essential to combatting some our biggest challenges, such climate change. The goals of the Paris Accord cannot be reached without continued technological innovation. Europe needs to regain its place at the global digital innovation table.

In this sense, the startups, new technologies and companies to develop them are critical. Even more central is the development of digital innovation ecosystems that become the engines of invention and advancement for years to come.

Consider how these ecosystems work. If we analyze the US case (where innovation is characterized by top-quality research, both basic and applied) through a fresh lens, we can see beyond the simplistic narrative of the "two guys in a garage". The Defense Advanced Research Projects Agency (DARPA), set up by President Eisenhower at the end of the 50s, had been one of the most sophisticated and consequential governmental programs of modern history. Government support and funding have been consistent over the years and, with the change in administration, it looks like the US might be in for a relaunch of their government ambition in this field. Also, even in years in which public funding has declined, this has been more than offset by rising venture investor and company R&D spending. As a result, the US maintains its leading position globally as the R&D powerhouse. It has a business-friendly academic culture and is very effective at converting basic research into companies with strong financial backing. In addition to Silicon Valley, the country has several multidisciplinary geographic centers, or hubs, of tech startup activity. In addition, it has the highest number of unicorn companies of any major region in the world.

In China, R&D is increasing fast in both volume and quality. Investment is booming and is about 70% financed by business, while basic and applied research is funded mainly by the government. Advanced tech startups receive massive financial backing. Innovation is centered in specialized hubs, clustered in four main regions. China has shown strong potential for creating unicorns. The 14th government five-year plan (2021 to 2025), to be announced in 2021, is expected to underscore the country's vision for robust innovation.

The EU is characterized by high-quality basic research and strong government support for R&D and startup creation, but there is no dominant model of nurturing and support. Europeans lacks a culture of taking risks, investing in venture capital, and betting on new technologies and innovations. Europe invested about €23 billion in venture capital in 2018, whereas the US invested $130 billion and China $92 billion.

There are exceptions. The European Commission and the European Investment Bank created the "InnovFin (EU Finance for Innovators) program, which offers a range of tailored financing products to SMEs having a significant innovation potential and presenting a risk of technology or industrial failure. The Joint European Disruptive Initiative (JEDI) brings together 3,700 technology business in 23 countries, with the goals of putting "Europe in a leadership position in breakthrough technologies". The EU's Horizon Europe program, currently in formation, contemplates €26 billion for basic research, €53 billion for applied research, and €14 billion to support innovation and startups from 2021 through 2027. What is more, industry and governments still need to fully realise the potential offered by new funds, such as the Next Generation EU, but also the Recovery Fund.

Case Study:

The Example of Docomo

In Japan, NTT Docomo offers a model for innovation support that Europe may want to consider emulating, given in particular, its foundation in 5G. Docomo has successfully established a test bed in which more than 3,000 participants (large enterprises and SMEs alike) are collaborating to create innovative use cases and business models based on 5G technology.

Docomo's 5G business model evolves around B2B corporate partnerships. Partners can run real-life 5G trials in an indoor lab, outdoor testing network, and open cloud platform, all of which constitute a real-life laboratory in which to experiment and innovate. The company shares developments in its 5G network technologies and results of field tests with its partners. It organizes partner workshops to enhance collaboration and ecosystem development. It supports joint field tests with partners and employs a sales force of more than 1000 people to build and manage the complex partnership network. Docomo's partner exchange network connects partners to facilitate 5G developments and enables meetings, collaborations and publications.

As a result, Docomo has been able to create new business models across a range of industries. It has established a leadership position as reliable 5G provider, expanded capabilities for 5G use cases by co-building and co-testing services with partners, and locked in partner relationships with more than 100 new use cases commercially launching in 2020. Recent partner trials include virtual reality training for technicians, process monitoring with video data and AI, wide-area monitoring with drones, live video streaming of remote events and processes, and outdoor vehicles and robots equipped with HD cameras.

The Opportunity for Europe's Telcos

Given their experience with platform business models, Europe's telcos are uniquely positioned to commit to rapidly building partnership networks. Many already have established partnerships with industry players and have long histories of operational experience in partnership networks. For example, Telefónica partners with technology start-ups and helps incubate their ideas and finance their development, offering access to resources such as connections, customers, and supply chain services. Nokia enables mobile network operators to use their existing telecommunications equipment to gather data on air quality, noise, and light; the findings form the basis of data products that they can sell to smart-city authorities, health care providers, insurance companies, and others. Other companies' successful experiences with platform business models has generated trust with telcos.

Europe's telcos can foster innovations across industries by setting up innovation hubs and enabling others to develop scalable 5G and IoT use cases and business models in the short to medium term. They can also encourage early research and development of technologies that are on the horizon, such as 6G and quantum security solutions. Telcos can act as the key innovation partner for the European tech sector, enabling innovations that contribute to sustainability targets (such as emission savings in smart cities and buildings), accelerating digitization of healthcare, and reinventing the self-image of the telecom sector by expanding beyond infrastructure, ultimately creating one digital sector.

Telcos and the EU will need to cooperate to make the best use of funding available in the Connecting Europe Facility and Digital Europe and Next Generation EU programs. Policy makers can help hasten development of telco-tech alliances and partnerships with support for the collaborations. They can help build scale by enabling entrepreneurial partnerships that go beyond infrastructure. They can allow consolidations within and across countries to enable telcos to build more scalable solutions and compete on a global level. And they can can support investment in networks by granting more legal certainty on network sharing and directing funding towards startups and venture capital to support the development of new technologies.

Towards a Brighter Future—Together

Policy makers and the telecom industry have long debated the proper role for, and rules regulating, Europe's telcos. Meanwhile, technologies advance, big corporations armed with new tech and startups with disruptive business models are challenging long-established industries, and consumers embrace new ways of doing things. The COVID-19 pandemic has caused a global reset in how we lead our lives.

Looking ahead to the rest of this decade and beyond, we see big challenges for the European alliance and equally big opportunities for Europe's digital future. Digital is not a binary state, but one of ongoing innovation as new waves of disruptive technologies are released to the market. Having opened substantial leads in foundational technologies such as cloud, the US and China are now making rapid progress on the advanced technologies of the future such as artificial intelligence, spatial computing, and, in time, quantum computing.

Europe needs to up its game. It has the know-how and the resources; it has been a leader in such technologies as cellular communications and semiconductor design. But Europe's governments cannot meet the challenges without support and assistance from the private sector. To transform business into models that are viable in an increasingly digital future, Europe's telcos require help from public sector. We need to move forward together. As an industry, we pledge to do our part.

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