The Mobile Economy Europe 2018

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with over 350 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

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Executive Summary

Subscriber penetration high, with consumer shift to 4G ongoing

At year-end 2017, 85% of the population in Europe – 465 million people – subscribed to mobile services. The total addressable market for the region's mobile operators is approaching saturation point, with the larger mobile markets such as France and the UK accounting for the majority of new unique subscribers.

Since 2012, rapid adoption of 4G services has occurred across many European countries. At the end of 2017, there were 285 million 4G connections in the region (a 25% increase on the previous year), accounting for 42% of total connections.[1] 4G has now overtaken 3G as the region's leading technology, though connections are forecast to peak during 2023. 4G investment will continue in the short term as operators seek network performance improvements to meet consumer demand for higher speed, always-on connectivity.

1. Excluding licensed cellular IoT

Momentum building as industry moves towards the 5G era

The European Commission is keen to take a leadership role in the development of 5G technology, launching the 5G for Europe Action Plan in 2016 and establishing the 5G Infrastructure Public Private Partnership (5G PPP) in conjunction with the region's wider ICT industry. Although the likes of China and the US will be at the forefront of 5G commercialisation, launches by European operators, such as Elisa and Telia, are expected by the end of the decade.

By 2025, 5G coverage is forecast to reach three-quarters of the population in Europe. The region will be home to 203 million 5G connections, accounting for 29% of total connections. From a regional perspective, Europe will account for the third largest share of 5G connections by 2025, behind Asia Pacific and Northern America. Early 5G investment is underway, although the majority of operators' capex will occur in the period after 2020.

Financial outlook stable rather than spectacular

Limited unique subscriber growth, regulatory decisions and fierce competition have all had an effect on mobile revenue and revenue growth in recent years. Operators' financials are now showing signs of stabilising; total mobile revenues reached €143 billion in 2017 and are expected to be €144 billion by the end of 2025, a compound annual growth rate (CAGR) of 0.1%. While the outlook remains mixed, the steadying performance has been supported by a combination of rising data demand, a better macroeconomic environment and a lessening impact of regulatory headwinds. With mobile data traffic forecast to grow at a CAGR of 42% between 2016 and 2021,[2] operators are looking to better monetise this opportunity through data-centric packages, content add-ons and shared plans.

Mobile contributing to jobs and the economy

In 2017, mobile technologies and services generated 3.3% of GDP in Europe, a contribution that amounted to €550 billion of economic value added. In the period to 2022, this figure will increase to €720 billion (4.1% of GDP), as the region experiences strong growth in productivity brought about by continued adoption of machine-to-machine (M2M) technology and the increased digitisation of industry and services.

The mobile ecosystem supported 2.5 million jobs in Europe in 2017. This includes workers directly employed by mobile operators and the ecosystem, and jobs indirectly supported in the rest of the economy by the activity generated by the sector. Mobile also makes an important contribution to the funding of the public sector, with €100 billion raised in 2017 – mainly in the form of general taxation, including VAT, corporate taxes and employment taxes.

2. VNI Mobile Forecast Highlights, 2016-21, Cisco

Mobile driving innovation across the region

Europe continues to see innovation across all areas of the mobile ecosystem, spurred by growth in new technologies, services and use cases. Mobile operators in Europe are contributing to the development of the Internet of Things (IoT) market, with commercial launches of licensed low power wide area (LPWA) networks occurring across the region. Many are also moving beyond their core telco businesses in an attempt to exploit new revenue streams in the consumer IoT space (e.g. Vodafone with 'V'), and some, such as Orange Business Services, are establishing partnerships in the enterprise IoT market.

In artificial intelligence (AI), European operators are now stepping up efforts as they seek to compete with large US and Chinese firms. The use of AI and voice interfaces has grown in prominence and functionality over the past couple of years, altering how consumers interact with technology. The range of AI-based applications is moving beyond chatbots or digital assistants to, for example, network performance management. Telco-related activity in blockchain is at a more nascent stage. However, a number of potential use cases are already being considered, including fraud prevention, mobile number portability and eSIM provisioning.

Policy influencing the future of mobile and building a digital Europe

A significant contributor of value to Europe's economy and society, the mobile sector continues to experience rapid change. With policy and regulation major influencers of technology development, it is important that policymakers formulate legislation to sustain growth, drive innovation, protect consumers in the online space and enable all to benefit from the highly dynamic and evolving digital ecosystem.

Three years after the Commission launched the Digital Single Market strategy, the EU has been quick to achieve agreements on some key proposals, including the modernisation of the European telecoms regulatory framework and the revision of data protection rules. However, these agreements still require appropriate implementation to ensure the long-term development of the region's mobile economy.

Appropriate decisions must also be made in other important policy areas, such as 5G spectrum and e-privacy, if EU policymakers are to create an environment that encourages investment and promotes the expansion of next-generation digital networks and services in Europe.

Mobile Economy Europe

Unique mobile subscribers

2017

465m

85% PENETRATION RATE (% of population) 88%

481m

2025

CAGR 2017–25

0.4%

SIM connections

Excluding licensed cellular IoT

673m

2017

706m

2025

123% PENETRATION RATE (% of population) 128%

0.5%

CAGR 2017–25

Smartphone adoption

As a proportion of total connections

2017	70%
2025	83%

Accelerating moves to mobile broadband networks

4G

4G as a proportion of total connections:

42%

in 2017

63%

in 2025

5G

203m

5G connections in 2025

29%

of total connections

Excluding licensed cellular IoT

Operator revenues and investment

Total revenues

€143bn

2017 — 2025

€144bn

Operator capex of

€67bn

for the period 2018–2020

Mobile sector contribution to GDP

€550bn 2017 — 3.3% of GDP

€720bn 2022 — 4.1%

Public funding

Mobile ecosystem contribution to public funding in 2017 (before regulatory and spectrum fees)

2017

€100bn

Employment

Employment supported by the mobile ecosystem

2017 **2.5m**

1.1m direct jobs

1.4m indirect jobs

01

Industry overview

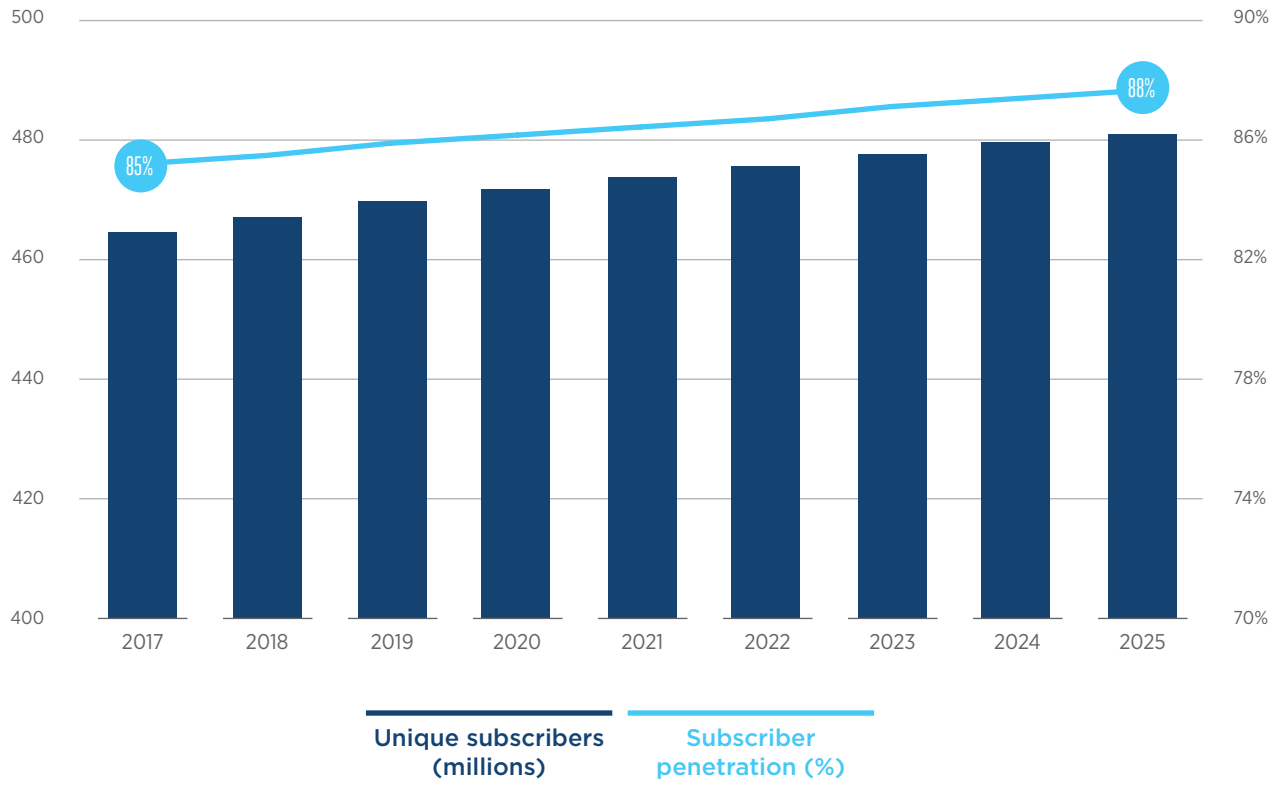
1.1
Limited headroom in European subscriber growth

At the end of 2017, Europe was home to 465 million unique mobile subscribers.[3] It has the highest regional rate of unique subscriber penetration at 85%, just above Northern America's 84% and 80% in the CIS. However, saturation of the total addressable market is edging closer, particularly in Northern and Southern Europe. Material increases in subscriber numbers are likely to be delivered by a collection of the larger European mobile markets where there is still scope for growth. For example, we forecast that the Netherlands and the EU5[4] will generate almost 13 million new unique subscribers between them by the end of 2025.

Future growth for Europe as a whole is likely to be modest compared to other regions, with 17 million unique subscribers forecast to be added by 2025. This represents a CAGR of 0.4%, which is well below the corresponding percentages for Latin America at 1.9%, and the Middle East and North Africa (MENA) at 2.4%.

Figure 1 Source: GSMA Intelligence

Unique mobile subscribers in Europe



3. Total unique users who have subscribed to mobile services at the end of the period, excluding M2M. Subscribers differ from connections such that a unique user can have multiple connections.
4. France, Germany, Italy, Spain and the UK

1.2
4G migration continues with untapped potential in some markets

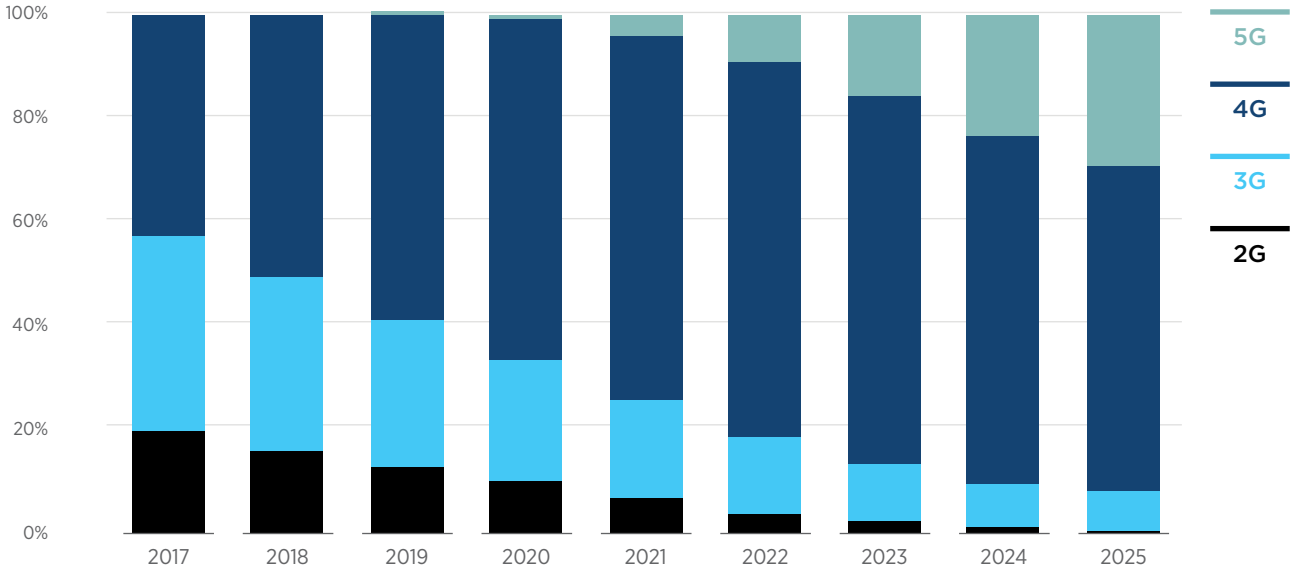
For several years, mobile operators in Europe have invested heavily in deploying 4G networks. Consequently, coverage of 4G services passed 97% of the population at the end of 2017 and will grow to 98% by 2025. 4G has been successful in enabling the transition from the connected consumer to the digital consumer, typified by an increasing willingness among users to engage with social media platforms and a range of services and content online.

The 4G lifecycle is not yet over; investment is likely to continue to the end of the decade.[5] However, attention has shifted to network upgrades. For instance, LTE Advanced Pro is the latest standard and has the potential to deliver throughput speeds in excess of 3 Gbps and latency of just 2 milliseconds. Over the past three years, 17 LTE Advanced Pro networks have launched in Europe. Meanwhile, voice over LTE (VoLTE) rollouts progress, with live deployments in 25 countries. Finalising the transition to this service is an important step for operators, facilitating spectrum refarming and the shutting down of legacy networks.

Widespread coverage, rapid growth in affordable smart devices, greater use of data-heavy services, and demand for higher speeds are all factors driving the adoption of 4G in Europe. At year-end 2017, there were 285 million 4G connections, representing 42% of total connections.[6] 4G connections overtook 3G connections in the region during 2017, making it Europe's leading mobile network technology. By 2025, 4G connections will have grown at a CAGR of 5.1% to almost 445 million, accounting for 63% of total connections. This growth will not be linear; 4G as a proportion of connections will peak at 72% in early 2023 before falling as consumers transition to 5G services.

Figure 2 Source: GSMA Intelligence

Shares of European connections by technology



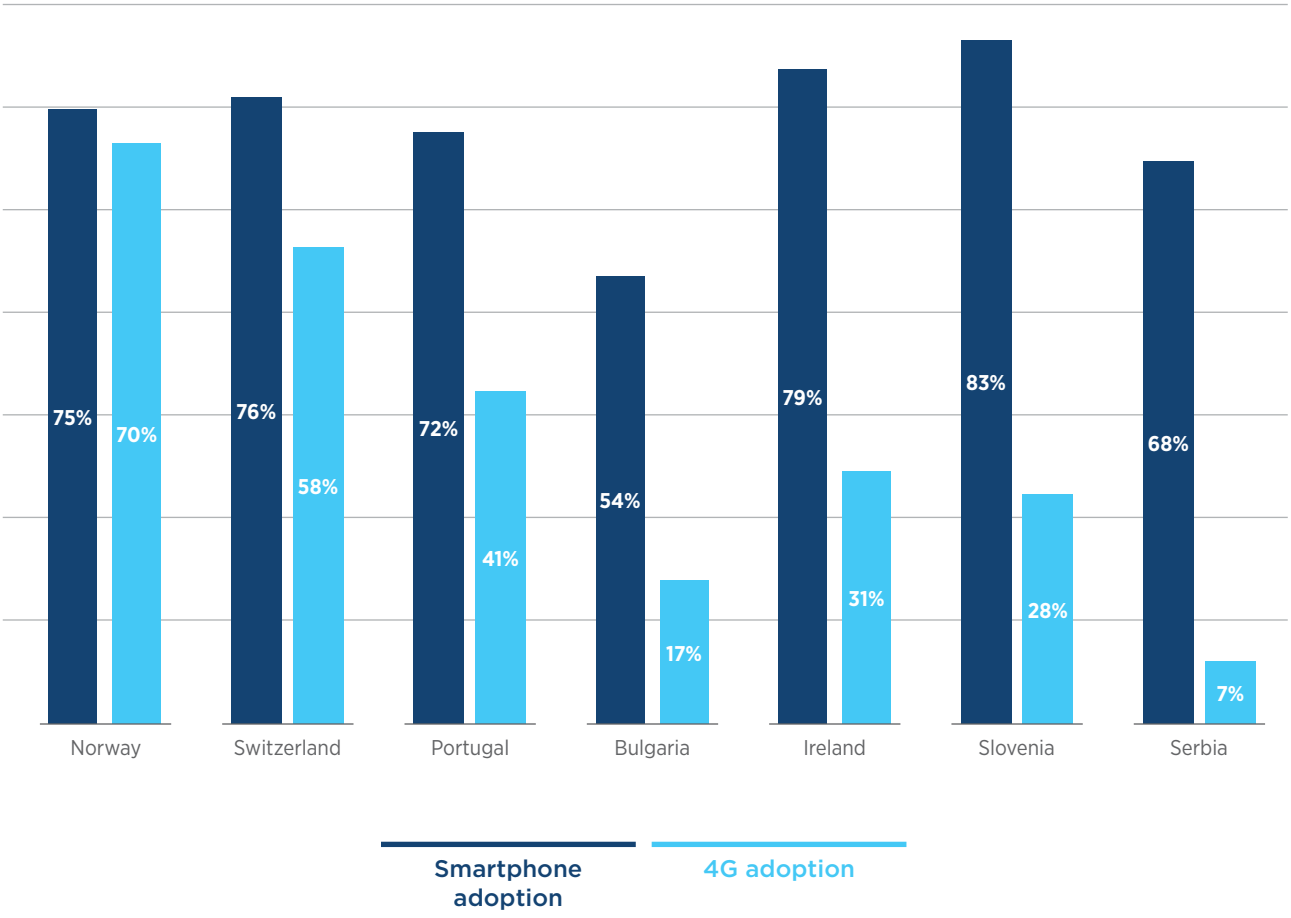
5. German mobile operators, for example, have signed a pledge with the government to cover 99% of the country with 4G networks by 2020.
6. Excluding licensed cellular IoT

While 4G coverage in Europe is extensive, adoption has not quite reached the same level. Smartphone adoption is fairly consistent across the region; in over half of European markets take-up of smartphones (as a proportion of total connections) is in the 65–75% range. Nevertheless, customer adoption of 4G services sometimes lags considerably behind. This situation, however, presents certain mobile operators with an opportunity. For example, in Croatia and Montenegro, there is a greater than 45 percentage-point gap between 4G adoption (as a proportion of total connections) and smartphone uptake. This leaves significant room for growth, which could improve operators' financial performance, while also benefitting users through faster and more robust connectivity.

Figure 3 Source: GSMA Intelligence

4G versus smartphone adoption in certain European markets

Percentage of connections



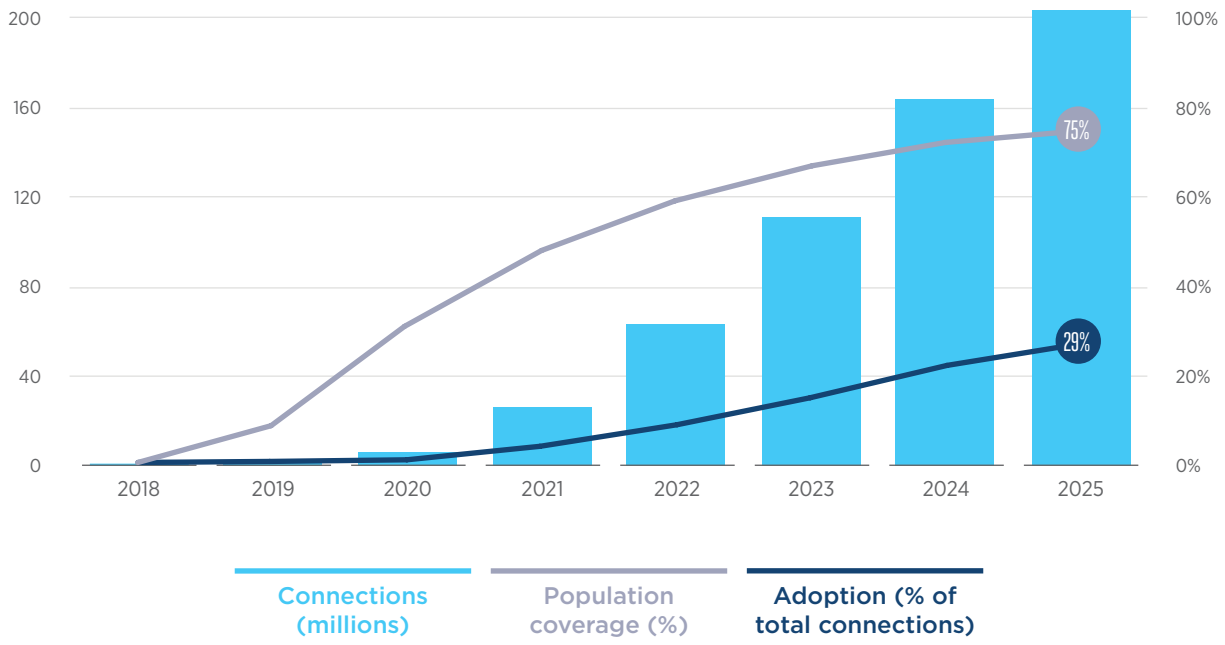
1.3
Much expected as operators begin their 5G journeys

With other regions having led the deployment of 4G networks, the European Commission is eager to spearhead the development of 5G. In September 2016, it launched the 5G for Europe Action Plan, which, among other measures, proposed to facilitate the implementation of an industry-led venture fund in support of 5G-based innovation and to make provisional spectrum bands available for 5G ahead of the World Radiocommunication Conference 2019 (WRC-19). The Commission has set an interim target for 5G to be commercially available in at least one major city in each EU member state by 2020.

In spite of this strategy, China, Japan, the US and South Korea are set to be the front-runners in terms of 5G commercial realisation. GSMA Intelligence forecasts that Asia will account for by far the largest share of 5G connections in 2025, followed by Northern America and Europe. Nevertheless, more coordinated rollouts of 5G services, compared to the staggered approaches of 4G, will result in coverage and adoption levels increasing at a faster pace in Europe in the first few years after launch than with the previous technology generation. We expect Europe to reach 203 million 5G connections by the end of 2025, accounting for 29% of total connections in the region. The largest advanced mobile markets, such as the EU5, will drive much of the take-up.

Figure 4 Source: GSMA Intelligence

Europe 5G forecasts



Recently, the European mobile industry has started to make progress with 5G, with successful trials undertaken in some countries and planned launched dates announced in others. Examples of developments in the region are shown in Figure 5.

Figure 5 Source: GSMA Intelligence

5G in Europe: developments in 2018

FEBRUARY

Swisscom outlines plans to launch mobile 5G in Switzerland by the end of the year. The operator is working in collaboration with Ericsson on software and hardware deployment, while the first compatible handsets are likely to be available in 2019. Swisscom expects "extensive" 5G coverage during 2020.

APRIL

KPN announces a plan to trial 5G for a range of applications in four locations across the Netherlands. In Amsterdam, the company will test 5G applications through Massive Multiple Input Multiple Output (MIMO) antennas at the Amsterdam Arena in partnership with Nokia.

MAY

Deutsche Telekom announces that the "first 5G antennas in Europe" have gone live in Berlin, as it moves towards a 2020 launch. The six antennas, which are based on non-standalone 3GPP standards, use Huawei products and spectrum in the 3.7 GHz band, and provide connectivity for an area up to 5 kilometres wide.

MAY

The leaders of Denmark, Finland, Iceland, Norway and Sweden sign an agreement for a common vision for 5G deployment across the Nordic region. They have pledged the creation of joint testbeds, technical co-ordination of 5G bands, and lighter regulation around installing network equipment in order to boost 5G uptake and drive the digital economy.

JUNE

Orange commences Europe's first 5G live multi-vendor fixed wireless access (FWA) network test in Romania. The trial, conducted in collaboration with Samsung and Cisco, involves 15 customers in different building types using multiple high-bandwidth applications, such as 4KTV and cloud gaming.

JUNE

Elisa claims to be the first operator in the world to launch commercial 5G and start selling subscriptions to its next-generation network. The Finnish operator is using Huawei terminals and is offering services in Tampere, Finland and Estonia's capital city of Tallinn.

JULY

Orange and SFR unveil new 5G test sites, while Bouygues announces France's first real-world pilot of the new network technology in Bordeaux. Having received regulatory approval, Orange will undertake tests in Marseilles and already has sites under development in Lille and Douai. SFR is primed to deploy trial networks in Nantes and Toulouse, having partnered with Nokia on a scheme in Paris.

SEPTEMBER

TIM states that it has switched on Europe's first antenna compliant with the latest 3GPP specifications in San Marino. The antenna uses MIMO technology on 3.5 GHz spectrum. In parallel, TIM is also testing the use of millimetre wave spectrum in its lab in Turin.

1.4
Revenue and capex outlook

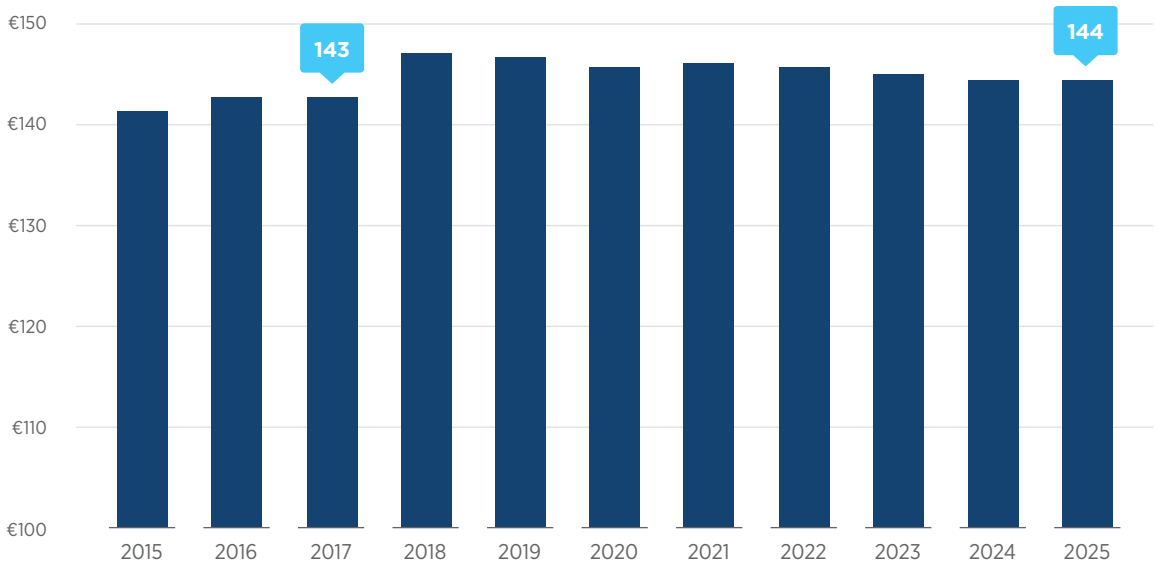
Mobile revenues stabilise but remain under pressure

Slowing unique subscriber growth, regulatory intervention and intense competition have resulted in sustained pressure on operators' core mobile revenues and consecutive years of little – even negative – growth. Looking out to 2025, Europe's mobile revenue over the period is forecast to be roughly stable across many markets. The unexceptional upturn in financial performance is a consequence of easing regulatory headwinds (e.g. as the impacts of reduced mobile termination rates are absorbed), in-market consolidation, an ongoing shift by consumers to 4G data plans, and an improved macroeconomic climate.

Figure 6 Source: GSMA Intelligence

Mobile revenue in Europe

Billions



The UK's digital technology sector

While annual UK mobile revenue is forecast to decline 1.9% in 2018, government-funded advocacy body Tech Nation has announced that the turnover of the country's digital tech companies rose 4.5% in 2017, compared to a 1.7% increase in GDP. The organisation's inaugural annual report[7] states that the sector is therefore growing faster than the overall economy and was worth £184 billion (€208 billion) in 2017. In addition, it is not the sole preserve of larger metropolitan cities, spreading out into "emerging digital suburbs". For example, Burnley in Lancashire is home to almost 100 tech businesses, including Vodafone Automotive, while telecoms provider Daisy is also based in the county.

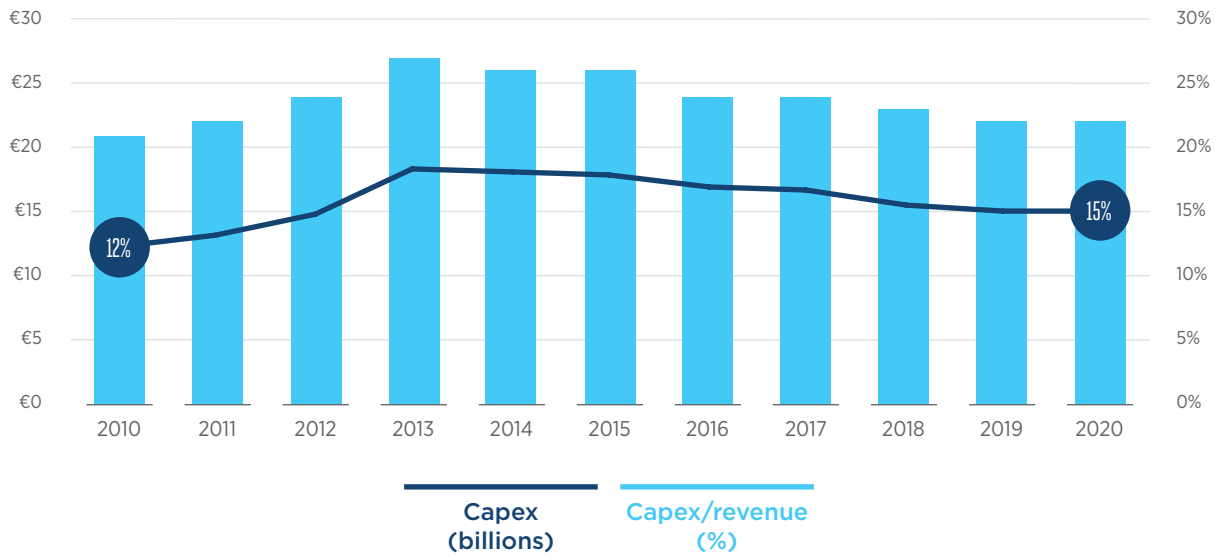
7. For more detail, see https://technation.io/insights/report-2018/

5G investment peaking after 2020

Between 2010 and 2017, mobile operators in Europe spent more than €193 billion on capex projects. In recent years, operators, particularly in the most developed markets, have focused their investments on 4G upgrades to deliver faster speeds and lower latencies, as well as on network densification. While 5G spend is still at a nascent stage, there is an increased focus on investment in fibre networks, whether organically or through acquisition, which could provide the backhaul element of future 5G architectures.

Figure 7 Source: GSMA Intelligence

Capex in Europe



Over the period 2018–2020, European operators are forecast to invest €67 billion in capex. Nevertheless, wide deployment of 5G is likely to require incremental capex above this figure. As many European mobile markets continue to experience a squeeze on traditional mobile revenues, any further capex increase beyond 2020 would push capex as a percentage of revenue above the 15% expected during 2018–2020. Ultimately, the increment will depend on various factors, including the approach taken, the targeted network coverage, the range of spectrum bands in use and the availability of fibre infrastructure.

Deutsche Telekom CEO, Timotheus Höttges, has estimated that the rollout cost for 5G across Europe will be significantly higher than for 4G, at between €300 billion and €500 billion. Meanwhile, Andrus Ansip, European Commissioner for the Digital Single Market, considers that at least €500 billion of investment will be required by 2025 to achieve the region's connectivity goals. While initial 5G investment is already underway, with the likes of Ericsson and Nokia having obtained loans from the European Investment Bank (EIB) to boost research and development efforts, the majority of the capital outlay is likely to come in the post-2020 period.

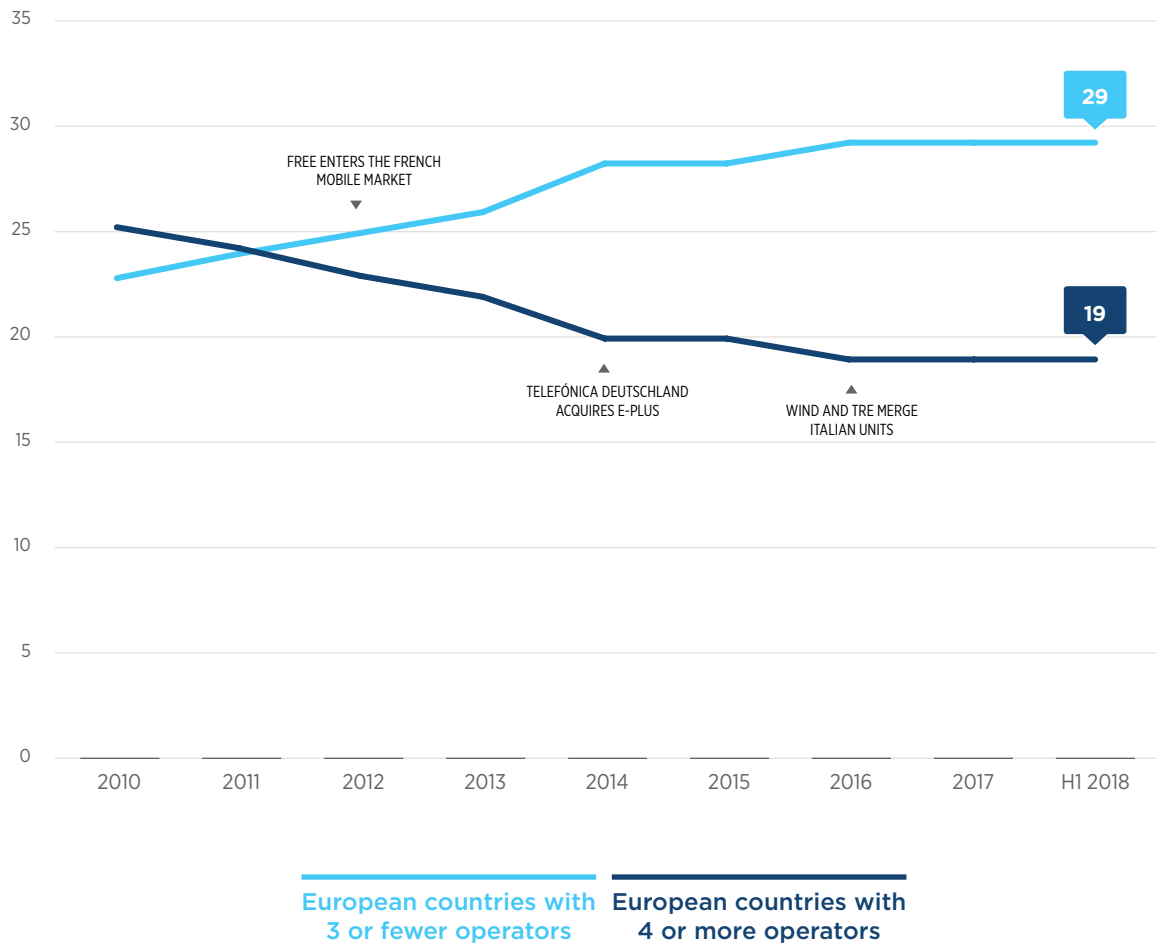
1.5
Evolving mobile market structures

The European telecoms landscape has witnessed some significant changes in recent years, driven by concentrations between operators in certain mobile markets (e.g. Austria, Norway, Ireland), fixed/mobile/cable convergence (Orange/Jazztel in Spain, BT/EE in the UK), and new entrants disrupting the status quo, such as Free Mobile in France. Since 2010, around 20 mobile operators in Europe have either closed or combined with rivals. When netted out against new players entering the market, the impact is an increase in the number of countries with three or fewer licensed mobile operators.

Figure 8 Source: GSMA Intelligence

Impact of network launches, closures and M&A in Europe[8]

Number of countries



8. Excludes MVNOs

This difference could have been greater, however, had certain proposed mergers (Three/O2 in the UK and TeliaSonera/Telenor in Denmark) cleared the necessary regulatory hurdles. In these cases, the European Commission, as the relevant competition authority, considered that only the creation of a new mobile network operator would be sufficient to address its competition concerns. The failure to submit suitable remedies led to a prohibition decision in the UK and a withdrawal of notification in the Danish case.

While network deployment remains a key source of competitive advantage in mobile markets around the world, operators may look to acquire or merge with rivals to expand their individual footprint, acquire spectrum and/or subscribers, realise synergies, or generally become a stronger market player to compete more effectively. However, without size or scale, the long-term viability for mobile-only businesses is increasingly challenging.

For policymakers, facilitating the right market structure can increase the incentives and ability of operators to make investments in new technologies,[9] which supports the growth of the digital economy. Under certain conditions, a mobile merger can have a significant positive impact on consumers in terms of wider network coverage and improved quality of service.[10]

Iliad's Italian odyssey

Around six years since Iliad (under the Free brand) began disrupting the French mobile market with its low-cost, unlimited usage offers, the same group has launched as an operator in Italy with a similarly aggressive strategy.[11] Iliad's expansion into Italy at the end of May 2018 is the result of its decision to take up the remedies package (spectrum, sites and roaming) put forward by Wind and Tre as they sought approval from the Commission to merge their respective operations.

Iliad Italia's CEO Benedetto Levi has promised a "revolution" in the country's mobile sector. Iliad's opening tariff comprises unlimited minutes and texts, 30 GB of domestic data and 2 GB for roaming in Europe for €5.99 per month (available to the first million subscribers). Levi also emphasised the company's commitment to transparency, in particular guaranteeing there would be no hidden charges for services such as voicemail. In its first 50 days of operation, it was reported that Iliad had signed up 1 million customers.[12]

In some European countries, traditionally mobile-only operators have impacted market and competitive dynamics by merging with fixed line, cable and/or media firms. From a product bundling perspective, fixed-mobile convergence (FMC), via triple- or quad-play, has the potential to improve the revenue mix and reduce customer propensity to churn. Converged telcos may also have the ability to offload mobile traffic onto fixed networks, to ease mobile network capacity and provide ubiquitous service to consumers. That said, expanding subscriber bases and driving higher retention through bundling has often required heavy price discounting and hence delivered little in terms of marginal revenue gains.

Spain, France and Portugal were the first markets in Europe to fully embrace FMC of services. Today, it is the norm for consumers and a strategic pillar for the major operators in those markets, marginalising fixed voice and broadband packages. According to La Comisión Nacional de los Mercados y la Competencia (CNMC), there were nearly 12 million FMC bundle subscriptions in Spain at year-end 2017, up from just over 1 million in 2012.[13] Belgium and France are also strong adopters; however, while other European countries, such as Germany and the UK, have launched FMC in recent years, the timing of convergence and market structures have meant slower adoption rates. Consequently, wave two of FMC has not been as strong as wave one.[14]

9. Assessing the case for in-country mobile consolidation in emerging markets, GSMA, 2015
10. Assessing the impact of mobile consolidation on innovation and quality: An evaluation of the Hutchison/Orange merger in Austria, GSMA Intelligence, 2017
11. "Can lightning strike twice for Iliad?", Mobile World Live, June 2018
12. "Iliad Italia hits 1M subscribers", Mobile World Live, July 2018
13. For more detail, see http://data.cnmc.es/datagraph/jsp/inf_trim.jsp
14. FMC in Spain – six takeaways five years on, GSMA Intelligence, 2018

Vodafone and Liberty: playing the long game[15]

In May 2018, Vodafone announced it was acquiring the cable operations of Liberty Global in Germany, Czech Republic, Hungary and Romania for €18.4 billion. The transaction would increase Vodafone's fixed line customer base by 9.6 million across its European footprint and grow the fixed line share of total revenue from 29% to 35% on a pro forma basis.

This is the largest piece of telecoms market consolidation in Europe since BT's purchase of EE in January 2016, furthering the broad market shift towards a converged fixed-mobile model at the infrastructure and service level. In Germany, the deal would result in a scaled and integrated competitor to the incumbent (Deutsche Telekom).

The proposed transaction will be subject to the relevant regulatory review and approvals.

Content has also emerged as a key battleground for converged players. Quad-play is the new growth story as operators have successfully upsold pay-TV to their existing FMC customers. Major telecoms groups and a number of domestic-only players are therefore gearing up their content efforts with increased investment into various content forms but also into network infrastructure. BT, for example, announced in May 2018 its intention to include Amazon Prime Video and Sky's Now TV within its TV offering as it looks to position itself as a leader in the UK's fledgling multiplay market. Similarly, in the same month, Telefónica and Netflix announced a partnership to integrate Netflix's service into Telefónica's TV and video platforms in Europe and Latin America. A Spanish launch is currently planned for the end of 2018. As more content, particularly video, is consumed outside the home and work, converged operators may be able to offer an enhanced user experience by controlling access points to both fixed and mobile services.

15. Vodafone and Liberty: playing the long game, GSMA Intelligence, 2018

02

Mobile driving growth, enabling innovation and forging a digital Europe

2.1
Mobile's contribution to economic growth and jobs

The mobile ecosystem makes a significant contribution to the European economy, with an economic value of €550 billion (or 3.3% of GDP). This overall impact includes the direct impact of the mobile ecosystem as well as the indirect impact and the increase in productivity brought about by the use of mobile technologies.

Direct economic contribution

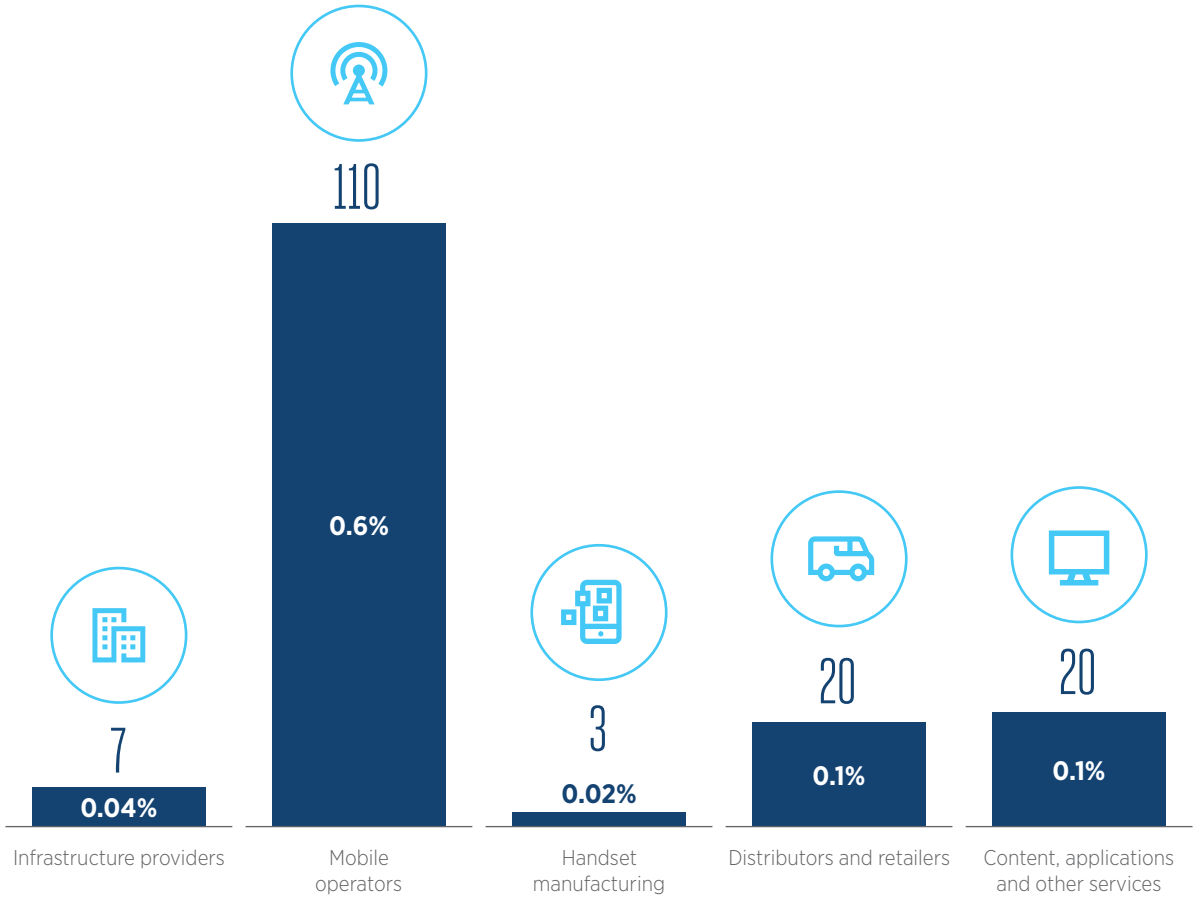
The mobile ecosystem consists of mobile network operators; infrastructure service providers; retailers and distributors of mobile products and services; mobile device manufacturers; and mobile content, application and service providers. The direct economic contribution to GDP of these firms is estimated by measuring their value added to the economy, including employee compensation, business operating surplus and taxes.

In 2017, the total value added generated by the European mobile ecosystem was around €160 billion (almost 1% of GDP), with network operators accounting for almost 70% of this.

Figure 9 Source: GSMA Intelligence

Direct GDP contribution of the mobile ecosystem

€ billion, % 2017 GDP



Note: totals may not add up due to rounding.

Indirect and productivity impacts of mobile technology

In addition to their direct economic contribution, firms in the mobile ecosystem purchase inputs from their providers in the supply chain. For example, handset manufacturers purchase inputs from microchip providers, and content providers require services from the broader IT sector. Further, some of the profits and earnings generated by the ecosystem are spent on other goods and services, stimulating economic activity in those sectors.

We estimate that in 2017, this additional economic activity generated a further €90 billion in value add in Europe, equivalent to 0.5% of GDP.

The use of mobile technology also drives improvements in productivity and efficiency for workers and firms. The mobile economy has supported the productivity of the European labour force, as workers have been able to use mobile voice and messaging services to communicate more efficiently. More recently, employees and businesses have been able to access high-speed mobile broadband as 4G networks are rolled out across Europe, expanding the areas where they are able to work and stay connected.

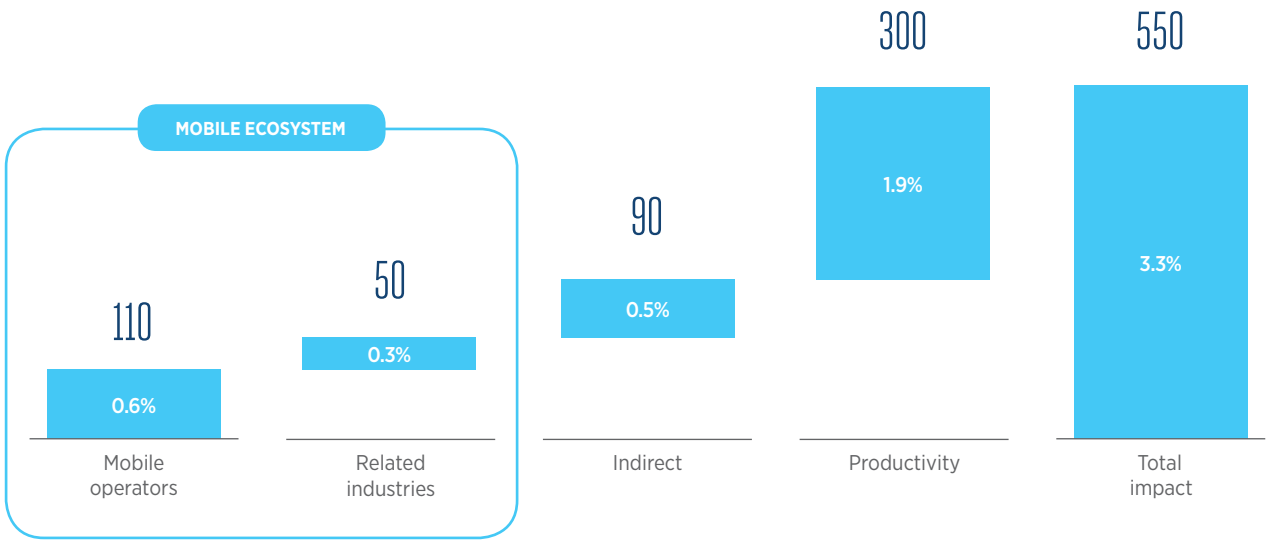
M2M and IoT are allowing the digitisation of services and improvement of industrial processes. As these technologies become increasingly adopted, we expect them to drive significant benefits via cost savings and efficiency gains in areas such as manufacturing, logistics and retail. Productivity impacts from M2M alone contributed €35 billion to European economies in 2017.

In total, we estimate the overall productivity impact from using mobile services was worth around €300 billion in 2017 (or 1.9% of GDP) in Europe.

Figure 10 Source: GSMA Intelligence

Total (direct, indirect, and productivity) contribution to GDP

€ billion, % 2017 GDP



Overall, taking into account the direct, indirect and productivity impacts, in 2017 the mobile industry made a total contribution of €550 billion to the European economies in value added terms, equivalent to 3.3% of the region's total GDP.

Note: totals may not add up due to rounding

Employment

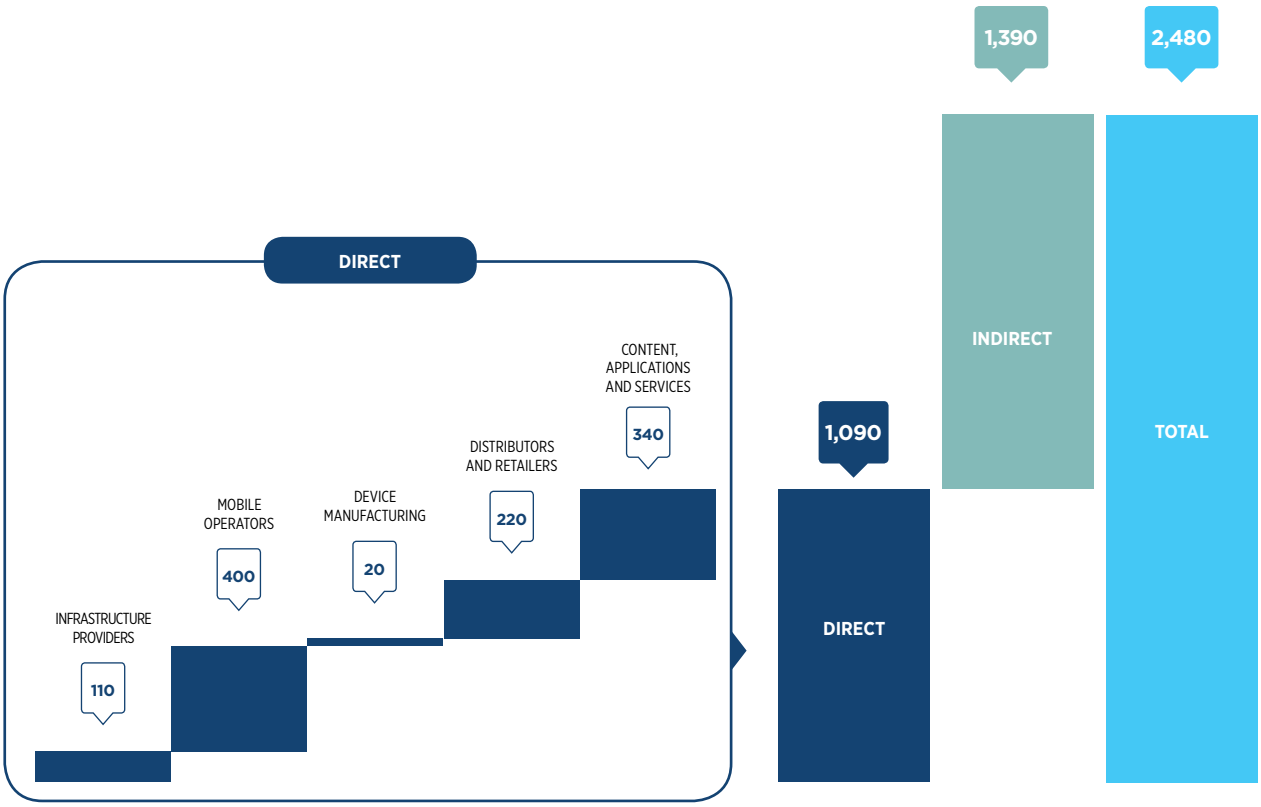
In 2017, mobile operators and the ecosystem provided direct employment to approximately 1.1 million people in Europe. In addition to this, economic activity in the ecosystem generates jobs in other sectors. Firms that provide goods and services as production inputs for the mobile ecosystem (for example, microchips or transport services) will employ more individuals because of the demand generated by the mobile sector. Further, the wages, public funding contributions and profits paid by the industry are spent in other sectors, which provides additional jobs.

We estimate that in 2017, around 1.4 million jobs were indirectly supported in this way, bringing the total impact (both direct and indirect) of the European mobile industry to 2.5 million jobs.

Figure 11 Source: GSMA Intelligence analysis

Employment impact

Jobs (thousands), 2017



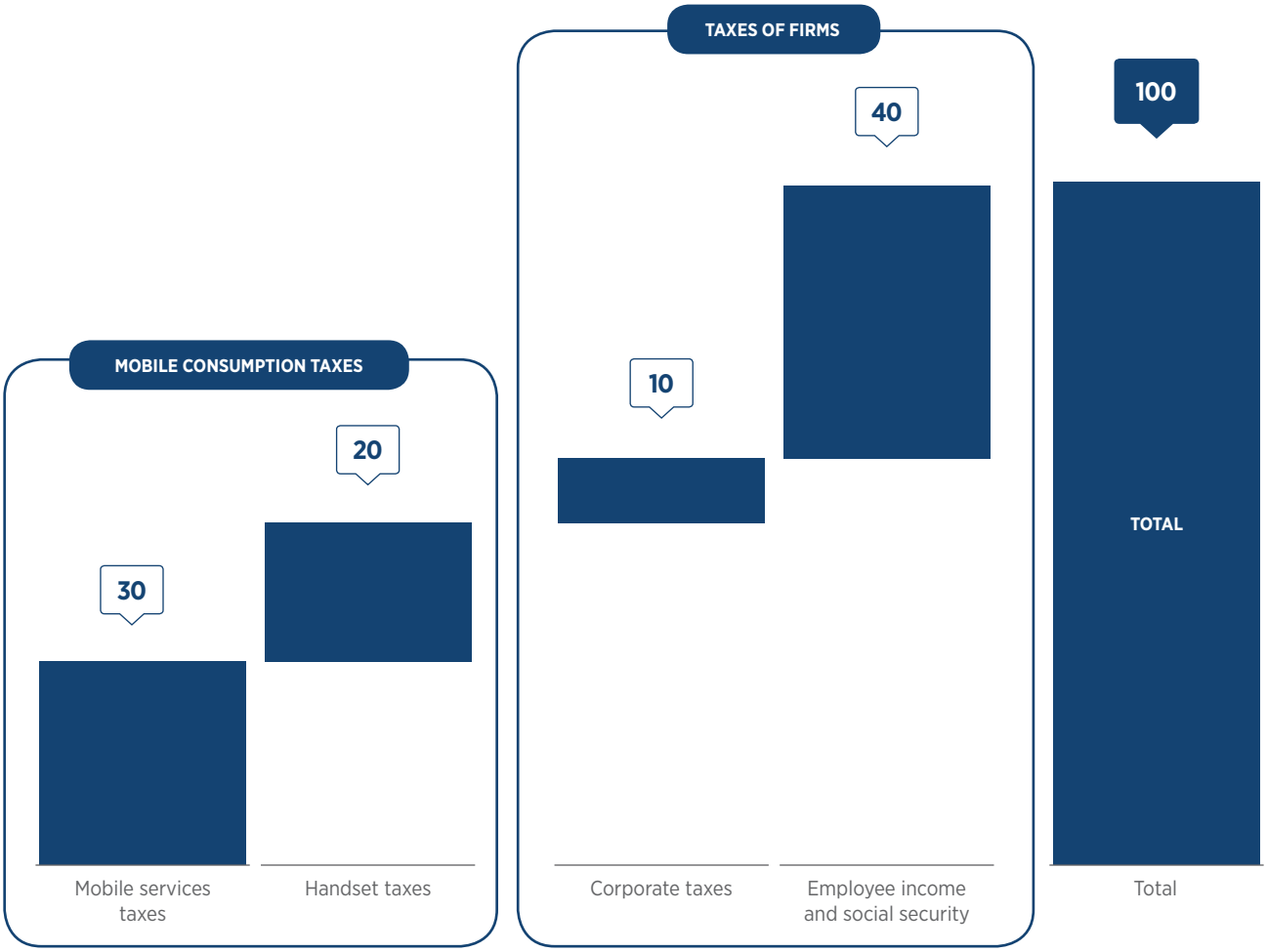
Public sector funding

The mobile ecosystem also makes a significant contribution to the funding of public sector activity in the region through taxation. In Europe, this includes value added taxes, corporation tax, income tax and social security from firms and employees. We estimate that the ecosystem made a tax contribution to the public finances of governments across Europe of €100 billion in 2017. In addition, several spectrum auctions concluded across Europe in 2017, generating more than €400 million in total for European governments.

Figure 12 Source: GSMA Intelligence

Contribution to public funding by the mobile industry

2017 € billion



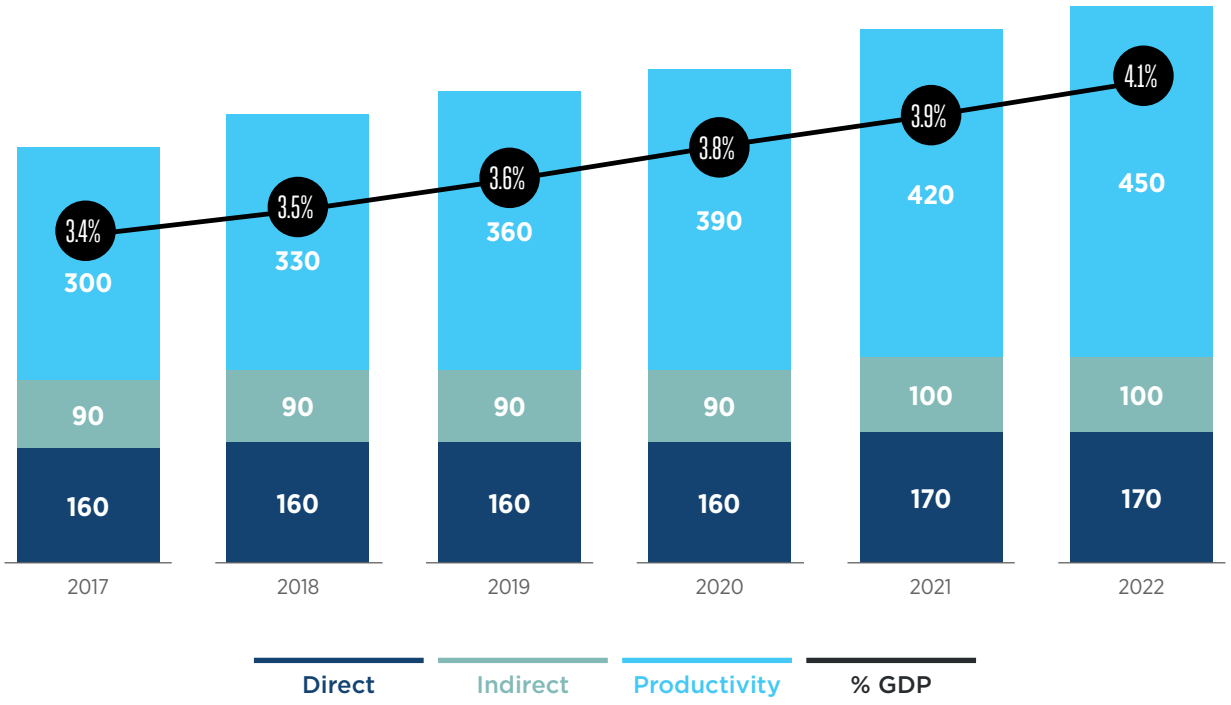
Future outlook

We expect the economic contribution of the mobile industry in Europe will continue to increase in both relative and absolute terms. In value added terms, we estimate that the ecosystem will generate €720 billion by 2022 representing 4.1% of GDP, up from €550 billion in 2017. The majority of this increase is due to improved productivity driven by continued adoption of M2M and IoT technology and the increased digitisation of industry and services.

Figure 13 Source: GSMA Intelligence

Outlook to 2022

€ billion, % GDP



2.2
Consumer engagement with mobile services

The GSMA's Global Mobile Engagement Index (GMEI)

The GMEI measures the level of engagement of smartphone and non-smartphone owners across 26 use cases and services across 10 categories, including traditional communications, lifestyle and e-commerce. The higher the score, the more likely consumers are to regularly interact with technology and use mobile services.[16] The GMEI has been built based on inputs from GSMA Intelligence's latest annual Consumer Survey, which covered 50 countries worldwide in 2017.[17]

Based on the usage patterns of 50,000 people (1,000 respondents in each surveyed country), consumers have subsequently been clustered into four distinct segments to reflect their mobile engagement levels:

- **Aficionados** – highest recorded engagement across all use case categories
- **Pragmatists** – high usage recorded across most areas but still experimenting with certain use cases, e.g. financial services
- **Networkers** – moderate usage recorded across fewer use cases than the above groups
- **Talkers** – low usage recorded across all use cases with the exception of traditional communications, such as voice calls and sending an SMS.

Mobile engagement in Europe

Europe has the highest level of mobile user engagement by region, with a GMEI score of 4.5. In fact, the continent accounts for three of the top five most engaged countries globally – Finland (5.6), Sweden (5.4) and Austria (5.3). Denmark also ranks highly in seventh position, with a score of 5.1. Further, 72% of European users are classified as being either Aficionados or Pragmatists, compared to 74% in North America but just under one in two in East Asia/Pacific. This high level of engagement in the region can partly be explained by the maturity of the mobile market, with close to ubiquitous 4G coverage and smartphone adoption at 70% at the end of 2017.

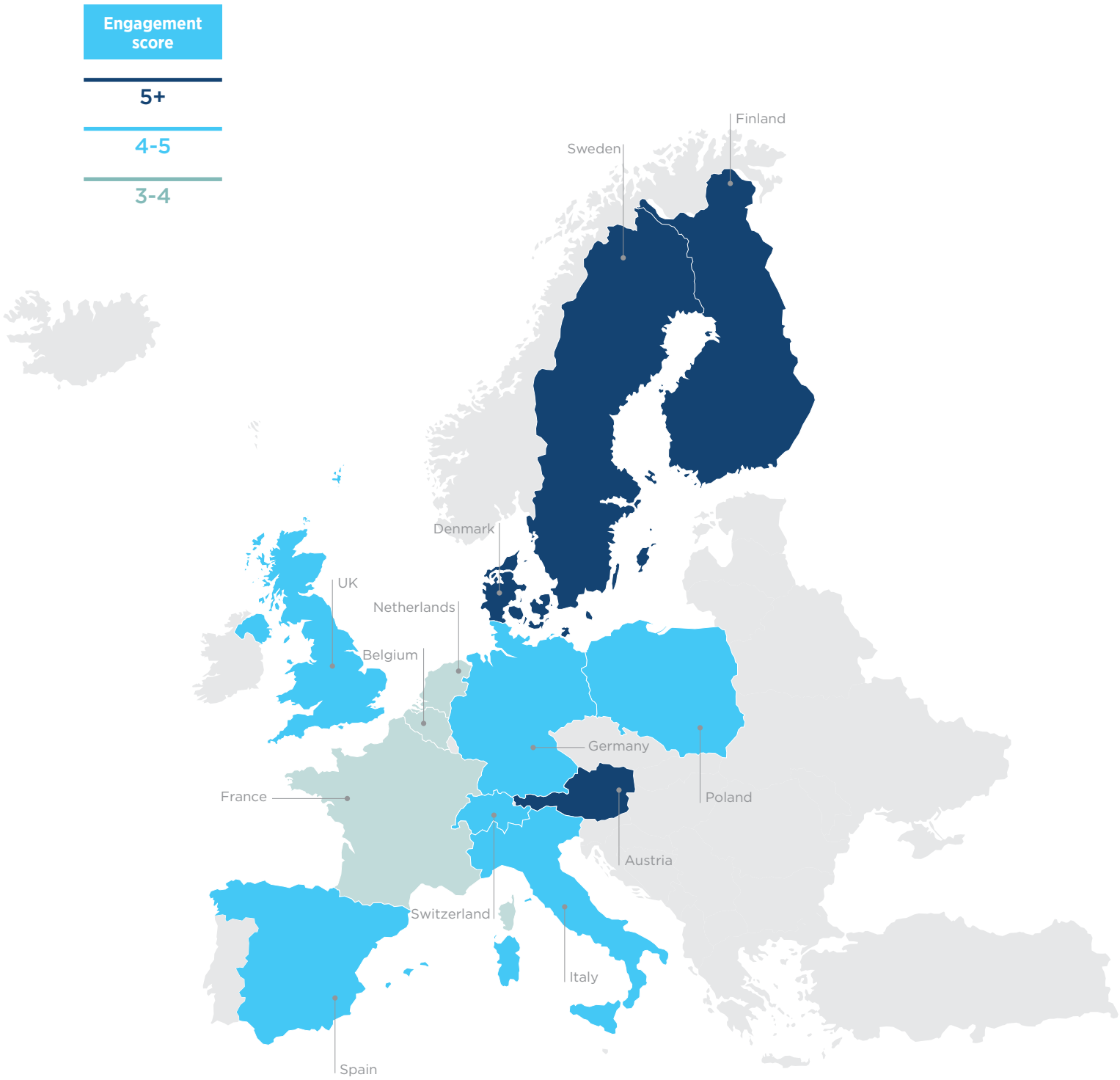
The GMEI shows that consumers use their smartphones on a regular basis to access not only internet-based messaging and social media but also entertainment content (such as movies, music, games and sports), e-commerce and other digitally delivered services (financial services, healthcare and education). Out of the 10 use case categories, people tend to use their smartphones most often for internet services, such as browsing websites or reading the news on their device, doing so at least every week, if not daily.

16. A score of zero would mean that consumers never use their mobile phones for any of the 26 mobile use cases covered in the survey. A score of 10 would mean that consumers engage in each of the use cases every month.
17. Consumer Insights: Evaluating mobile engagement, GSMA Intelligence, 2018

Figure 14

Source: GSMA Intelligence

GMEI ranking of European countries surveyed



Key findings:

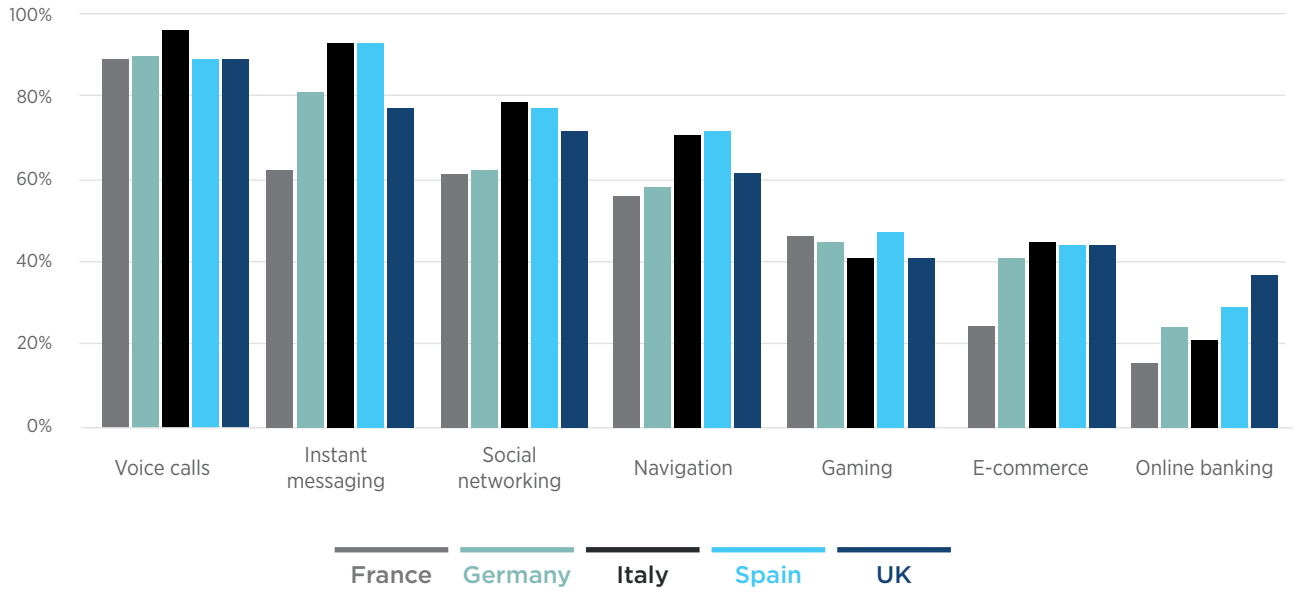
In Europe, smartphone users still show a preference for **making phone calls** over mobile networks (nine in 10 do so on a monthly basis) compared to phone calls using VoIP (55% do so every month). On average, there are similar levels of monthly engagement with **SMS and IP messaging** across the region; however, there are significant differences between countries, with Poland users more inclined to send an SMS and the Netherlands demonstrating the opposite persuasion.

In terms of the use of **social media platforms**, smartphone users in Europe demonstrate a marginally lower level of engagement compared to those in Latin America, MENA and North America. Among the EU5 markets, a higher proportion of smartphone users in Italy and Spain engage with these sites on a monthly basis than those in the UK, France and Germany.

Entertainment and e-commerce are core focus areas for mobile operators and ecosystem players in Europe. GMEI research shows that free online entertainment drives greater mobile user engagement. While more than half of smartphone users in Europe watch free online video (e.g. YouTube, Dailymotion) at least every month, less than 20% pay for on-demand TV or movies with their smartphone with the same frequency – and some never do. A number of mobile operators are already targeting this opportunity by bundling premium video content into their packages

Figure 15 Source: GSMA Intelligence

Percentage of smartphone users in the EU5 engaging with certain use cases every month



Consumer behaviour continues to evolve, as mobile devices get smarter, digital services grow richer, and societies become more connected. In Europe, today's digital consumers will likely become tomorrow's augmented customers in the 5G era; they will increasingly adopt emerging technologies such as augmented reality; virtual reality; technology solutions and applications for smart homes, cities and buildings; and emerging services such as drone delivery, consumer robotics and autonomous cars.

Moreover, in light of demographic projections that indicate millennial and post-millennial mobile users transitioning to older age bands, the prevalence of highly engaged users (i.e. Aficionados and Pragmatists) will gradually increase across Europe over the next decade. While this presents an opportunity for mobile operators, the challenge remains to balance network investment and the monetisation of rising data traffic.

2.3
Mobile operators facilitating and driving innovation across the region

The burgeoning Internet of Things market in Europe

Total (cellular and non-cellular) IoT connections in Europe will increase almost three-fold between 2017 and 2025, reaching 4.9 billion, from 1.7 billion in 2017.[18] This figure will represent 20% of the global IoT market at the end of the period. Mobile operators are playing a role in the growth of this market not only by providing connectivity through the evolution of network technology, but also by providing business solutions across a range of verticals, and through partnerships.

Licensed low power wide area (LPWA) networks, including narrowband IoT (NB-IoT) and LTE-M, are designed for IoT applications that have low data rates, require long battery lives, are low cost, and can operate in remote and hard to reach locations. By mid-2018, there had been 25 commercial launches of NB-IoT networks in Europe. Meanwhile, DNA and TIM have achieved nationwide NB-IoT coverage in Finland and Italy, respectively.[19]

However, telecoms providers are now looking to employ multi-technology strategies to deliver best-in-class connectivity to serve IoT use cases and meet the demands of end users in the most effective way possible. In addition to NB-IoT, Orange and Telenor are supporting LTE-M, having recently deployed networks in Belgium and Denmark, respectively. Meanwhile, KPN is using a mix of cellular and non-cellular technologies – NB-IoT, LTE-M and LoRa – to deliver the coverage element of its KPN Things solution for business customers.

IoT is rapidly becoming a mainstream technology in some consumer markets, such as smart homes and consumer electronics, with an array of vendors offering a range of services and/or connected 'things'. While historically smart home relied on short-range connectivity (e.g. Wi-Fi), some European operators are exploring adding cellular to the technology mix and offering IoT products directly to consumers as a means of enhancing customer experience and as potential new revenue streams.[20]

18. IoT: the next wave of connectivity and services, GSMA Intelligence, 2018
19. See GSMA IoT Deployment Map, https://www.gsma.com/iot/deployment-map/#deployments
20. For more detail, see Smart home: from niche to mainstream by 2025, GSMA Intelligence, 2018

In November 2017, Vodafone launched V by Vodafone in Germany, Italy, Spain and the UK, later expanding into Portugal in July 2018. This is a consumer-oriented IoT product range that includes tracking solutions and wearables. While there is no news as of yet on the progress of V, it should augment existing IoT revenue, which Vodafone reported to be €747 million in 2017.

Like Vodafone, other European operators such as Orange, Telefónica and Deutsche Telekom all have lines of business dedicated to IoT. Applications, platforms and services will drive substantially all IoT revenue growth, with connectivity – where operators typically sit – only accounting for 5% of revenues by 2025 – a decrease on its current share. This is a significant challenge to the operator business model, and operators are deploying different strategies to retain their relevance in IoT. The operator role in the value chain could vary from being the overall aggregator of the solution to simply providing enablers that other companies use to build a solution.

Operators are also seeking to gain a foothold in the industrial IoT market. Beyond providing wireless connectivity to support use cases like fleet management, operators are beginning to collaborate with enterprise clients, targeting segments throughout the value chain and positioning themselves as partners for digitisation.

Orange Business Services, for example, has established a relationship with Siemens to drive the adoption of IoT in the industrial sector. The initial focus of the venture, which is built around Siemens' MindSphere operating system and Orange's Datavenue platform, is to realise efficiencies in asset tracking and monitoring, and to develop digital enhanced products.

Moving forward, 5G could present telcos with opportunities in healthcare and manufacturing where the use of robotics (particularly for remote surgery) requires ultra low latency connectivity.

Despite consumer IoT accounting for 65% of total IoT connections in Europe in 2017, GSMA Intelligence forecasts that industrial IoT connections will ramp up at a faster rate to become almost identical in size (more than 2.4 billion connections and almost 50% of the regional market) at year-end 2025.[21]

The IoT revenue opportunity

Revenue from IoT will reach $242 billion (€210 billion) in Europe in 2025, up from $53 billion (€47 billion) in 2017.[22] Europe will therefore see a CAGR of 21% over the period and account for 22% of total global revenue in 2025. Players from a range of backgrounds, including telecoms, IT, device manufacturing and systems integration, are all vying to capture a portion of this opportunity. As with other regions, IoT applications, platforms and services (which includes cloud, data analytics and security) will account for the largest share of Europe's revenue, while standalone connectivity will become less valuable over time.

21. IoT Forecast, 2010-25, GSMA Intelligence, 2018
22. IoT: the $1 trillion revenue opportunity, GSMA Intelligence, 2018

Funding tech innovation and the start-up ecosystem

Between 2013 and 2017, private firms invested €186 billion in financing tech start-ups and emerging companies in Europe.[23] Private investment has flowed into various sectors, particularly those experiencing digital disruption, including TMT, banking, transportation, energy and healthcare.

Corporate venture capital (CVC) is on the rise in the wider TMT sector, as demonstrated by an increasing number of transactions and associated funding over the last few years. While investment in Europe is on a smaller scale than in the US (which is being led by the larger tech firms), there are a number of notable examples of growing telco CVC activity in the region as operators seek to accelerate innovation and protect themselves from disruption. These include Swisscom Ventures (which has been active since the mid-2000s), Vodafone Ventures, Telefónica Ventures and Orange Digital Ventures.

Orange originally launched a CVC arm in 2000, later rebranding to its current name in 2015, investing across its European and African footprint. An analysis of its CVC investee portfolio suggests that around two-thirds consists of start-ups that support extension of core assets (e.g. hardware) or a move into new business lines altogether, with media & content and fintech the most prevalent.

Across Europe, tech hubs are also providing start-ups with business support and services to help them scale, usually by facilitating access to critical resources such as skills, funding, technology, networking and digital tools. TechHub is a prominent community workspace in London, where winners of BT's Infinity Lab competition receive a six-month membership, allowing them to share their experiences with, and benefit from the advice of, tech professionals.

Meanwhile, in Paris, Xavier Niel, owner of Iliad, has launched Station F, a start-up campus home to more than 1,000 fledgling firms as well as some much larger corporate partners.

GSMA 100

On 5 September 2018, the GSMA launched the GSMA 100, a global innovation discovery initiative designed to identify and advance the next generation of connectivity and digital services. Comprising the world's most promising growth-stage companies and selected by mobile operators and investment partners, the GSMA 100 reflects operator innovation priorities in key areas such as 5G and networking, AI and machine learning, IoT and security, among others. The GSMA 100 will be selected in three cohorts per year; the first 29 companies have now been revealed.

23. Data from CB Insights. The investment figure for H1 2018 was $38 billion (€32 billion)
24. For more detail, see https://www.gsma.com/aboutus/gsma-100

Advancements in operators' AI strategies

The global artificial intelligence (AI) industry is currently dominated by the big internet ecosystem and enterprise players in the US (e.g. Google, Amazon, Apple, Facebook, Microsoft and IBM) and the Chinese 'BAT' companies (Baidu, Alibaba and Tencent). However, an increasing focus on, and investment in, AI by European policymakers, governments and TMT firms is moving the industry beyond chatbots and digital assistants, and spurring a growing range of applications.

For example, in April 2018, 24 EU member states plus Norway [25] signed a declaration for collaboration on AI. In its subsequent communication "Artificial intelligence for Europe",[26] the Commission put forward a European approach to AI based on three pillars: being ahead of technological developments and encouraging uptake by the public and private sectors; preparing for socio-economic changes brought about by AI; and ensuring an appropriate ethical and legal framework.

In June 2018, the Commission appointed 52 experts to its high-level expert group on AI. The committee will provide recommendations on addressing the mid- to long-term challenges and opportunities of AI, propose draft ethical guidelines, and support the Commission on engagement and outreach to other stakeholders. [27]

In addition to work at the regional level, leading European telcos are also stepping up their efforts with respect to AI, recognising its strategic importance for future business and digital transformation as well as driving autonomous and intelligent networks. Customer care/experience is a core business area for operators that has been particularly impacted by AI. Telefónica, Vodafone, Deutsche Telekom and Telenor are among a group of operators that have already launched chatbots or digital assistants in various guises in an attempt to improve customer service and satisfaction, increase agility and reduce dependence on call centres.

Operators are also exploring further possible areas of AI, including operations, services and platforms, to improve efficiency and productivity, expand into new markets and develop alternative business models. In Q1 2018, Orange launched its Djingo home assistant and smart speaker, which allows control of home-connected devices and access to entertainment, as well as communications services. Despite some operators looking to collaborate with the likes of Amazon, Djingo will directly compete with Alexa, the current market leader. Meanwhile, Telefónica, as part of its Fusion Red project, has partnered with Juniper Networks and is using machine learning and AI to improve the self-management of its network in Spain. Vodafone is working with Cisco in Ireland, trialling machine-learning algorithms in a centralised self-organising network (C-SON) to determine where 3G traffic will peak in the subsequent hour through monitoring data processing and pattern recognition.

25. Croatia, Cyprus, Greece and Romania have joined the initiative since it launched.
26. Communication Artificial Intelligence for Europe, European Commission, 2018
27. At the same time, the Commission launched its European AI Alliance online forum, which will enable other interested parties to debate AI matters.

Telco-related blockchain initiatives in Europe

While the initial focus of blockchain was financial payments and transactions, attention is now shifting to broader uses incorporating the principles of trust and ownership. These include identity management, traceability of assets, transparency of supply chains and executing smart contracts, with IoT a potential key focus. The openness of blockchain and the ability of all blockchain network participants to view and validate transactions on the chain allow blockchain to address issues of trust among parties without the need for intermediaries or central authorities, and can be used to protect identity and prevent fraud where users wish to remain anonymous.

Governments around the world are therefore considering blockchain for managing identity and voting records, and recording assets such as land registry. Estonia is leading the charge; it has been testing blockchain since 2008. In 2012, it became operational in a number of areas, including health, judicial, legislative, security and commercial code systems, and there are plans to extend its use to other spheres, such as cyber security and 'data embassies'.

While Estonia has been an early-mover in this space, the European mobile industry is still at an early stage with testing and adopting blockchain use cases, and requires a better understanding of the value propositions and learnings from actual projects to develop approaches. However, there is hope that by establishing blockchains between operators, the industry could provide differentiated services that guarantee transparency, security and real-time transactions. In terms of the use of this technology in telecoms, there are a number of potential touch points beyond identity. Various use cases are being considered, including fraud prevention, micropayments for entertainment services delivered over mobile devices, business process efficiency (such as for mobile number portability or eSIM provisioning) and roaming management.

At Mobile World Congress 2018, Telefónica showcased the initial results of a co-innovation project with SEAT and Ficosa, in which blockchain was used to optimise operations in the supply chain of parts and products.

In May 2018, BT and Telefónica, along with HGC and Telstra, announced that they had joined PCCW, Colt and Clear's blockchain initiative. This tests whether the technology can be used for automating the inter-carrier settlement of wholesale international services. According to the partners, this solution could drive efficiencies by reducing the time taken by traditionally labour-intensive activities from hours to minutes.

03

Policy influencing technology development and shaping the future of mobile

The mobile industry contributes a significant amount of value to Europe's economy and its society more generally. While mobile broadband access is now widely available, the convergence of digital technologies is driving ongoing growth and innovation, enabling a steady flow of new services. Advanced applications and novel ways of communicating are revolutionising the way people interact with technology, and impacting how network operators provide connectivity. Given how policy influences technology development, it is important that policymakers formulate legislation to sustain growth, protect consumers in the online space, and foster a culture of creativity, innovation and progression for all.

The Digital Single Market is the European Commission's top priority under President Jean-Claude Juncker, aimed at sustaining European growth over the coming years. The Commission estimates €415 billion[28] in additional growth per year from a fully integrated Digital Single Market. The initiative envisages a far-reaching overhaul of policies and regulations, affecting areas such as copyright, parcel delivery, cybersecurity, cloud and data economy.

In little over three years since the Commission launched the Digital Single Market strategy, the EU has achieved important agreements on some key proposals, including the modernisation of the European telecoms regulatory framework and the revision of data protection rules. However, these agreements still require appropriate implementation to ensure the long-term development of the region's mobile economy.

Appropriate decisions must also be made in other important policy areas, such as 5G spectrum and e-privacy, if EU policymakers are to create an environment that is conducive to investment and promote the expansion of next-generation digital networks and services in Europe.

3.1 Reforms to drive digital evolution

The European Electronic Communications Code (EECC)

2018 marks 25 years since the deadline was passed for transposing into national law the establishment of a single internal market within the EU. Yet, work remains to be completed if there is to be a truly Digital Single Market. Achieving this objective requires that the EU telecoms sector be underpinned by a predictable regulatory framework that incentivises investment and is dynamic and agile enough to respond to the industry's constant evolution.

In June 2018, EU policymakers reached a political agreement on the EECC. However, the agreed EECC does not sufficiently reflect the considerable socioeconomic benefits released as a result of the spread of mobile connectivity and associated digital services. In particular, the agreement does not deliver sufficiently on the ambition to provide a strong, pro-investment regulatory reform. Only such an assurance would allow the industry to make the necessary capex that would ultimately benefit consumers.

Further, the agreement fails to address the fact that European telecoms operators are still over-regulated in some key areas, resulting in an uneven playing field. The agreement does align some consumer rights attached to the use of all interpersonal services providers, but many differences remain. A policy of 'same service, same rules' would lead to more competition, greater innovation, and higher consumer welfare. Moreover, the adopted measures on retail price caps for intra-EU calls are unjustified and disproportionate as consumers and businesses enjoy a variety of choices for making calls to other EU countries.

28. A Digital Single Market Strategy for Europe, European Commission, 2015

Europe therefore stands at a crossroads, with the opportunity to be at the forefront in the development of next-generation technology and networks, transforming itself, its economy and its society. The region needs a holistic, flexible regulatory framework that reinforces its position as a preferred location for investment and emboldens operators to innovate and capitalise on the opportunities of a vibrant digital economy, all the while ensuring consistent protections for European citizens. Strong dialogue between stakeholders and appropriate policy decisions when implementing the agreed EECC across the EU will be fundamental in creating an environment where companies compete and new services flourish in a genuine Digital Single Market.

Spectrum policy for the 5G era

Operators and other ecosystem players have consistently invested in wireless networks and technologies to deliver better service, to augment speeds and capacity and to handle increasing volumes of data traffic. Having achieved wide coverage of LTE services across much of Europe, the region's mobile industry is now looking to 5G to meet the demands of a digitised world. 5G promises boundless connectivity and intelligent automation, bringing network performance to unprecedented levels and creating a platform on which new digital services and actors can thrive. As such, pro-investment policies and a modern regulatory framework are critical to realising the full potential.

Despite the EU inter-institutional agreement on the EECC, the current spectrum rules need further amendments to incentivise a step-change in infrastructure investment to fulfil the potential of the Digital Single Market. Europe should seize the chance to champion genuine spectrum policy reform that will position the region as a true global leader in mobile telecoms. For instance, while the EECC will introduce some constructive provisions, greater spectrum policy harmonisation among member states is fundamental to improve the quality, reach and adoption of mobile broadband services, and to support the EU's Digital Single Market objectives.

Spectrum is an enabler for growth and competitiveness in the digital age, and the Commission has rightly recognised the need to encourage its efficient and timely release. However, the reforms as they stand will perpetuate the fragmented and inconsistent approach that exists across the EU today. Harmonised spectrum in the right frequencies, at the right time, and under the right conditions is a prerequisite for enabling the investments needed to deliver 5G leadership and the next wave of mobile innovation for European citizens and businesses. With the increased need for spectrum to support high data traffic in a 4G and 5G world, fair pricing techniques will become ever more important to support efficient spectrum allocation and promote healthy investment in networks. To lay the foundations – and ultimately maximise the benefits – of 5G, it is imperative that the EU establishes a framework that allows the region's operators to make the most of a vital and scarce resource.

3.2
Aligning data protection and privacy regulation

The General Data Protection Regulation (GDPR) came into force on 25 May 2018, replacing the 1995 Data Protection Directive. It was designed to provide a level playing field for data privacy law across the EU, to protect citizens' data from breaches, give them more control over it, and to reshape the way companies across the bloc approach the matter of data protection. The updated regulation is having the effect of driving up standards of responsible data governance, not only in the EU but also around the world. The GDPR incorporates a risk-based approach, underpinned by concepts like data protection by design and accountability. This approach facilitates innovation while requiring strong data protection. The GDPR is also principles-based, which helps provide a future-proof regulatory basis for data protection.

Nevertheless, even with the GDPR now in force, mobile operators in Europe must continue to comply with the requirements of earlier legislation, namely the Privacy and Electronic Communications Directive 2002, otherwise known as the ePrivacy Directive (ePD).[29] The European Commission's proposal to replace the existing ePD with an ePrivacy Regulation (ePR) will apply to electronic communications services providers, including over-the-top (OTT) applications, which will help resolve the current regulatory imbalance between the telecoms industry and other players in the digital world.

The proposed ePR retains the ePD's commitment to maintaining the confidentiality of communications, which is crucial for consumer trust in the digital ecosystem. However, the proposed ePR limits the ability of mobile operators to process communications metadata. Metadata can be used in privacy-protective ways to develop innovative services that deliver new societal benefits, such as public transport improvements and traffic congestion management. In many cases, pseudonymisation can be applied to metadata to protect the privacy rights of individuals, while also delivering societal benefits.

In contrast to the proposed ePR, GDPR embraces the implementation of pseudonymisation as a privacy-protective tool and allows the processing of data similar to communications metadata, such as GPS location data, subject to the GDPR's risk-based approach, which ensures that individuals receive a high level of protection.[30] A lack of alignment between the ePR and the GDPR could create regulatory uncertainty for operators.

It is therefore vital that policymakers, industry and stakeholders work together to further align the GDPR and the proposed ePR. The mobile industry has built its reputation on the foundation of trust that it keeps communications and personal data secure and confidential. With operators subject to a greater number of regulations than other companies operating in the digital space, inconsistencies with the GDPR should be addressed in the ePR.

From an international perspective, there is much to be gained for consumers by quickly ensuring compatibility between the various data privacy laws that have been enacted. Greater coordination could expedite the shift to a world where countries allow personal data to flow relatively freely between them. Easing the flow of information will enable consumers to benefit from the full potential offered by next-generation technologies, including 5G, IoT, AI and big data. Recent high-profile incidents, such as the Cambridge Analytica scandal, highlight the need to protect data at a global, rather than just regional, level.

29. Certain parts of the Directive were amended in 2009 to reflect updates to the EU telecoms regulatory framework following the Lisbon Treaty.
30. The Proposed ePrivacy Regulation: joint position, GSMA and ETNO, 2017

Regulating the transfer of non-personal data

In addition to introducing new legislation relating to the handling and processing of personal data, in June 2018, the European Parliament agreed with EU member states new rules to safeguard the free movement of non-personal data within the bloc. The regulation prohibits data localisation restrictions, ensures public authorities can access and retain data throughout the EU, and recommends cloud service providers establish codes of conduct to enable professional users to switch more easily.
The Commission considers that legislating to ensure the free flow of non-personal data will help to stimulate growth, provide jobs and drive innovation, as well as being an important step in creating a Digital Single Market.

3.3
The forthcoming Cybersecurity Act

In September 2017, the European Commission proposed an update to the EU's Cybersecurity Strategy. The package builds on existing instruments but comprises several new proposals designed to improve EU cyber resilience and response. These include the Directive on the security of network and information systems (NIS Directive), which came into force in May 2018 and requires, for example, that member states establish a competent national NIS authority.

There is also a proposal for a stronger, permanent mandate for the European Union Agency for Network and Information Security (ENISA), the region's Cybersecurity Agency, to ensure that it can provide support to member states, EU institutions and businesses in key areas. The Commission's strategy also proposes a voluntary framework for EU-wide security certification of ICT products and services, also known as the Cybersecurity Act.

The protection of digital services is at the forefront of mobile operators' concerns, but it is important that robust security measures are adopted by the whole digital value chain, including software and hardware manufacturers. This need is exemplified by the development of IoT, which will see almost 5 billion connections in Europe by 2025.[31] Security is, and will be, critical to the success of these services, to the development of this new ecosystem, and to guarantee users' privacy. Many devices and equipment, which have not previously been connected to any form of network, need to have adequate security protections designed into them from the outset. Hence, the principles of 'security by design' should be applied across the value chain.

It is essential that governmental institutions and public authorities support the development and adoption of aligned and cost-effective cybersecurity enablers to both set a good example and preserve trust and security. Practical examples could be integrating appropriate security requirements or liability clauses for suppliers into public procurement practices. Further, there is a need for coordinated action at the EU level to educate citizens in ICT products and services, which will help the development of a digitally skilled workforce and cyber-responsible individuals.

More specifically, the proposed certification framework must minimise duplication and fragmentation across member states, reduce compliance costs and promote a more secure European and global ICT market. The framework should build on existing national and international certification standards, especially those defined by industry, such as those promoted within the GSMA IoT Security Guidelines.

In a time of fast innovation and transformation of mobile networks to 4G/LTE and now 5G, operators will face a new set of cybersecurity challenges. The mobile industry, with its long history of providing reliable security solutions, and network operators are the established, trusted providers of these services. Network operators continue to investigate, improve and roll out measures that add new and additional layers of security while meeting the pressures of the next generation of mobile networks. In this context, it is important that EU institutions reach an agreement over balanced and forward-looking legislation on cybersecurity, clearing the way for the first European standardised certification programmes.

31. IoT: the next wave of connectivity and services, GSMA Intelligence, 2018

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