# The Mobile Economy

# China

## 2021


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# Contents

# Executive Summary

## Connectivity takes centre stage in the response to and recovery from Covid-19

The profound impact of the Covid-19 pandemic on the health and livelihoods of individuals and communities around the world has brought into sharp focus the increasingly important role of connectivity to society's wellbeing. Given the implementation of social distancing measures by governments to curb the spread of the virus, connectivity has emerged as a lifeline for people to stay connected and businesses to operate in a safe way. In China, around 200 million people were working remotely by the end of the Chinese New Year holiday in February 2020,[1] while 78% of consumers had shifted to online shopping in the wake of the pandemic.[2]

Mobile networks have been instrumental in providing the connectivity to sustain social and economic activities through the pandemic. Despite the surge in data traffic (in China, mobile data traffic volume jumped 40% in March 2020 compared to the same period a year earlier[3]), networks largely remained resilient, underlining the significant investments in advanced networks by operators in recent years. In 2019 and 2020 alone, operators in China invested a cumulative sum of $78 billion, equivalent to a fifth of revenue, on average.

One of the most remarkable contributions of mobile connectivity to mitigate the impact of Covid-19 is the use of advanced and innovative digital solutions to support various response measures. Across China, mobile networks, and 5G in particular, have supported frontline healthcare efforts to stem the rate of infections while also enabling remote business operations to comply with social distancing rules. Indeed, the pandemic has presented a test platform for a wide range of 5G-enabled solutions, further demonstrating the benefits that the technology can bring to society.

As countries bring the pandemic under control, a top priority for governments will be to help economies to recover and become more resilient to future shocks. Advanced connectivity will be crucial to realising this objective by enhancing productivity and efficiency through 5G- and IoT-enabled digital transformation of industries and underpinning the rapid expansion of the digital economy, which will be at the heart of a post-Covid-19 world.

1 "A blueprint for remote working: Lessons from China", McKinsey Digital, March 2020
2 COVID-19 and E-commerce: Findings from a survey of online consumers in 9 countries, UNCTAD, 2020
3 Ministry of Industry and Information Technology (MIIT)

## 5G momentum grows as 4G reaches its peak

Due to the rapid take-up of 5G in China, the region sits among the global leaders in terms of 5G adoption. In 2020, the region added more than 200 million 5G connections, taking its share of global 5G connections to 87%. Growth in 5G adoption in the China region is supported by aggressive network rollout and a growing device ecosystem. Despite the outbreak of Covid-19, Chinese operators deployed around 600,000 new 5G base stations in 2020,[4] and have announced plans to deploy more than that number during 2021. Meanwhile, 5G networks now cover more than 90% of the population in Hong Kong and Taiwan, making both markets among the first in the world to reach that milestone.

The swift transition to 5G means that 4G adoption has now peaked in the China region. 4G adoption contracted for the first time in 2020, and it will continue to trend downwards in the coming years as consumers switch to increasingly ubiquitous 5G services. Consumers in China are more eager to upgrade to 5G than those in any other market in the world, according to the GSMA Intelligence Consumers in Focus Survey 2020. This is backed by the growing share of 5G device sales in mainland China; 163 million 5G smartphones were sold in 2020, accounting for nearly 53% of total smartphone shipments.[5] By 2025, 4G will account for 53% of total connections in China, compared to 47% for 5G. Both technologies will dominate China's mobile connectivity landscape for the foreseeable future as operators step up plans to shut down earlier generations.

## Subscriber growth slows with increasing market saturation

By the end of 2020, 1.22 billion people subscribed to mobile services in China, equivalent to 83% of the region's population. This places China among the world's most developed mobile markets, given that global average penetration is 66%. However, increasing market saturation also means that subscriber growth is slowing, a scenario that is also occurring in other advanced markets around the world. That said, mobile internet adoption and usage continues to grow steadily as operators focus on expanding access to digital services. More than 990 million people in the China region now use mobile internet services and this figure is expected to increase by a further 200 million by 2025.

4 Ministry of Industry and Information Technology (MIIT)
5 China Academy of Information and Communications Technology (CAICT)

## The mobile industry continues to lead in efforts to tackle social issues

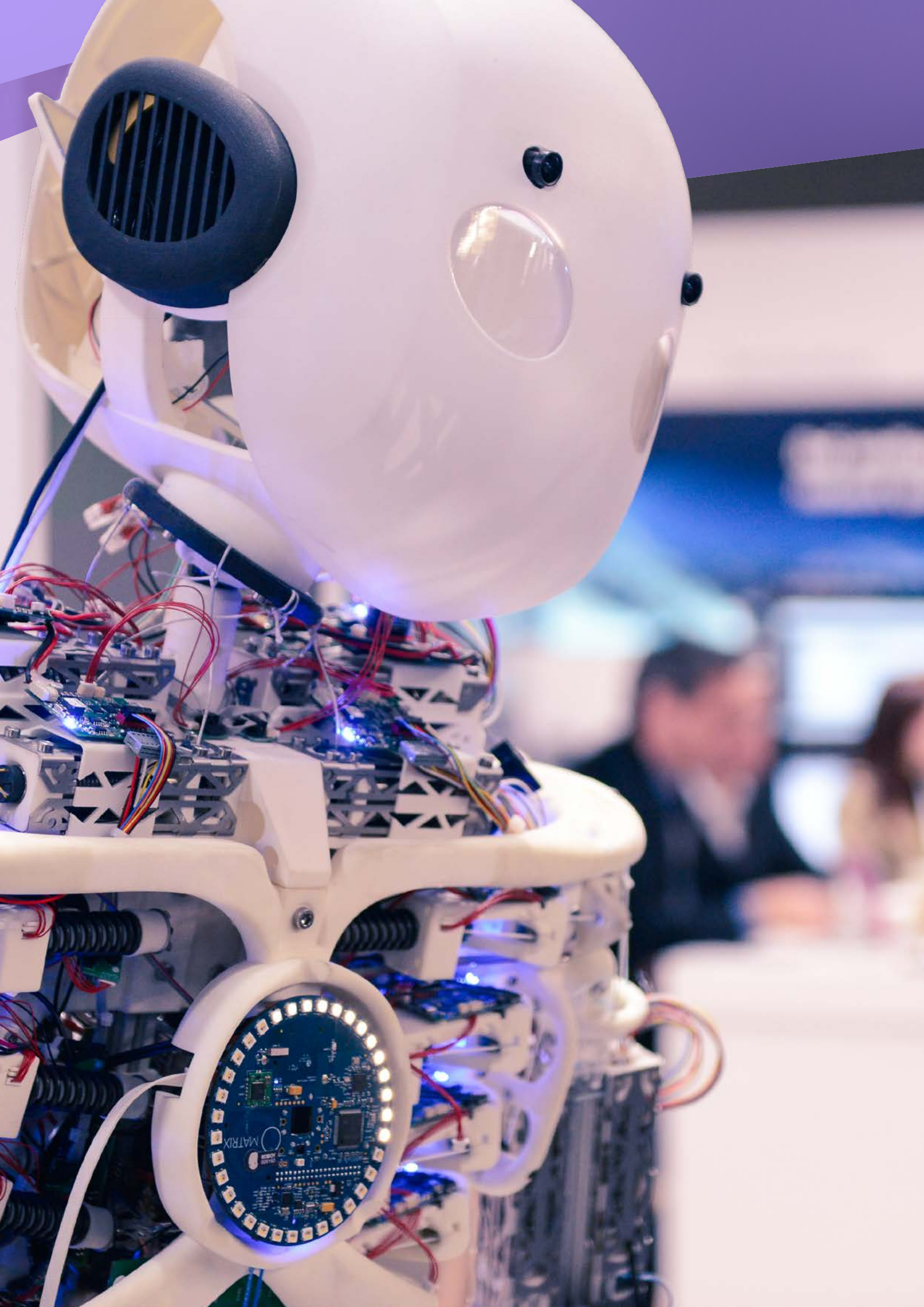
With less than a decade until the target date for the UN Sustainable Development Goals (SDGs), governments around the world are exploring new ways to accelerate progress on the goals. Mobile operators play a key role in efforts to achieve key objectives of the SDGs, primarily by delivering connectivity and access to life-enhancing services, but also by enabling sustainable development through their business and operational activities. In China, mobile operators are, for example, increasingly taking steps towards, and making investments in, energy-saving solutions. This has the potential to reduce emissions and support the global transition towards a zero-carbon economy.

## Policies to support the digital era post Covid-19

During the Covid-19 pandemic, society has relied heavily on communications and digital technologies, which in turn depend on international supply chains and the ability to process personal data and move data across borders. These digital services have allowed businesses to continue operations in difficult circumstances and enabled consumers to access health and education services and to engage in social interactions. In a post-pandemic world, policymakers should continue to strive to protect people's personal data and facilitate cross-border data flows so that businesses and consumers can continue to enjoy the advantages of digital services.

China's mobile operators lead the way with tiered and/or hybrid private and dedicated network offerings, which will support the ongoing digital transformation of industries. Realising this opportunity requires forward-looking policies and regulations, particularly in the area of spectrum. To this end, regulators should aim to:

- make available 80–100 MHz of contiguous spectrum per operator in prime 5G mid-bands (e.g. 3.5 GHz) and around 1 GHz per operator in high bands (e.g. mmWave)
- avoid setting aside spectrum for verticals in priority bands, as that could mean a valuable resource goes unused in many areas and could limit the amount of spectrum available for public 5G services, with a direct impact on speeds, coverage and cost.


MATRIX

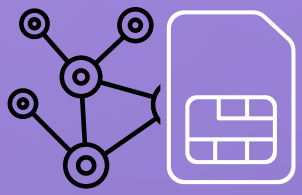
# Mobile Economy China

## Unique mobile subscribers

2020–2025 CAGR: **0.6%**

| 2020 | | 2025 |
|---|---|---|
| 1.22bn | | 1.26bn |
| Penetration rate (% of population) | 83% | 85% |

## SIM connections



2020–2025 CAGR: **0.8%**

| 2020 | | 2025 |
|---|---|---|
| 1.66bn | | 1.73bn |
| Penetration rate (% of population) | 112% | 116% |

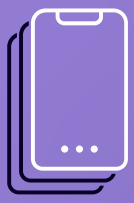
## Mobile internet users

2020–2025 CAGR: **3.2%**

| 2020 | | 2025 |
|---|---|---|
| 992m | | 1.20bn |
| Penetration rate (% of population) | 67% | 80% |

## Smartphone adoption

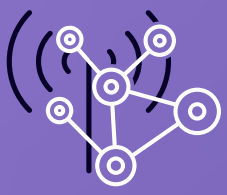
(% of total connections)



2020 **73%**

2025 **89%**

## Licensed cellular IoT connections



2020 **1.34bn**

2025 **2.29bn**

## 4G

### Connections

2020 **1.31bn**

2025 **911m**

### Adoption

(% of total connections)

2020 **79%**

2025 **53%**

## 5G

### Connections

2020 **202m**

2025 **822m**

### Adoption

(% of total connections)

2020 **12%**

2025 **47%**

## Operator revenues and investment

### Total revenues

2020 **$175bn**

2025 **$197bn**

### Operator capex for 2020–2025

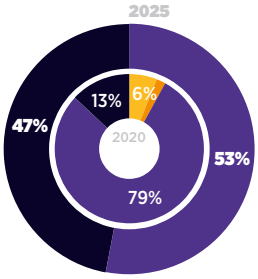
**$210bn**

**90%** on **5G**

2G 3G 4G 5G

## Mainland China

Technology mix*




Subscriber penetration

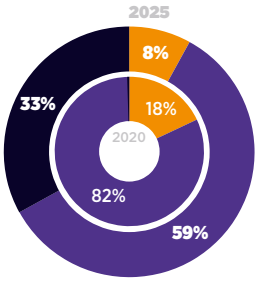
2020 83% → 2025 84%

Smartphone adoption

2020 72% → 2025 89%

## Hong Kong, SAR China

Technology mix*




Subscriber penetration

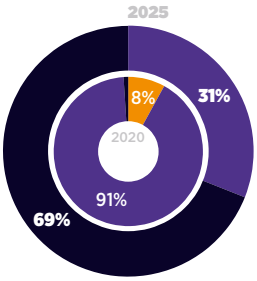
2020 89% → 2025 89%

Smartphone adoption

2020 81% → 2025 89%

## Macao, SAR China

Technology mix*




Subscriber penetration

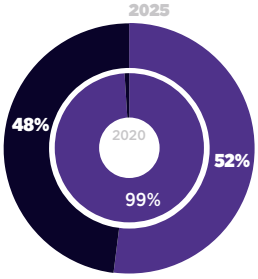
2020 88% → 2025 88%

Smartphone adoption

2020 89% → 2025 94%

## Taiwan, Province of China

Technology mix*




Subscriber penetration

2020 91% → 2025 92%

Smartphone adoption

2020 82% → 2025 88%

* Percentage of total connections

1

# The mobile market in numbers

## 1.1
# Subscriber growth slows with rising market saturation

**Figure 1**

Source: GSMA Intelligence

Key milestones over the next five years in China

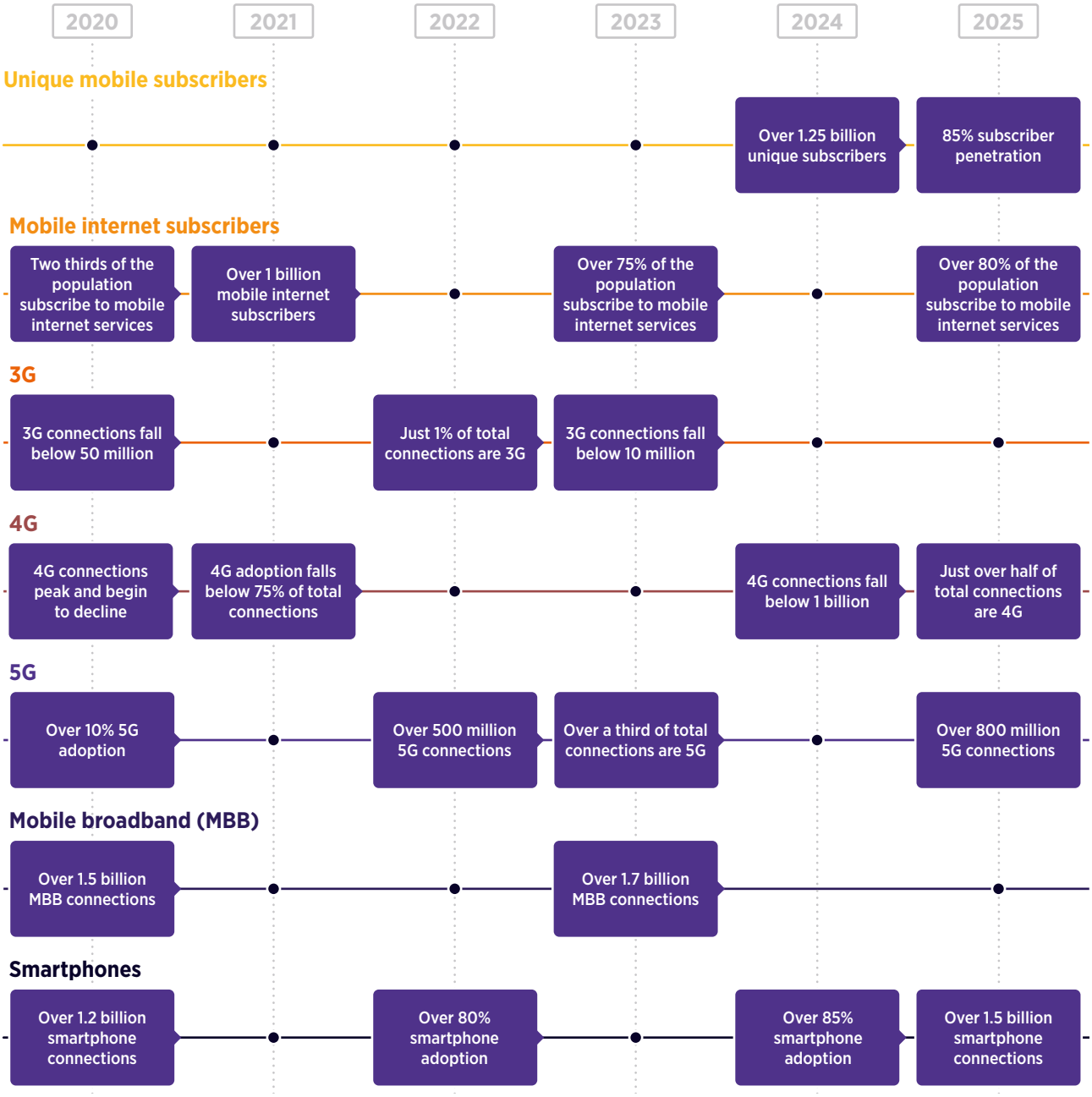
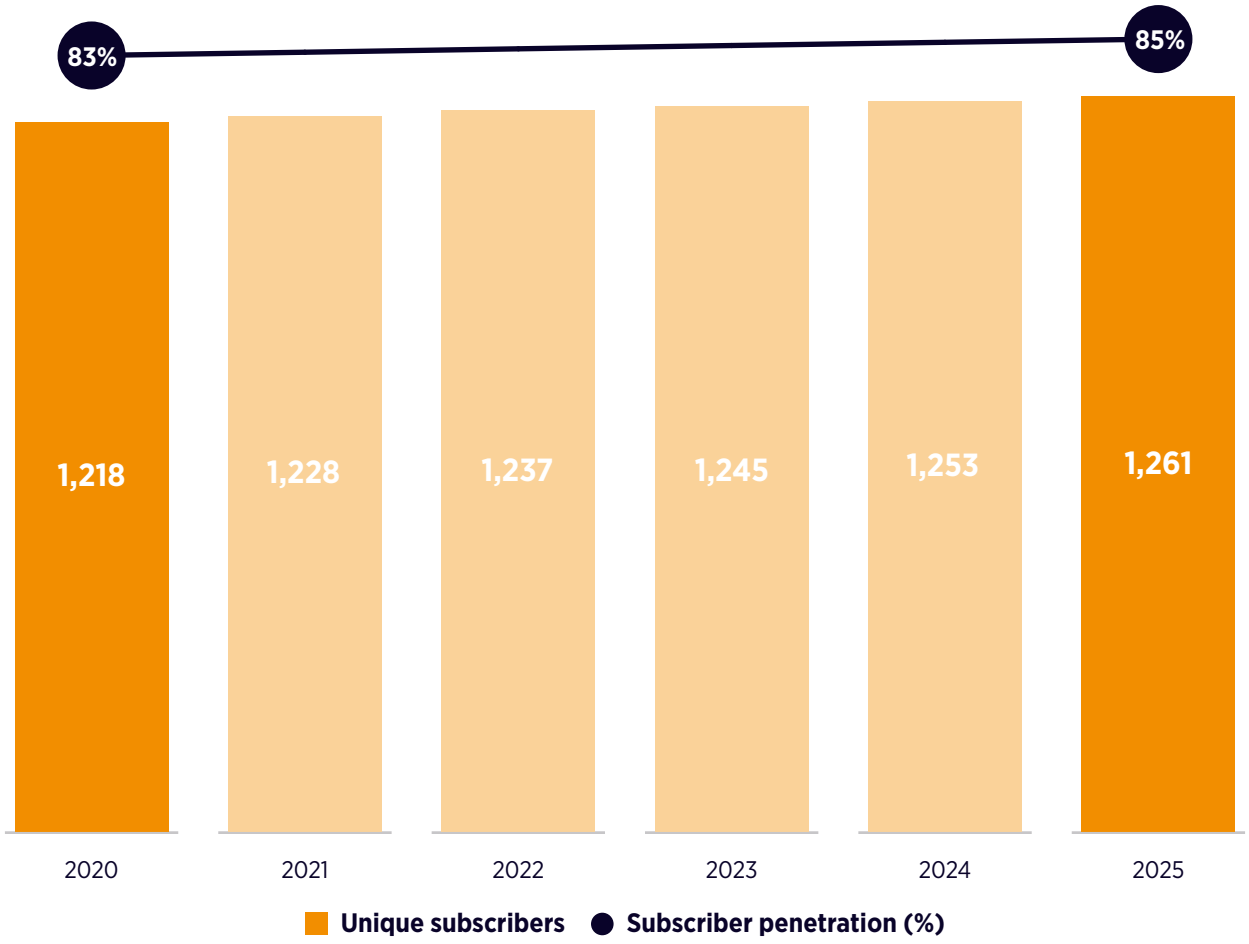


Figure 2

Source: GSMA Intelligence

## China's unique mobile subscriber penetration rate is among the highest in the world

Million




## Subscriber penetration (2020)

## 1.2
# China set to dominate the global 5G landscape

**Figure 3**

Source: GSMA Intelligence

### 4G is currently the leading mobile technology in China but has reached its peak, while 5G take-up continues apace

Percentage of total connections (excluding licensed cellular IoT)

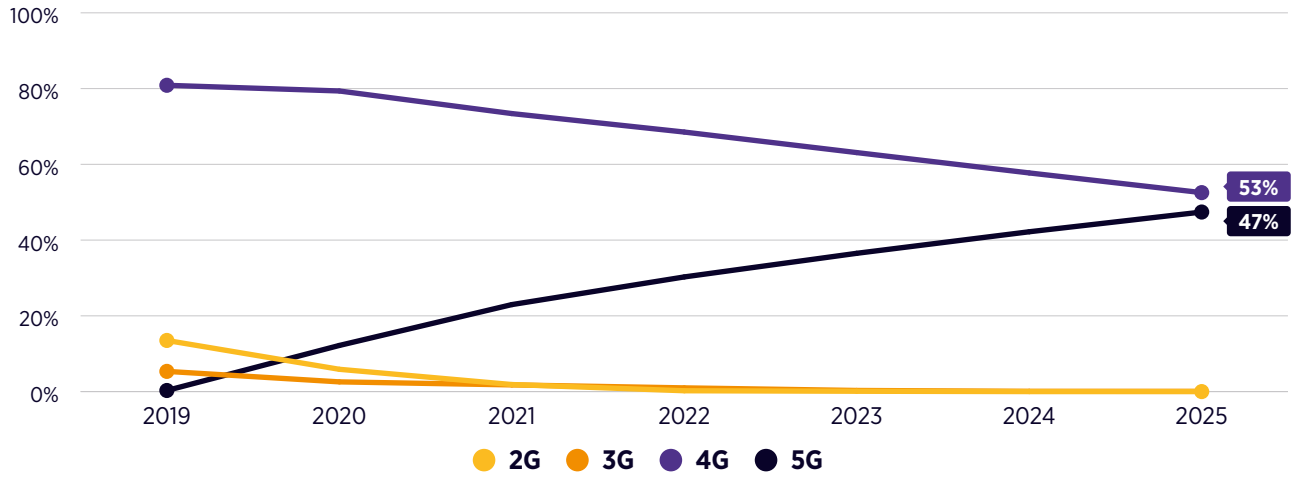
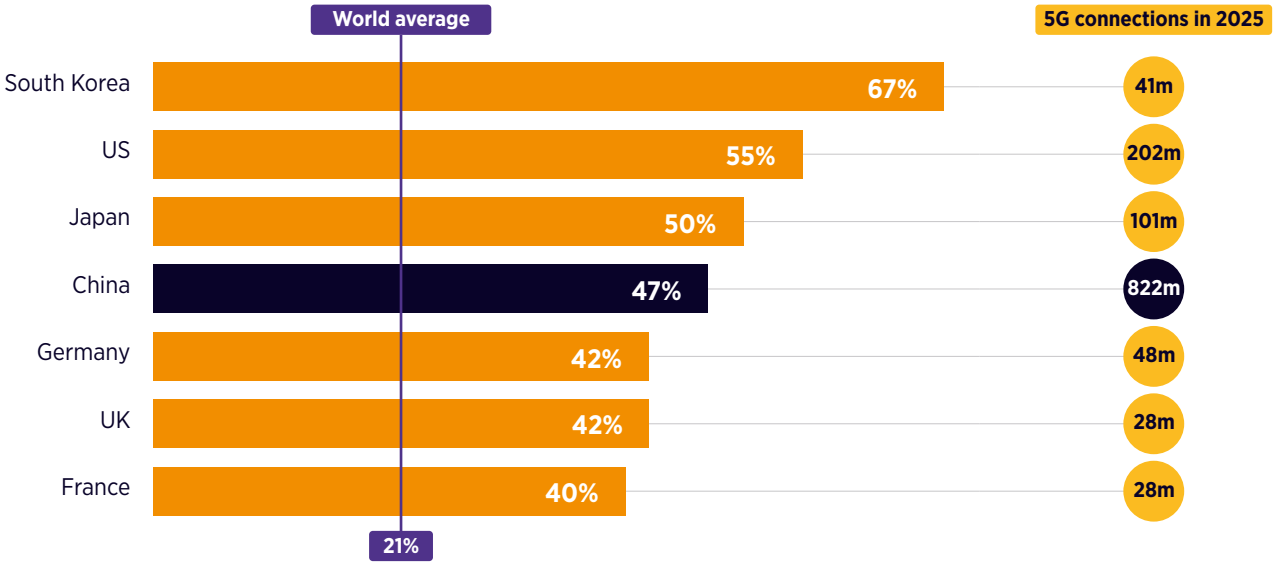



**Figure 4**

Source: GSMA Intelligence

### China will be among the leading markets in terms of 5G adoption

5G adoption in 2025 (percentage of total connections)



## 1.3
# Consumers go digital

**Figure 5**

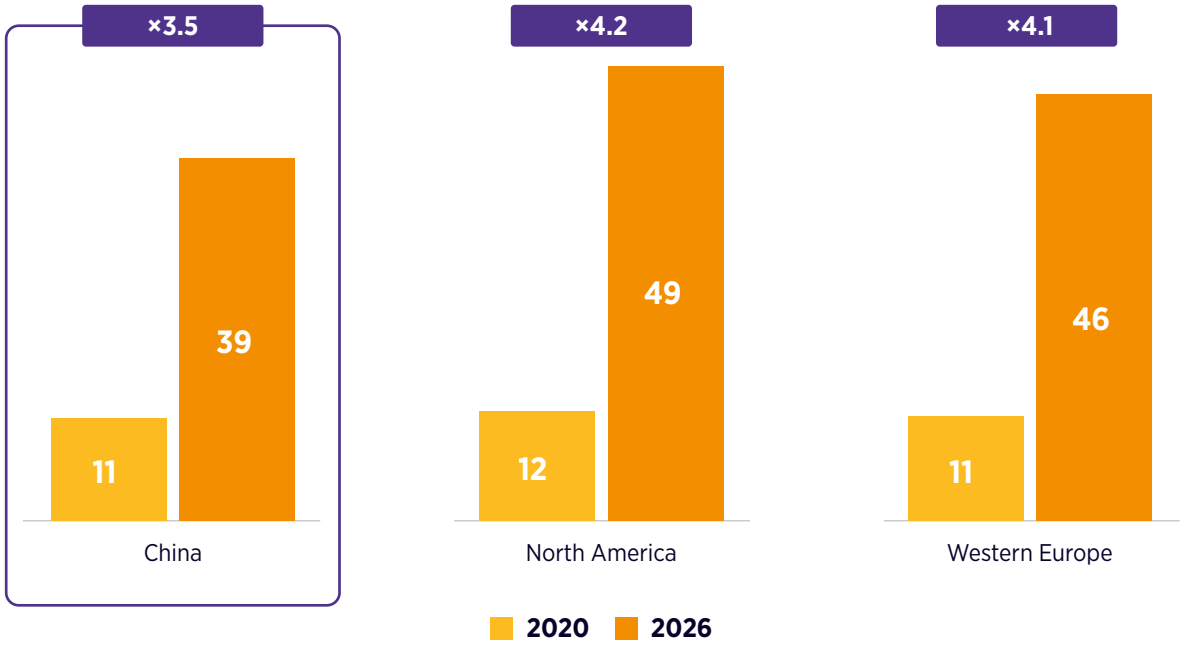
Source: GSMA Intelligence

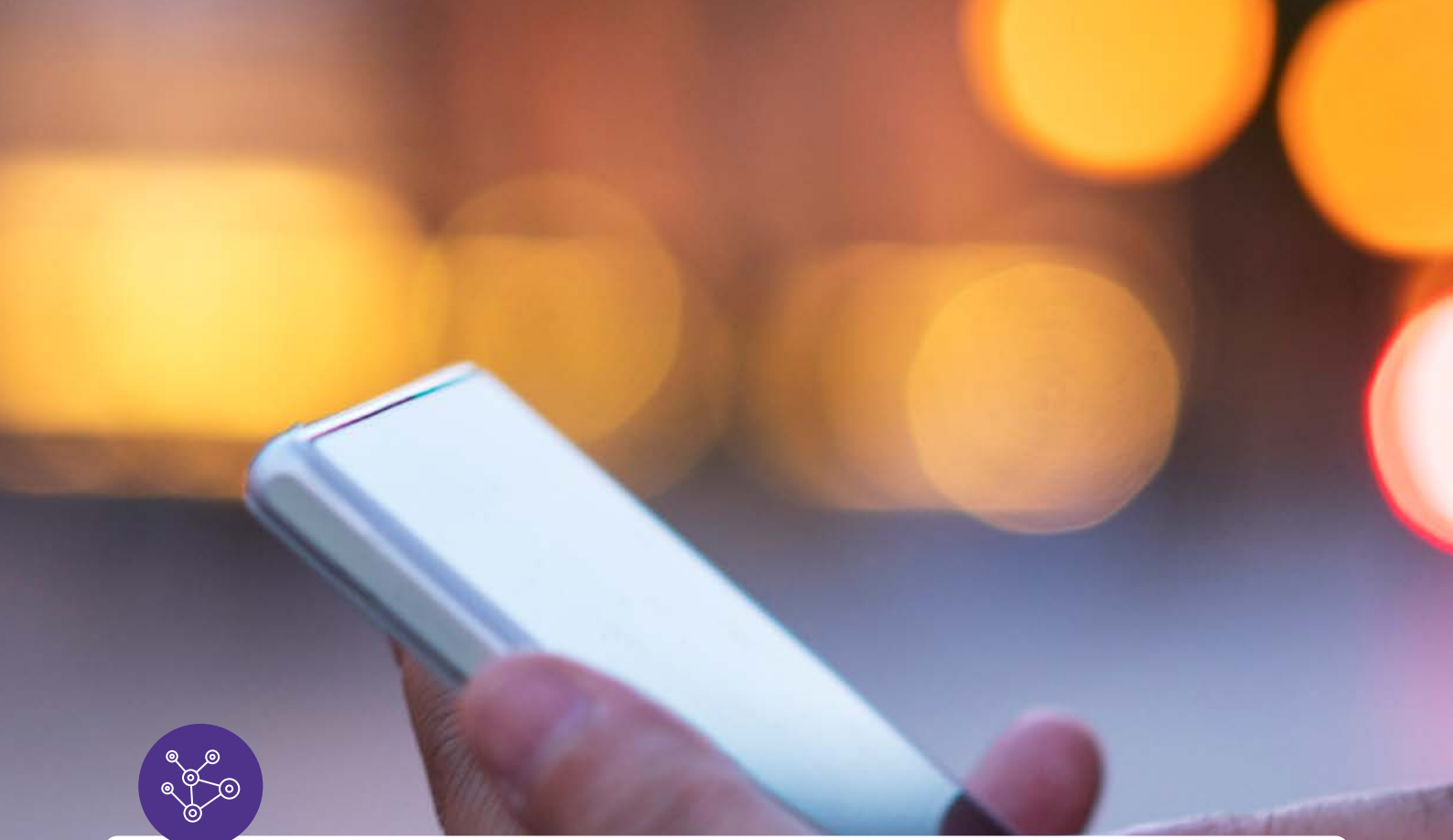
### Two thirds of the population will subscribe to mobile internet by 2025
Number of mobile internet subscribers and penetration rate (2025)


**Figure 6**

Source: Ericsson

### Mobile data traffic in China will grow more than threefold by 2026
GB per subscriber per month





## Data traffic trends: Digital engagement on the rise

In mainland China, increasing smartphone adoption and the wide availability of 4G have led to a surge in mobile internet usage, supporting the country's movement up the digital-society value chain. More than 990 million people now use mobile internet services and this figure is expected to increase by a further 200 million by 2025.

Covid-19 has had a notable impact on mobile data traffic in China. At the peak of the pandemic in early 2020 – when the majority of people in China were confined to their homes – the use of mobile internet surged to 7.3 hours per user per day, an increase of more than one hour compared to before the pandemic.[6] This was largely driven by the shift in daily activities, such as work, learning and shopping, to online channels. The pandemic has also accelerated the use of digital financial services. According to the GSMA Intelligence Consumers in Focus Survey 2020, around 46% of smartphone users now pay for goods using contactless mobile payment technology at least once per week (compared to 30% in Japan and 20% in the US).

6 Statista

Figure 7

Source: GSMA Intelligence

## China will add nearly 340 million smartphone connections by 2025, with adoption rising to nine in 10 connections

Number of smartphone connections (2025)

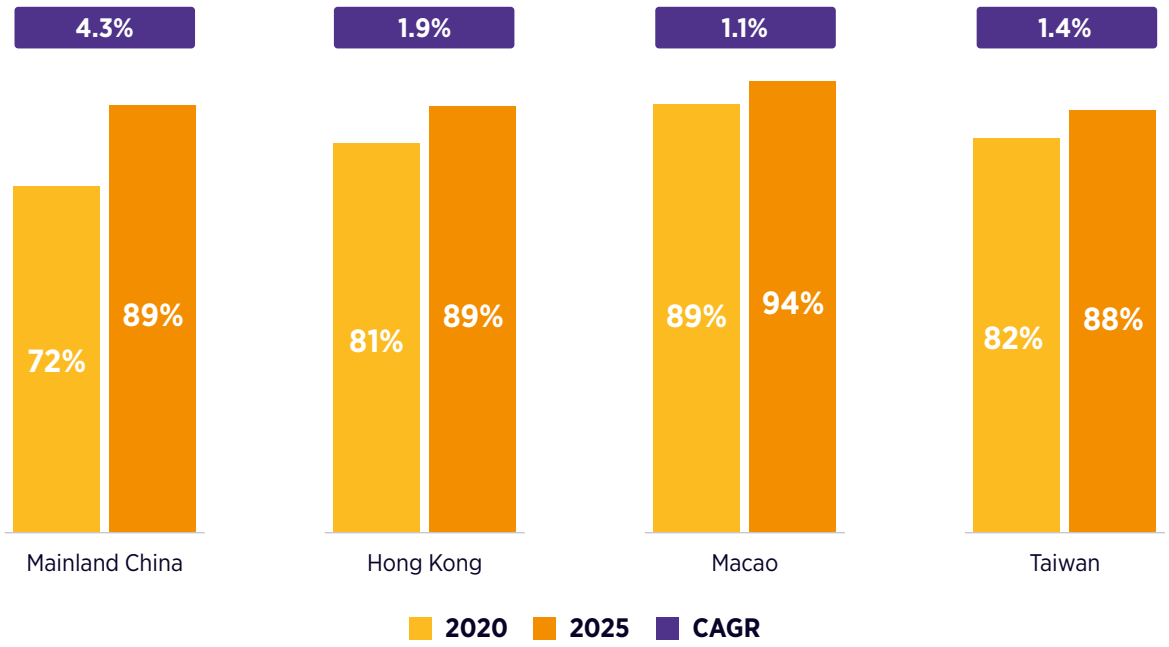
**1.5 billion**
**Mainland China**

**12.3 million**
**Hong Kong**

**1.9 million**
**Macao**

**25.7 million**
**Taiwan**

### Smartphones as a percentage of total connections




## Smartphone trends: China at the centre of smartphone manufacturing

China is home to several global smartphone vendors, including Huawei, Oppo, Realme and Xiaomi. With diverse portfolios and competitive pricing, Chinese OEMs have steadily built market share over the past five years and expanded into other regions: Honor[7] devices have become popular in the Russian market; Shenzhen-based Transsion is a market leader in Africa; and in October 2020, Vivo began to sell handsets in France, Germany, Italy, Poland, Spain and the UK.

Data from the China Academy of Information and Communications Technology (CAICT) shows that smartphone shipments in China declined 20% in 2020, as Covid-19 led to manufacturing disruptions, softer demand and delays to the release of new models.[8] However, production has mostly returned to normal, and the proliferation of low- and medium-range 5G handsets from Chinese vendors could influence local and global 5G adoption. In August 2020, Realme launched a 5G-capable smartphone for RMB1,399 (~$215). Huawei and OnePlus have also established 5G handset portfolios that cater to different, lower-price segments.

7 Honor was owned by Huawei but was sold to a consortium called Shenzhen Zhixin New Information Technology Co. Ltd in November 2020.

8 "China smartphone shipments drop 20%", Mobile World Live, January 2021

## 1.4
# Positive revenue projections as 5G underpins capex growth

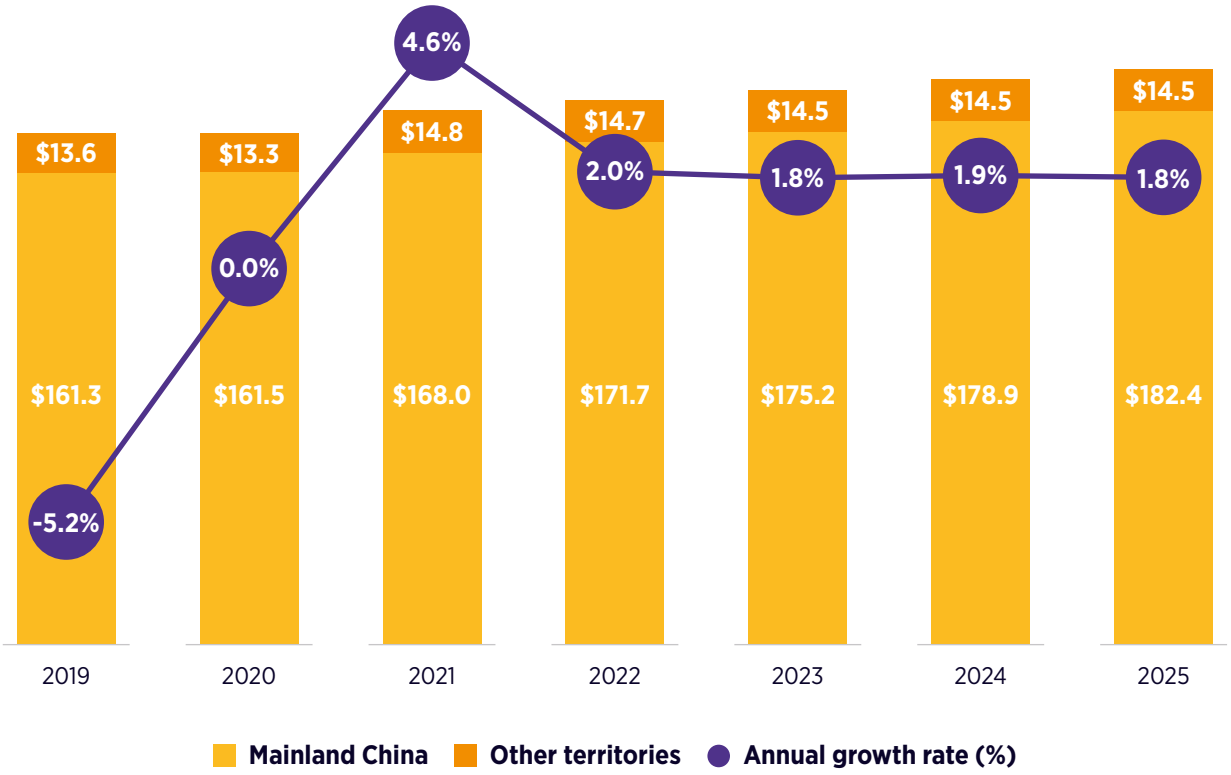
After disappointing results in Q1 2020, revenues for the three Chinese mobile operators recovered well during the rest of the year. The deflationary effects of Covid-19 (and of extensive lockdowns and retail closures) on customer acquisition and smartphone sales have eased, and growing 5G volumes have supported positive top-line trends.[9] Out to 2025, we expect total revenues for operators in the China region to increase at a compound annual growth rate (CAGR) of 2.0%, reversing a negative trend reported over the 2014–2019 period.

**Figure 8**

Source: GSMA Intelligence

### Revenue recovers from Covid-19 slowdown; outlook better than most

Operator revenue (billion)




9 For more detail, see Region in Focus: China, Q3 2020, GSMA Intelligence, 2020

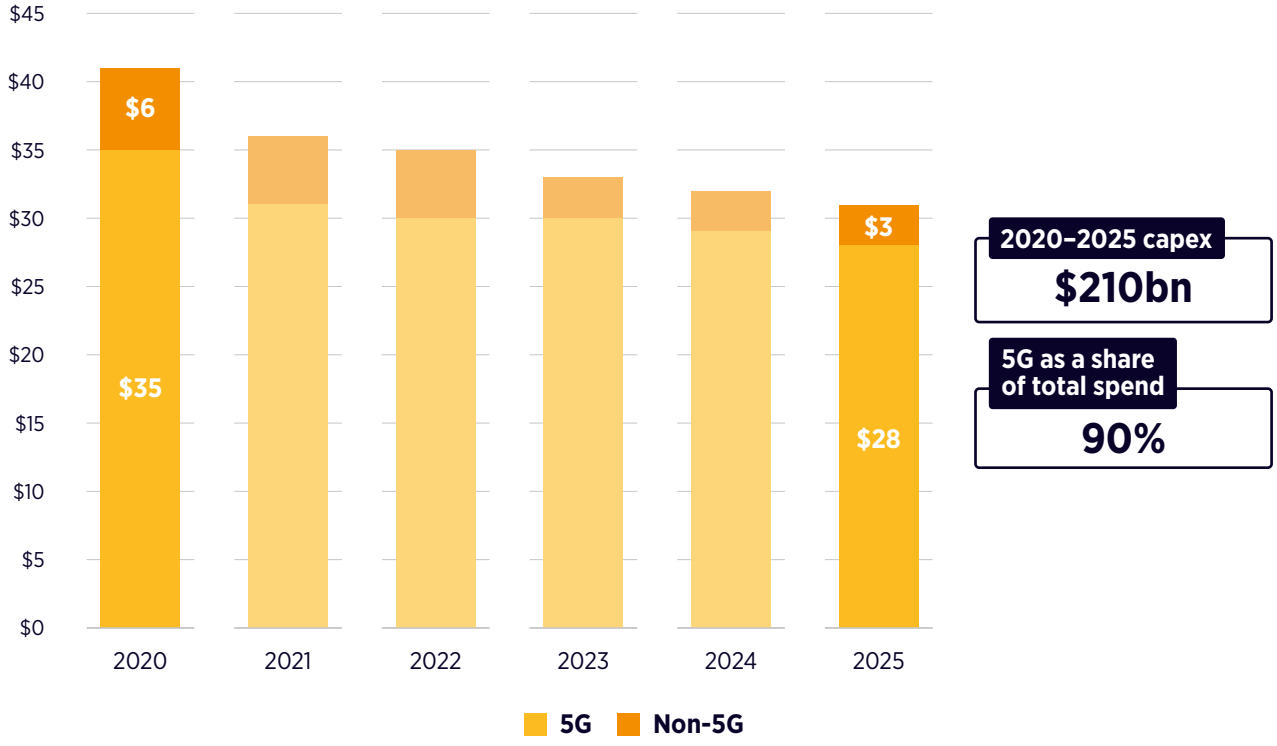
Mobile operators in the China region will invest nearly $210 billion in their networks between 2020 and 2025, of which 90% will be dedicated to 5G.[10] In mainland China, operators are deploying 5G infrastructure rapidly. According to the Ministry of Industry and Information Technology (MIIT), the combined build-out of dual-mode 5G base stations increased by around 200,000 in the last quarter of 2020, taking the total to more than 700,000. This makes mainland China's 5G infrastructure presence by far the largest in the world, reflecting the country's approach of "promoting 5G use through network construction".[11] Elsewhere, mobile operators in Taiwan and Hong Kong have also stepped up 5G investments, targeting up to 99% population coverage within the next two years.

**Figure 9**

Source: GSMA Intelligence

## 5G has driven a surge in aggregate capex, which will rationalise over the coming years

Capex (billion)




10 Including RAN, core and transport

11 "China has over 500,000 5G base stations", Xinhua, June 2020

2

# Key trends shaping the mobile industry

## 2.1
# 5G standalone networks on the horizon

The transition to 5G experienced mixed fortunes in 2020, as the Covid-19 pandemic slowed progress in some countries but had the opposite effect in many others. In India and Spain, 5G spectrum auctions were delayed due to the pandemic. However, in several other countries, such as South Africa and Sweden, operators launched 5G services ahead of schedule after receiving additional spectrum to boost capacity at a time of heightened demand. Globally, there were 144 commercial 5G networks in 57 countries as of January 2021, with around 235 million 5G connections between them.

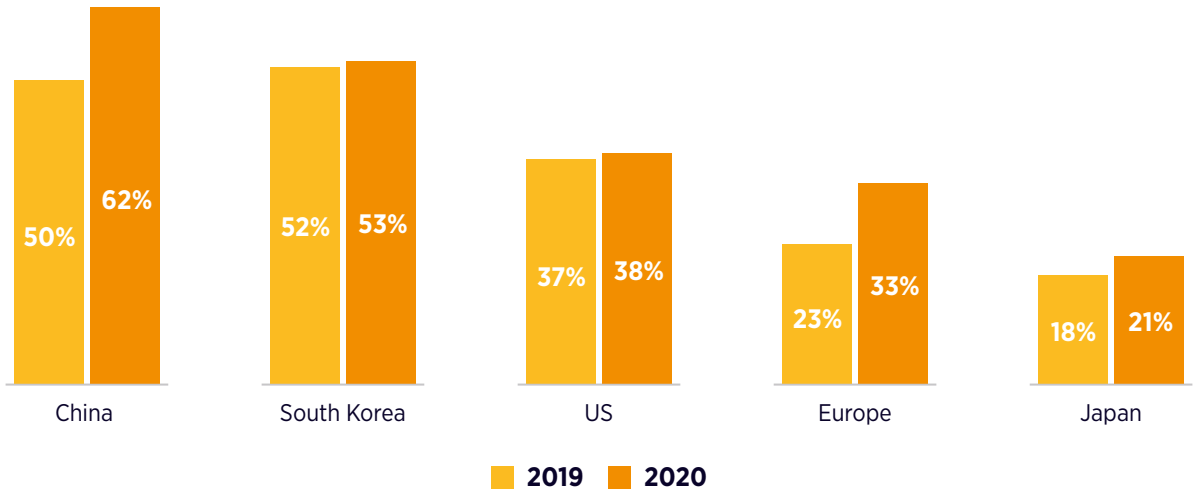
The China region is one of the most advanced for 5G, with commercial services now available in all four markets. Strong 5G uptake in mainland China during 2020 means that it now represents the single largest 5G market in the world, with 5G connections in the country accounting for 87% of global 5G connections at the end of 2020. In Taiwan, 5G connections reached 1 million in December 2020, five months after commercial launch, and in Hong Kong, 5G networks now cover more than 90% of the population. 5G growth in China is being driven by supportive regulations, aggressive infrastructure deployment by operators and a rapidly expanding device ecosystem – in 2020, more than 200 5G device models were sold in China.[12]

**Figure 10**

Source: GSMA Intelligence Consumers in Focus Survey 2020

**Despite the pandemic, intention to upgrade to 5G increased in most markets; however, nowhere is enthusiasm as strong as it is in China**

Do you intend to upgrade to 5G? (Percentage of respondents who said yes)




Figures are weighted by smartphone penetration in each market to estimate national upgrade intention

12 China Academy of Information and Communications Technology (CAICT)

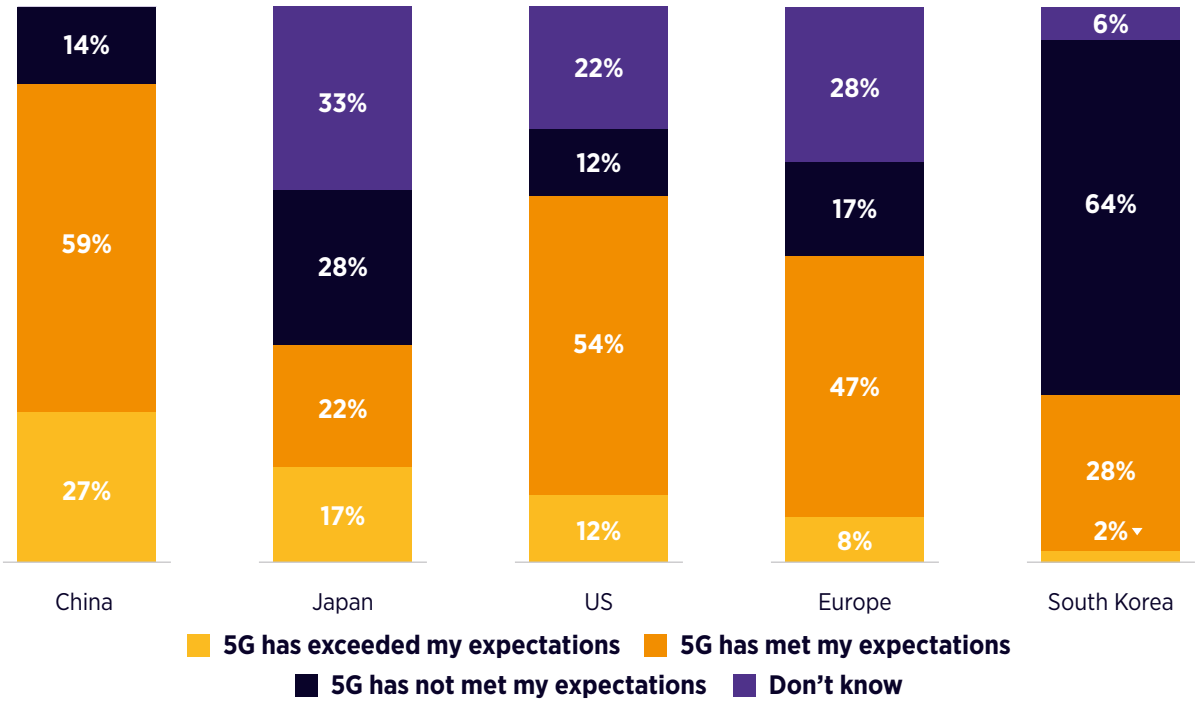
The transition to 5G could be capital-intensive for operators considering the densification requirement of the technology, particularly in high-frequency bands. Among the global leaders in 5G deployment, Chinese operators are at the forefront of efforts to trial and bring to market innovative and cost-effective infrastructure deployment models, such as network sharing. China Telecom and China Unicom have jointly built and currently operate over 320,000 5G base stations across China – the world's largest commercial 5G network sharing agreement – covering more than 300 cities. The move has helped the operators to save RMB60 billion ($9.3 billion) in capex, as of September 2020, with the potential to help save another RMB270 billion ($41.8 billion) over the next five years.

Figure 11

Source: GSMA Intelligence Consumers in Focus Survey 2020

## Positive 5G sentiment in China, as more than 85% of 5G users believe the service has met or exceeded their expectations

Which of the following statements best describes your experience with your 5G network? (Percentage of 5G users)




Mobile operators are making a big push for opportunities in the enterprise market, where there is growing enthusiasm for 5G-enabled solutions in verticals such as manufacturing, transportation and healthcare. Much of the enterprise opportunity for 5G will rely on standalone (SA) networks being deployed in order to benefit from unique 5G capabilities, such as ultra-reliable low-latency communication (URLLC) and network slicing.

There were a number of significant announcements around 5G SA in China in the latter half of 2020, and further developments are expected in 2021. In November 2020, China Telecom announced the start of commercial 5G SA operations on a network capable of secure network slicing and latency of below 5 ms. US and European operators, particularly in the Nordic region, are also moving in the same direction, partnering with vendors and enterprise conglomerates to trial and launch 5G industrial applications.

Figure 12

Source: GSMA Intelligence Network Transformation Survey 2020

## The enterprise opportunity has increased focus on the deployment of 5G standalone networks in leading markets; enthusiasm is highest in Asia

Considering your 5G network assets and strategy, when do you plan to deploy standalone 5G? (Percentage of operators)

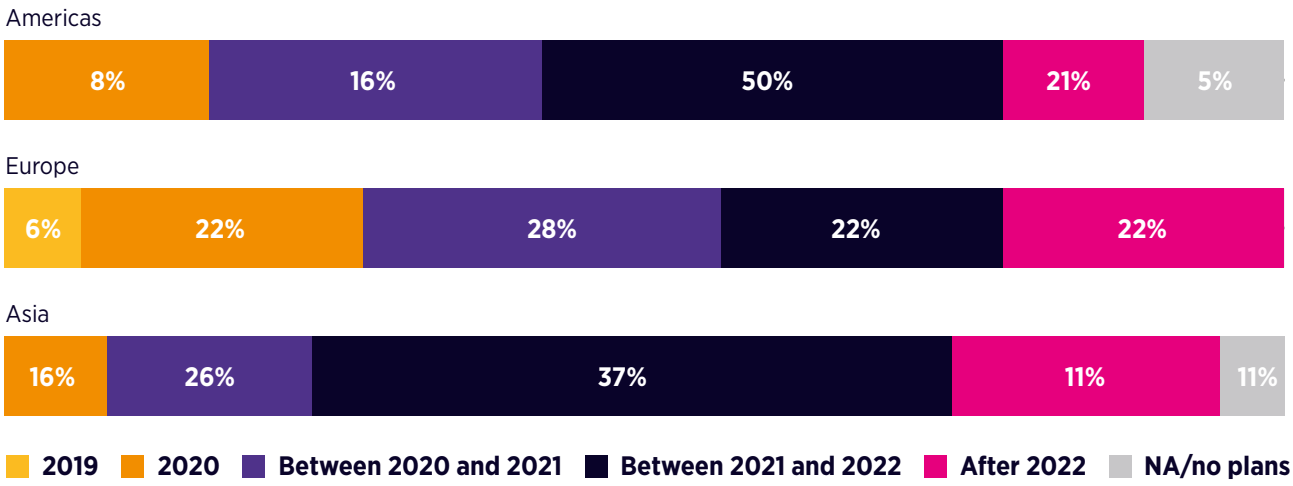
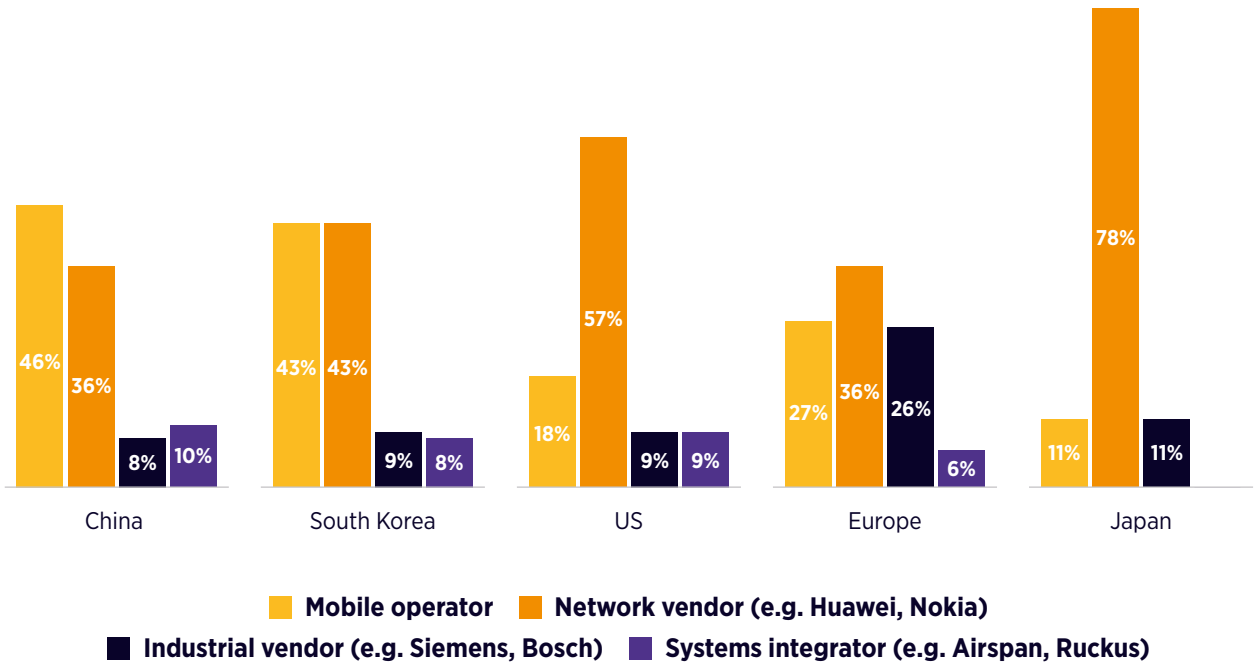



Figure 13

Source: GSMA Intelligence Enterprise in Focus Survey 2020

## For Chinese enterprises, mobile operators are the preferred partners for private networks and dedicated networks, reflecting the opportunity for 5G SA deployment

Who would you prefer to partner with to create a private network? (Percentage of enterprises)



## 2.2
# IoT underpins digital transformation

Covid-19 caused considerable disruption to the Chinese and global IoT market in 2020, mostly due to economic uncertainties that affected supply chains. However, the pandemic has also accelerated the trend towards digital transformation as enterprises look to boost productivity and efficiency.

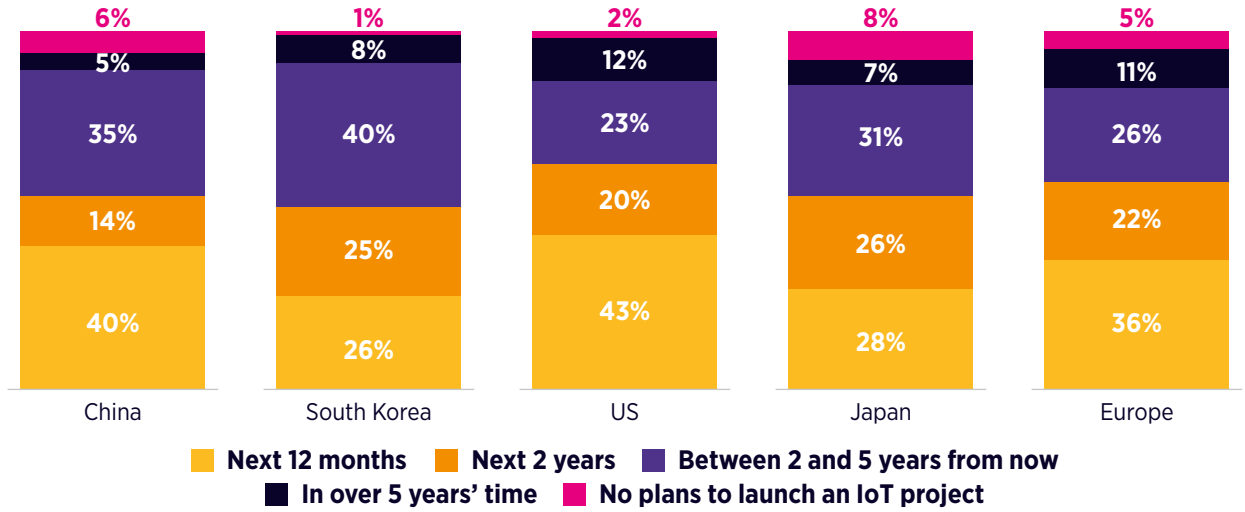
Meanwhile, IoT solutions have been repurposed or created to address immediate challenges faced by enterprises, such as ensuring the safety of workers and adhering to Covid-19 regulations, which has led to short-term growth opportunities.

**Figure 14**

Source: GSMA Intelligence Enterprise in Focus Survey 2020

### Two in five enterprises in China intend to deploy a new IoT project within 12 months; only in the US is there greater urgency

When do you expect to next deploy an IoT project? (Percentage of enterprises)




In 2020, Chinese operators invested considerable sums in NB-IoT, leveraging their extensive 4G network infrastructure. In June 2020, China Mobile said it would deploy 118,000 NB-IoT base stations across the country to take its total to 350,000 by the end of the year.[13] Chinese operators are also exploring new IoT markets beyond their borders as opportunities emerge from enterprise digital transformation initiatives around the world.

In December 2020, China Telecom partnered with IoT network carrier 1NCE to launch a commercial NB-IoT roaming product for China, enabling Chinese companies to expand their IoT business worldwide.[14] In November 2020, China Mobile selected Nokia's Worldwide IoT Network Grid (WING) to deliver unified connectivity management for its international business customers.[15]

13 "China migrates IoT connections off 2G", Mobile World Live, June 2020
14 "1NCE launches NB-IoT offering powered by China Telecoms Global", IoT Business News, September 2020
15 "China Mobile opts for Nokia global IoT grid", Mobile World Live, November 2020

Figure 15

Source: GSMA Intelligence Enterprise in Focus Survey 2020

## 5G and NB-IoT are set to rule China's IoT connectivity landscape, benefiting from considerable investments from mobile operators

Which of the following connectivity options would your organisation use for a future IoT implementation? (Percentage of Chinese enterprises)

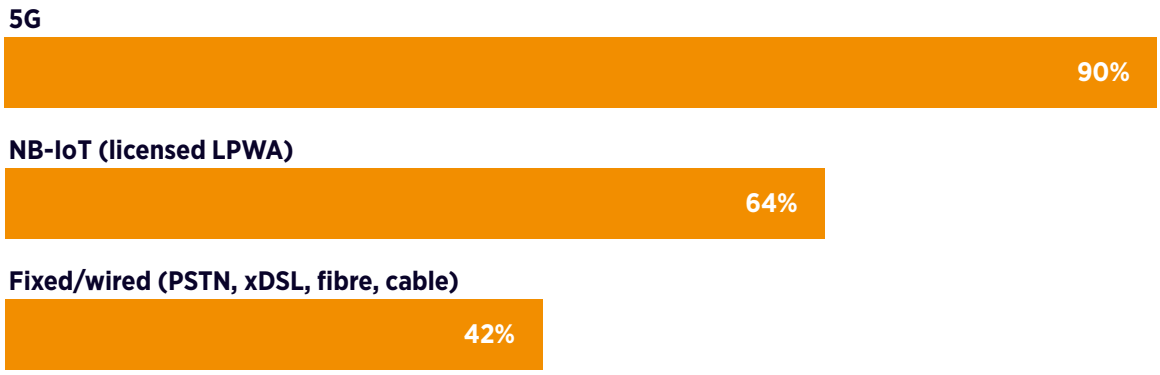
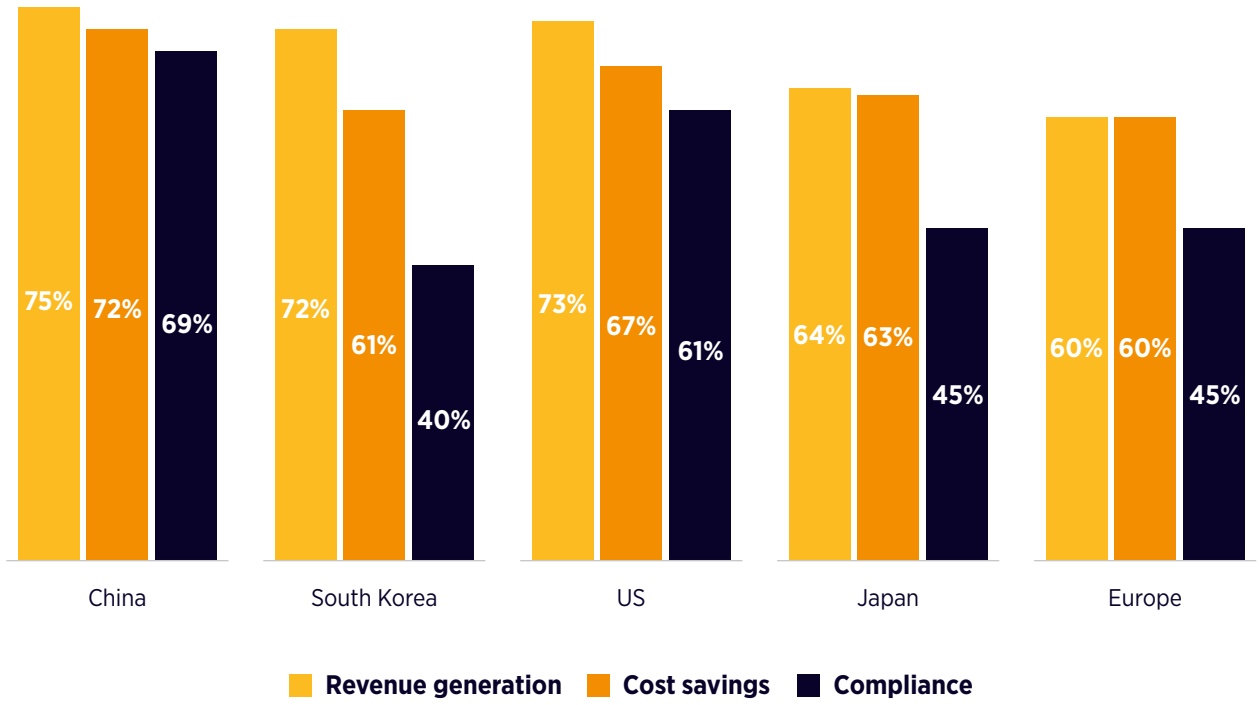



Figure 16

Source: GSMA Intelligence Enterprise in Focus Survey 2020

## Revenue generation and costs savings remain the top measures of IoT success; but for Chinese enterprises compliance has become almost as important in the wake of Covid-19

How do you measure the success of IoT deployment? (Percentage of enterprises)



## 2.3
# 5G rollout brings energy efficiency to the fore

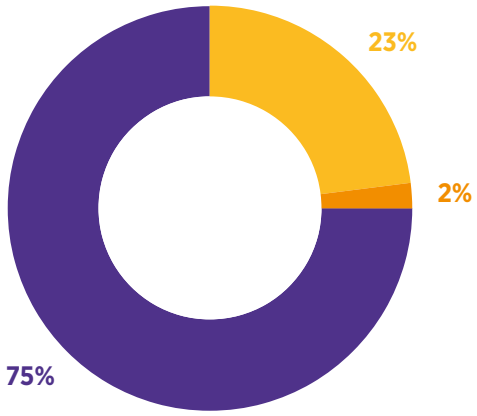
As the transition to 5G gathers pace, the energy efficiency of networks has become a key priority for operators. While 5G new radio (NR) offers a significant energy-efficiency improvement per gigabyte over previous generations of mobile technology, new 5G use cases and the adoption of mmWave will require more sites and antennas. Cost savings and the need to align with industry and governmental commitments to tackle climate change provide further incentives to improve the energy efficiency of networks.

**Figure 17**

Source: GSMA Intelligence

### Network costs account for around a quarter of total operating costs, of which over 90% are spent on energy (fuel and power) consumption

Percentage of total operator cost base




Figures are averages and will vary by operator

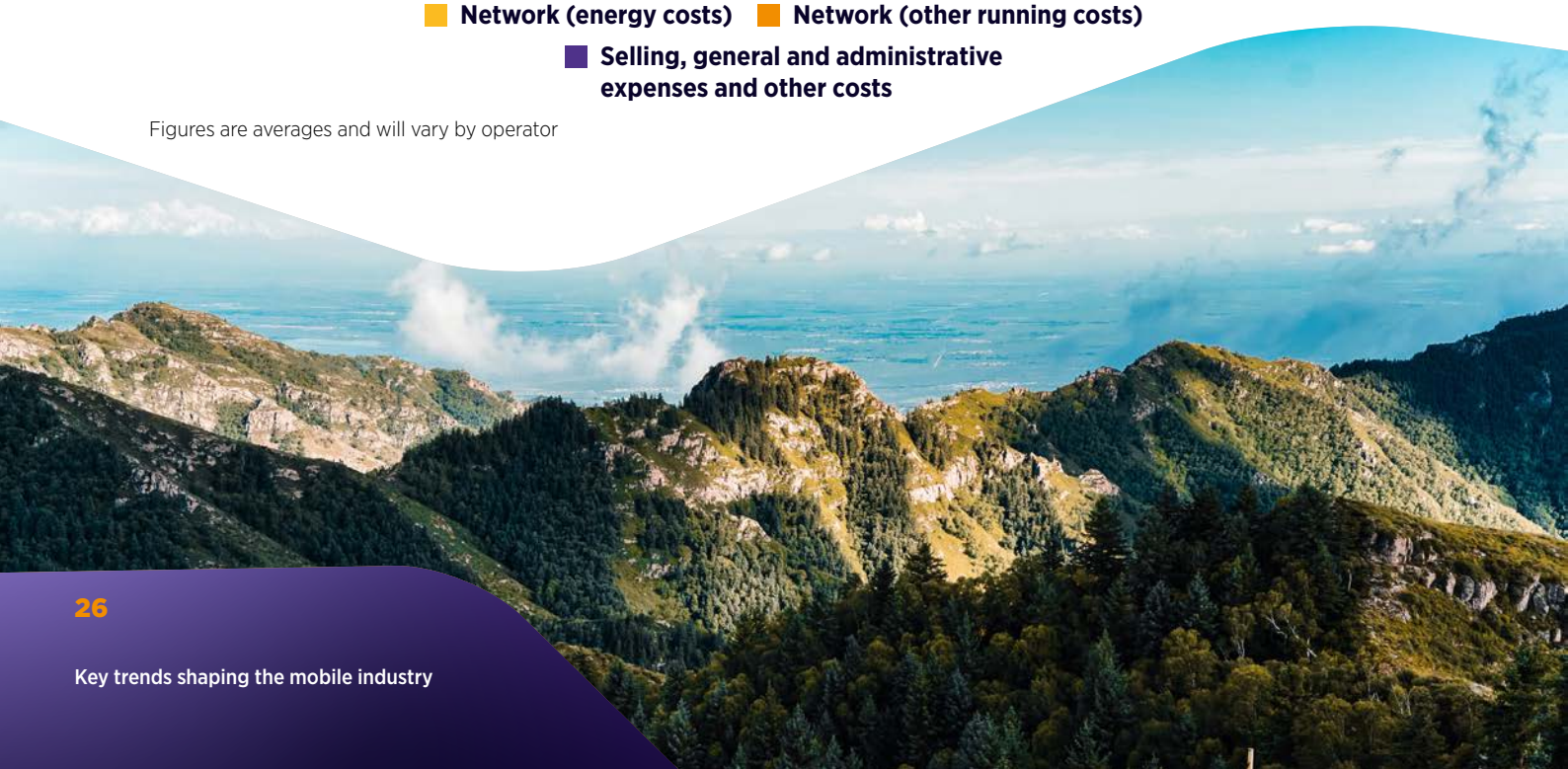


Figure 18

Source: GSMA Intelligence

## Technical improvements to reduce energy leakage and improve efficiency holistically across the network have emerged in recent years

| | |
|---|---|
| **Site innovations** | Solar has become a competitive alternative to diesel in off-grid areas, as the price of photovoltaic panels has fallen and base-station battery solutions have become more advanced. For example, lithium batteries have a smaller and lighter form factor compared to traditional lead-acid batteries, saving space after installation, as well as a significantly longer expected lifespan (five or six years on average). |
| **RAN and network equipment innovations** | Turning off equipment even for a short period of time, or putting it into a sleep mode when there is no traffic to serve, saves energy. The 5G NR standard allows more components to switch off or go to sleep when the base station is in idle mode and requires far fewer always-on signalling transmissions. |
| **Network-wide planning and optimisation** | There are several tools available to operators here, including the sunsetting of legacy networks, AI-driven network planning and optimisation, and content catching nearer to the consumer. Equipment vendors have started to offer AI-driven energy-saving solutions as an extension to existing network management platforms. Major vendors are currently offering solutions that can make energy savings of 5–15% on the RAN. |

In China, mobile operators have launched energy-management solutions that leverage AI and advanced data analytics to optimise energy consumption. AI can help operators to increase energy efficiency and deal with increased data traffic in the 5G era in terms of network planning and optimisation. Operators are also working with vendor partners to trial and deploy energy-saving technologies, with the potential to significantly save costs and improve energy efficiency:

- China Mobile and Huawei implemented an energy-saving solution in Zhejiang province, resulting in energy-saving optimisation of more than 15% in 2020. This was achieved under the same traffic patterns and volumes, with no negative impact on network quality. The project included three main phases: enabling basic energy-saving functions, enabling 4G and 5G collaboration, and optimisation in idle mode and service mode.
- China Telecom has partnered with Huawei and the State Grid to build a 5G-based smart power grid in Qingdao, Shandong province. As part of the project, a peak-clipping power source stores energy during low electricity consumption periods and uses it to support 5G stations in peak periods. Each base station with a peak-clipping power source consumes about 20% less electricity, resulting in savings of RMB13,800 ($2,100) annually.
- China Mobile has partnered with ZTE to deploy shutdown and deep sleep technologies for 5G networks in Lianyungang. Results show that the sub-frame shutdown from midnight to 6AM can reduce energy usage by 16% and up to 25% on a single site over 24 hours during low traffic.
- China Unicom is working with ZTE to trial several energy-saving solutions in Dalian. Results so far show that power consumption can be reduced by up to 15–25% with channel shutdown techniques and 60–80% with deep sleep measures. A combination of energy-saving techniques also reduced consumption on a single 5G base station by 10–12 KWh per day on average, with no impact on network performance.

3

# Mobile contributing to economic growth and social progress

## 3.1
# Mobile's contribution to economic growth

The Covid-19 pandemic has had a significant impact on China's economy, as social restrictions put in place to tackle the spread of the virus resulted in disruptions to established supply chains and caused enterprises to seek new ways to operate in compliance with new safety measures. In this context, the mobile industry has emerged as a lifeline for society by enabling many economic activities to continue, even at the peak of the pandemic, and mitigating the impact of social restrictions on economic output.

As the world eventually transitions to a post-pandemic economic recovery phase, mobile technology will likely play an even more crucial role in facilitating new business models for enterprises and digital experiences for consumers. By 2030, upgrades to 5G and the new services enabled by 5G will add over $600 billion annually to the global economy. This will represent approximately 2.1% of the income growth expected in the coming decade, across all industries and sectors.[16] We estimate that the benefits of 5G in the next decade will be especially concentrated in manufacturing, services and retail. These industries will drive almost a third of the $600 billion of economic activity that will be added to the global economy.

Due to a lack of sufficient data at the time of writing, this report does not include a comprehensive analysis of the contribution of mobile to China's GDP in 2020 and the outlook for the coming years. This analysis will be included in subsequent editions and other GSMA publications, when sectoral data of the impact of the pandemic becomes available.

16 Mobile technology and economic growth: Lessons to accelerate economic growth and recovery, GSMA Intelligence, 2020

## 3.2
# Expanding the benefits of mobile internet

Mobile internet access continues to grow in China. Over the past decade, operators have invested significantly in the rollout, upgrade and maintenance of mobile networks to increase digital inclusion and reduce the 'coverage gap' i.e. those with no access to mobile broadband services (3G and above).

Moreover, since 2010, the number of people subscribing to mobile internet across the region has more than trebled to over 990 million (67% of the population). However, this leaves a section of the population – nearly 470 million people – covered but unconnected. This is defined as the 'usage gap', which represents those who live within the footprint of a mobile broadband network but are not using mobile internet services.

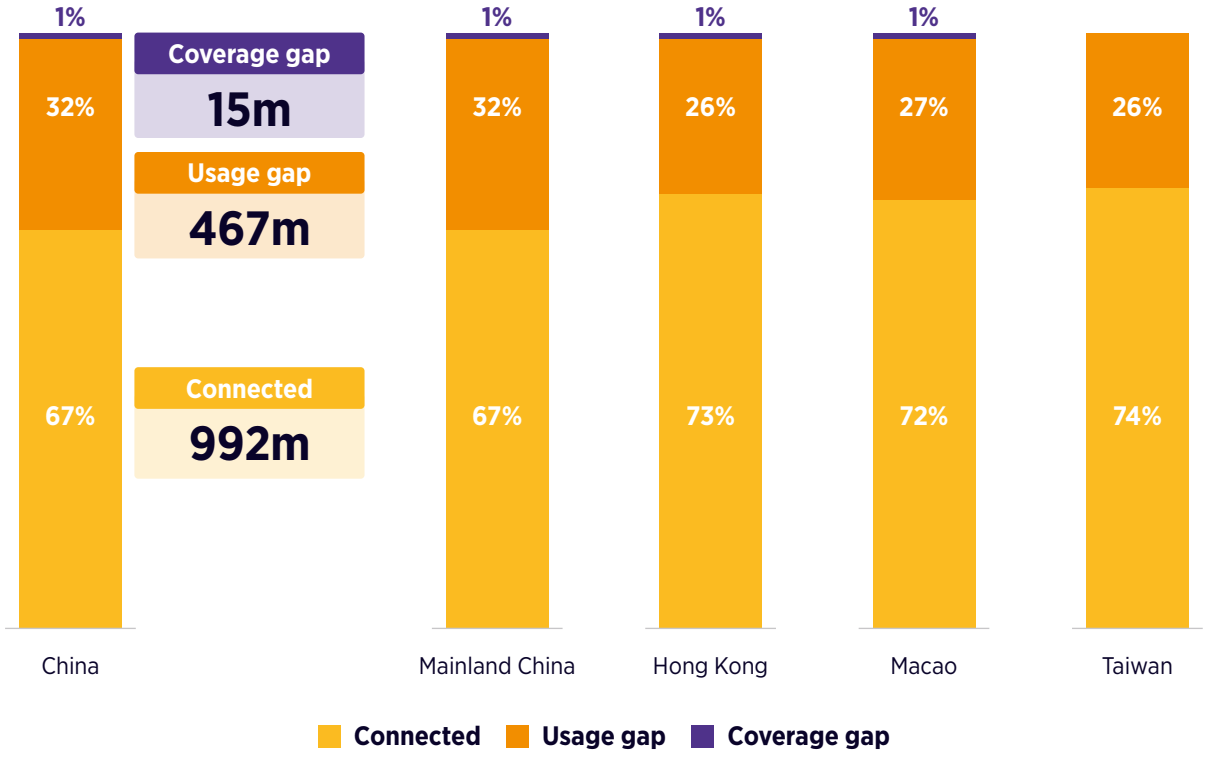
As the key barriers to mobile internet adoption – namely infrastructure, affordability and consumer readiness – are overcome, the usage gap will continue to close. By 2025, over 200 million people across China will start using mobile internet for the first time, reducing the unconnected to less than 20% of the population.

**Figure 19**

Source: GSMA Intelligence

**Mobile internet penetration has trebled in the last decade, although non-users still account for a third of the population**

Percentage of population



According to the GSMA's Mobile Connectivity Index (MCI), mainland China has progressed from being a 'Transitioner' market in 2014 to a 'Leader' in 2019,[17] joining Hong Kong in this foremost category. The country's digital development has been driven by various factors, including operator investments in network performance, reductions in mobile tariffs, improvements in online security and greater social media penetration.

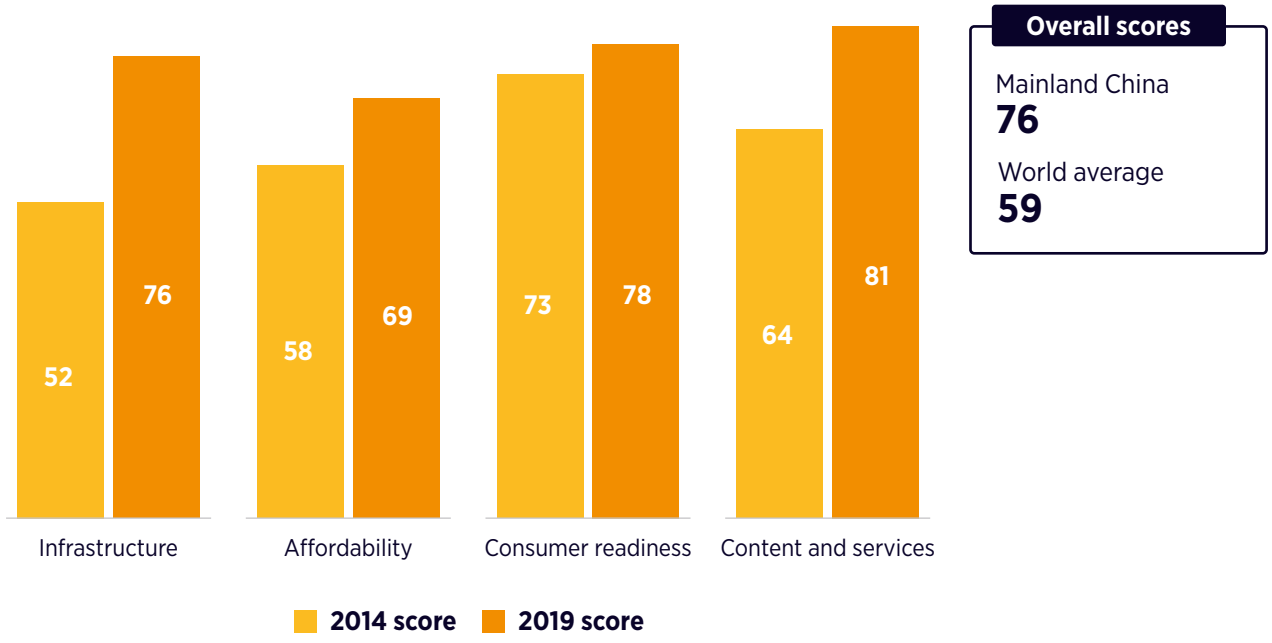
China's Index score is well above the global average, but it trails leading markets such as Australia and Singapore. This is particularly evident in the MCI's affordability enabler, which includes measures of handset tax and prices. Though no single reason stands out for why consumers are not using mobile internet, affordability and relevance appear most pressing for unconnected population groups.[18]

**Figure 20**

Source: GSMA Intelligence

## In the GSMA's Mobile Connectivity Index, mainland China has seen the greatest improvement to infrastructure in recent years

GSMA Mobile Connectivity Index scores for mainland China




17 www.mobileconnectivityindex.com

18 GSMA Intelligence Consumers in Focus Survey 2020

## 3.3
# The mobile industry's response to Covid-19

As the first epicentre of the Covid-19 outbreak was in China, the country's economy and mobile industry were impacted before many other countries in Asia, Europe and the Americas. Operators have strived to ensure that people remain connected and have provided support for vulnerable individuals and communities, engaging with the public and private sectors in the process.

One of the most remarkable aspects of the early 2020 period was the use of advanced technology to assist with frontline healthcare efforts to stem the rate of infections and treat patients. As a result, the pandemic has presented a test platform for 5G's utility in medical settings and is likely to accelerate industrial deployments.

**Figure 21**

Source: GSMA Intelligence

### Selected operator response measures to the Covid-19 pandemic

| Territory | Initiatives |
|---|---|
| Mainland China | Fujian Changle Hospital has implemented China Mobile's 5G-enabled remote thermal imaging solution to pre-screen patients with fevers to reduce the risk of transmission during temperature measurements. |
| Mainland China | China Unicom and State Grid Hangzhou Electric Power Company have used a 5G-enabled cable tunnel inspection robot to conduct real-time monitoring of power systems. |
| Mainland China | China Telecom and ZTE have helped West China Hospital and Sichuan University to realise the country's first 5G-based remote diagnosis system for Covid-19. |
| Mainland China | China Mobile has partnered with the local education authorities in Hubei province to provide 5G-powered infrared thermal imaging and temperature-measuring equipment to schools. The solution was also used in other densely populated places such as hotels and shopping malls. |
| Mainland China | In Yunnan province, 5G drones were used to patrol areas and advise people to avoid gatherings. 5G drones also dispatched face masks and delivered hot meals to hospital patients. |
| Mainland China | Hubei Radio and Television Station has used the 5G network of China Broadcasting Network Corporation (CBNC) to provide a network-wide live broadcast of press conferences on epidemic control in Hubei Province. |
| Taiwan | The Department of Cyber Security has worked with Taiwan's operators to track the movements of people under isolation or quarantine orders by using mobile phones and the triangulation of base station data. |
| Hong Kong | AIA, HKT and Gleneagles Hospitals have launched a telemedicine platform, allowing patients to make appointments with doctors, receive consultation and diagnosis via video call, and order prescriptions. |
| Macao | CTM has installed free Wi-Fi hotspots at all border checkpoints, enabling inbound residents and tourists to complete online health declaration forms. |

## 3.4
# Mobile tackling social challenges

As the first industry to have committed fully to the UN Sustainable Development Goals (SDGs), the mobile industry continues to have substantial positive effects on lives and livelihoods, with tangible results. According to GSMA research,[19] the sector has made particularly strong contributions in mainland China in 2020 on SDGs 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy) and 4 (Quality Education). Further, the country scores highest in SDGs 9 (Industry, Innovation and Infrastructure), 6 and 7.

**Figure 22**

Source: GSMA

### Mobile's impacts on the SDGs in mainland China, 2019


## Mobile boosting industry, innovation and infrastructure

SDG 9 aims to build resilient infrastructure, promote inclusive and sustainable industrialisation, and deliver affordable internet access for all. With almost 1.2 billion unique subscribers and 99% 4G population coverage in China, mobile technology contributes to this goal as a provider of critical infrastructure and as a platform for innovation.

The high score for SDG 9 in mainland China is also driven by mobile's catalytic effect on adjacent sectors. The connectivity provided by mobile operators enables industrial processes and manufacturing to utilise technological advancements in IoT, AI and big data analytics, which in turn facilitates productivity gains. For example, China Unicom offers governments and industrial and transportation customers an LTE-based measurement and control method for an unmanned aerial control solution that reduces costs, improves efficiencies and removes any distance and altitude constraints usually found in traditional point-to-point communications.[20]

19 2020 Mobile Industry Impact Report: Sustainable Development Goals, GSMA, 2020
20 Case study: Ground-to-air LTE communication services for industrial drone applications, GSMA, 2019

## Mobile industry at the forefront of efforts to tackle climate change

The mobile sector's support for SDG 9 also has knock-on effects on other goals, including SDG 13 (Climate Action), which calls for urgent steps to combat climate change and its impact. Mobile technology contributes to SDG 13 by improving energy efficiency, effecting changes in behaviour and reducing greenhouse gas (GHG) emissions. Chinese operators are increasingly taking steps and making investments to support the global transition towards a zero-carbon economy.

China Mobile implemented its Green Action Plan more than a decade ago to promote environmental sustainability by researching and developing energy-saving technologies, enhancing climate resilience, implementing green operation and management, and driving energy conservation and emissions reduction in the supply chain. In 2019, the operator invested RMB160 million ($25 million) in the plan, managing to reduce its overall energy consumption "per unit of information flow" by 43% compared with the previous year.[21]

Despite the reduction in human activity due to the pandemic, the resulting 6% drop in GHG emissions projected for 2020 falls short of what is required: the world needs to halve emissions by 2030 to limit global overheating to 1.5°C, which is necessary to avoid catastrophic consequences and irreversible changes. With mobile communications technologies able to avoid 10× more emissions than they cause,[22] more can be done to leverage the power of mobile to drive decarbonisation efforts, improve quality of life and support the delivery of the SDGs.

The GSMA and mobile operators are taking collaborative action to be fully transparent about the industry's own climate emissions, and have developed an industry-wide climate action roadmap to achieve net-zero GHG emissions by 2050 in line with the Paris Agreement. Globally, more than 50 mobile operators are now disclosing their climate impacts and GHG emissions via the internationally recognised CDP global disclosure system.[23] These include leading operators in the China region: China Mobile, China Telecom, China Unicom, Chunghwa Telecom, Far EasTone and Taiwan Mobile. This will enable full transparency for customers, policymakers, vendors and investors to follow the progress.

21 See https://sec.report/Document/0001564590-20-016952/
22 The Enablement Effect: The impact of mobile communications technologies on carbon emission reductions, GSMA, 2019
23 See www.cdp.net/en

# 4 Policies to support the digital era post Covid-19

Digital transformation is gaining momentum across society. Governments and enterprises increasingly rely on cutting-edge digital technologies, underpinned by high-speed connectivity, to improve operational processes. Consumers are also exploring new digital lifestyle experiences, with an ever-increasing array of connected devices and digital services. The disruption to traditional social and businesses activities brought about by Covid-19 is set to accelerate this trend over the next decade, highlighting the imperative for effective policies to support the emerging post-pandemic digital era.

## 4.1
# Realising the potential of 5G for private and dedicated networks

In terms of customised 5G services for enterprises, China's three mobile operators are leading the way with tiered and/or hybrid private and dedicated network offerings. The flexibility that they offer, even at this early stage, highlights what operators can do and gives food for thought for other countries looking to set aside spectrum, irrespective of what range is available for licensing.

In July 2020, China Mobile unveiled plans to help enterprises across 15 industries, including manufacturing, healthcare, automotive and ports, to build private 5G networks. China Telecom has advanced aggressively on its cloud-network convergence strategy to strengthen its competitive edge and capabilities for vertical industries. For example, it is playing a crucial role in the implementation of a smart grid project in Qingdao, based on a slice of the operator's 5G SA network built for the national utility, the State Grid. China Unicom has also made available its offerings for virtual, hybrid and dedicated private networks, with specific focuses on converged media, industrial internet, transportation, education, health and tourism. It has also provided dedicated networks for the mining industry, which greatly improved the efficiency and security of underground operations.

For enterprises and other end users, private networks hold the promise of enhanced security, greater control and flexibility over key network features such as coverage and capacity. A report jointly published by the GSMA and the China Academy of Information and Communications Technology (CAICT) featured innovative 5G use cases across multiple industries, from manufacturing and utilities to aviation and education. Collaboration between mobile operators and equipment vendors, and their joint efforts to identify and respond to practical problems faced by verticals, have been crucial in developing new enterprise use cases to improve efficiency and safety and to support a cleaner environment.

To make the most of the potential of private and dedicated networks in the emerging digital era, forward-looking policies and regulations are required, particularly in the area of spectrum. Access to the right amount and type of spectrum under the right conditions is essential to deploy high-performance next-generation networks. The speed, reach and quality of 5G services depend on a significant amount of new harmonised mobile spectrum across low (<1 GHz), mid (1–6 GHz) and high bands (mmWave). Below, we highlight key recommendations for regulators.

## Allocate large and contiguous blocks of spectrum

For initial launches, regulators should make available 80–100 MHz of contiguous spectrum per operator in prime 5G mid-bands (e.g. 3.5 GHz) and around 1 GHz per operator in high bands (e.g. mmWave spectrum). While mid-band spectrum has been widely utilised for 5G since initial deployments of the technology, mmWave spectrum can deliver the capacity to power new use cases and cutting-edge services, with improvements in speed and latency.

Although the use of mmWave spectrum is still at an early stage, trials and the first commercial mmWave 5G networks are already capable of delivering gigabit speeds. The IMT-2020 (5G) Promotion Group in China is actively conducting field trials with industry stakeholders in mmWave spectrum that will lay important groundwork for commercial deployments.

## Avoid setting aside spectrum for verticals in priority bands

There is ongoing debate as to what approach to 5G spectrum licensing yields the most innovative networks and applications, and whether spectrum should be set aside for industry verticals. The concern is that setting aside 5G spectrum in key bands could mean that a valuable resource goes unused in many areas, limiting the amount of spectrum available for public 5G services, with a direct impact on speeds, coverage and cost.

More widely, set-asides for restricted use cases and limited coverage areas could also lead to inefficient spectrum usage, which defeats the fundamental policy objective of spectrum planning. For example, industry verticals are unlikely to use spectrum in priority 5G bands very widely across countries, potentially resulting in unused spectrum assets. Further, it means less spectrum is available for public 5G services, which has a direct impact on speeds, coverage and cost, and creates artificial coverage gaps of sub-optimal 5G performance in areas clashing with set-aside spectrum for verticals.

The GSMA recognises that there are experiments for novel spectrum tools and practices to explore options to cater for increasing appetite from verticals to deploy dedicated networks. These include club licensing and database-oriented tiered sharing, in addition to dedicated spectrum set-asides. National exclusive licensing to mobile operators continues to stand out as the most effective and efficient spectrum assignment mechanism; however, if planned well in advance and in comprehensive consultation with the industry, novel sharing tools could also be explored to complement the exclusive IMT licensing in key and core spectrum for the mobile industry.

Mobile operators continue to be well placed to address concerns by providing dedicated 5G services for verticals, which can benefit from network slicing, small cells and wider geographical coverage. Additionally, operators can leverage their larger and more diverse spectrum assets and largescale deployment experience to build networks more efficiently and effectively. Regulators can also utilise market mechanisms, such as a sunset clause, to mitigate the risk of set-aside spectrum going unused.

## 4.2

# Data protection and cross-border data flows: enabling the digital economy

The adoption of a data protection framework in line with international standards is central to consumer trust in new technologies such as 5G, IoT and AI. It can help to facilitate cross-border data flows, enable the digital economy and cement confidence in international trade while respecting people's privacy and their human rights.

China has embraced key concepts of data protection through a series of specific laws and promulgations that culminated in the adoption of the Cybersecurity Law and the subsequent regulation establishing pre-assessments for cross-border data flows. However, the recent consultation on a draft general data protection law, similar to the EU's GDPR, goes a step further with the creation of individual rights, new legal bases for processing of personal data, new ways to transfer personal data, fines of up to 5% of turnover, and duties to perform data privacy impact assessments and notify the authorities of data breaches.

China places a high value on consumer trust and will minimise data localisation in favour of cross-border data flows, as indicated by the proposed data protection law. This is also indicated by the following: China's signing of the Regional Comprehensive Economic Partnership (RCEP) with 14 other countries in Asia; the conclusion of negotiations for the EU-China Comprehensive Agreement on Investment; and China's vocal support for multilateralism and multi-stakeholder collaboration at a time when rules-based trade has been in decline. Indeed, the RCEP mandates the adoption of data protection laws in line with international standards and prohibits national rules that require a company to have a local presence or to use only local computing facilities.

The adoption of a general data protection law in China would not only satisfy one of the key requirements of the RCEP trade agreement, but would also bring China into greater alignment with international data privacy standards. This resonates with national data protection laws and regional frameworks already adopted around the world, such as the APEC Data Privacy Framework, the ASEAN Personal Data Protection Framework, the African Union Convention on Cybersecurity and Personal Data Protection, and the Council of Europe's Convention 108 on data protection.

These laws forge a common high level of protection with close enforcement cooperation between national authorities so that consumers' data can be protected adequately even when it is transferred to another country. This allows data to flow with resulting benefits for the digital economy and society. Agreements can also be reached between entire regions or between specific countries and a region, if they share the same high standard of data protection. The mutual data protection adequacy agreement between the EU and Japan, for example, which accompanied the trade deal between them, created the single largest economic area to date in which personal data can flow freely.

However, such aspirations to open up trade and facilitate data flows could be undermined by strong national security concerns and practices that may conflict with data protection principles and could create tensions in many countries. Governments will therefore need to balance these competing priorities very carefully. The adoption of a general data protection framework in China that protects people's privacy and facilitates cross-border data flows, combined with China's commitment to open up trade and minimise data localisation, is an important step towards enabling the digital (and real) economy in China, the wider region and beyond.

Greater intra-regional and inter-regional alignment of data protection laws and a greater variety of mechanisms to facilitate cross-border data flows can boost the benefits expected from 5G, IoT and AI. Conversely, data localisation or data sovereignty requirements to keep certain data in-country or to use local facilities can significantly hamper any such gains. This is particularly true for the proliferation of innovative IoT and industrial solutions that are critical to industrial digital transformation, which is being expedited by the pandemic.

Mobile operators and other players in the IoT ecosystem need common business models and technologies that can work anywhere in the world and regulatory frameworks that allow data to flow across borders to enable greater efficiencies and economies of scale. While the application of IoT business models, such as using data from sensors to provide new solutions and services, can lead to further gains for local businesses, these domestic gains can be improved by enhanced trade and investment across borders. Similarly, big data analytics and AI implementations depend heavily on the availability of data. While these may work within a country, particularly one the size of China, restricting the available sources of data may reduce diversity in the data and the value of insights learned from the data for greater regional economic growth.

The GSMA has conducted evidence-based research that suggests that over half of the benefits from IoT would be lost if a country decided to implement localisation restrictions. Specifically, data localisation requirements can:

- increase business costs through the need to duplicate expensive IT infrastructure, such as data centres
- cut business efficiencies and competitive advantages by imposing restrictions on cross-border data flows that hamper ICT companies and mobile operators, especially multinational operators, as they introduce new and better services across their footprint
- reduce choice for businesses, communities and individuals, who will have access to more limited and lower-quality apps and services delivered from a smaller pool of domestic providers.

In effect, data localisation requirements can weaken the business case for adopting IoT, even for the most profitable multinationals. Furthermore, increased costs from data localisation requirements can result in suppressed economic activity across the entire economy, with negative impacts not just in GDP growth, but also trade flows, employment and investment.

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