The Mobile Economy China 2020

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Executive Summary

China cements its position as a global leader in 5G

2019 was a pivotal year for the Chinese mobile industry. The country was one of the first globally to launch 5G services. With operators and enterprises forging ahead in the development of 5G services, and growing consumer excitement, China has cemented its position as a global leader in 5G.

- **Operators:** Across China, as well as globally, operators are increasingly seeking ways to boost revenue and cut costs in a low-growth environment. They are therefore exploring ways to evolve their networks to meet the demands of the 5G era, with Asian operators focussing on indoor 5G coverage, RAN automation, and transport network and security upgrades. Meanwhile, Chinese operators are leading on growth beyond core services, with non-telecoms services – both for consumers and enterprises – growing at 30% year-on-year in local currency (compared to less than 10% for most other major operators).
- **Enterprises:** Globally, the key benefits of 5G other than speed gains (e.g. network slicing, edge computing and low-latency services) are not widely appreciated, with many companies believing 4G is 'good enough'. But China is a clear exception. Early partnerships and trials from local operators have paid dividends, as evidenced by the widespread intent among companies in the country's industrial sector to utilise 5G. Chinese operators are also leading the charge for standalone (SA) 5G, which will help deliver the key benefits of 5G for enterprises.
- **Consumers:** Awareness and knowledge of 5G are rising as hype makes way for reality. Chinese consumers are among the most excited by the prospect of 5G. They are generally more optimistic than other markets about the benefits of 5G, with greater expectations of lower service costs, innovative services and new connected devices. In addition, consumers in China are likely earlier adopters of 5G (versus the US, Japan and Europe) and seem the most willing to pay more for 5G services – a key driver of potential 5G consumer revenue uplift.

4G dominates, but 5G will ramp up quickly

4G is by far the dominant mobile technology across China, accounting for more than 80% of total connections (excluding licensed cellular IoT). However, 4G's share will peak in 2020 (at 82%) as 5G grows significantly.

Several 5G smartphones have been launched, many by local OEMs, and Chinese consumers are among the most keen to upgrade to 5G. As a result, China will account for 70% of global 5G connections in 2020, and 5G adoption will grow to just under 50% by 2025, placing the country among the leading nations along with South Korea, Japan and the US. To support this generational shift and drive consumer engagement, Chinese operators are expected to invest more than $180 billion between 2020 and 2025 in mobile capex, roughly 90% of which will be on 5G networks.

Despite some financial headwinds – including market saturation, increasing competition and the country's 'speed upgrade and tariff reduction' policy – China's mobile revenue remains stable. Financials will recover in 2020 and 2021, and revenue will rise steadily at around 1% per year to 2025, largely because of growing revenues in enterprise IoT and new 5G services.

Growth is limited, as it is in all advanced markets

By the end of 2019, 1.2 billion people subscribed to mobile services across China. This accounts for 82% of the region's population and places China among the world's most developed markets. As with all advanced markets, adding new subscribers is increasingly difficult, with the cost of reaching rural populations hard to justify against a challenging financial backdrop for operators. Despite this, there will be around 60 million new subscribers by 2025.

Since 2012, the number of people subscribing to the mobile internet across China has doubled to more than 900 million. By 2025, nearly 260 million people will start using the mobile internet for the very first time, almost halving the unconnected proportion of the population to 22%.

The benefits of mobile are reaching further than ever

With high levels of connectivity, individuals are increasingly using mobile to access an array of life-enhancing services that contribute to and catalyse the achievement of the UN Sustainable Development Goals (SDGs). In addition, the mobile industry is playing a key role in mitigating the catastrophic impacts of climate change, which threaten sustainable development everywhere. However, much more can be done to leverage the power of mobile and support the delivery of the SDG 2030 targets. This includes helping people realise the full benefits of accessing health information, public services and digital payments, and leveraging new technologies to reduce pollution, improve resilience to climate change and increase energy efficiency.

Meanwhile, mobile continues to make a significant contribution to the Chinese economy. In 2019, mobile technologies and services generated $759 billion of economic value added (5.4% of GDP) across China. This figure will surpass $900 billion by 2024 as the region increasingly benefits from the improvements in productivity and efficiency brought about by the increased take-up of mobile services.

Policies to enable China's 5G future

The success of 5G heavily relies on government support for timely access to the right amount and type of affordable spectrum, and under the right conditions. 5G will need a comprehensive range of spectrum across sub-1 GHz, 1–6 GHz and above 6 GHz to satisfy the requirements of 5G services in the future. The lower- and mid-frequency ranges are key to improving 5G coverage, speed and latency compared to 4G, while spectrum above 24 GHz – mmWave spectrum – will be a critical component to enable super high speeds and ultra-low-latency applications.

Since mmWave spectrum will play a vital role in the future success of 5G in China, particularly in the manufacturing sector, the GSMA recommends the following policy considerations:

- Continue to provide policy incentives by reducing frequency utilisation fees for mmWave spectrum similar to those for the 2.6, 3.4–3.6 and 4.8–5.0 GHz bands.
- Allocate large and contiguous blocks of spectrum in the mmWave bands where possible – around 1 GHz per operator.
- Avoid setting aside spectrum for verticals in priority mmWave bands (e.g. 26 and 40 GHz). Sharing approaches such as leasing are better options where verticals require access to spectrum.

Mobile Economy China

UNIQUE MOBILE SUBSCRIBERS

2019-2025 CAGR: 0.8%

2019	2025
1.20bn	1.26bn
82%	85%

Penetration Rate (% of population)

MOBILE INTERNET USERS

2019-2025 CAGR: 4.3%

2019	2025
0.91bn	1.17bn
62%	78%

Penetration Rate (% of population)

SIM CONNECTIONS

Excluding licensed cellular IoT

2019-2025 CAGR: 0.8%

2019	2025
1.65bn	1.73bn
113%	116%

Penetration Rate (% of population)

OPERATOR REVENUES AND INVESTMENT

2019	2025
RMB1.21tn	RMB1.29tn

Operator capex of RMB1.29tn for the period 2020–2025 (90% on 5G)

INTERNET OF THINGS

2019: 3.63bn

2025: **8.01bn**

Total connections

SMARTPHONES

% of connections

Excluding licensed cellular IoT

2019: 72%

2025: 89%

4G

2019: 81%

2025: 53%

% of connections Excluding licensed cellular IoT

5G

2019: 5m (0.3%)

2025: **807m** (47%)

% of total connections Excluding licensed cellular IoT

MOBILE INDUSTRY CONTRIBUTION TO GDP

2019: RMB5.34tn — 5.4% of GDP

2024: **RMB6.38tn** — 4.9% of GDP

PUBLIC FUNDING

2019

RMB611bn

Mobile ecosystem contribution to public funding

(before regulatory and spectrum fees)

EMPLOYMENT

2019

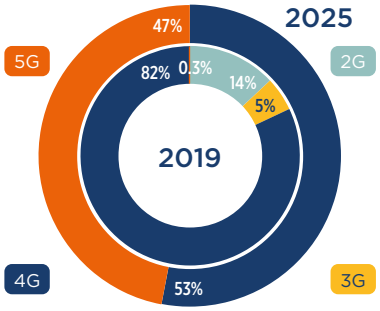
2.8m

Jobs directly supported by the mobile ecosystem

+3.7m indirect jobs

Mainland China

TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2019 — 2025

82% 84%

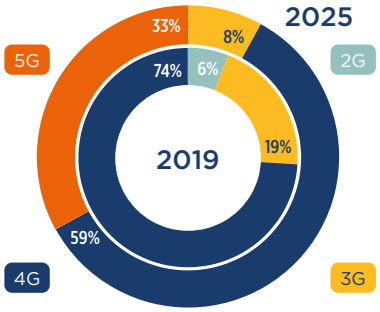
SMARTPHONE ADOPTION

2019 — 2025

71% 89%

Hong Kong, SAR China

TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2019 — 2025

89% 89%

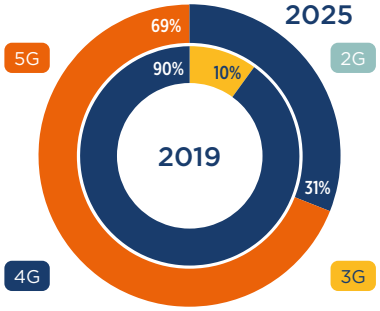
SMARTPHONE ADOPTION

2019 — 2025

78% 89%

Macao, SAR China

TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2019 — 2025

88% 88%

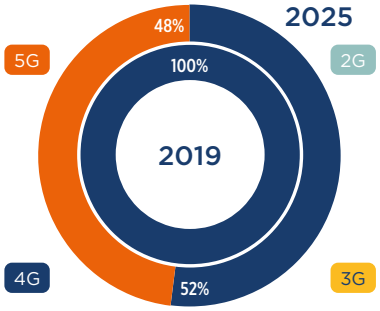
SMARTPHONE ADOPTION

2019 — 2025

84% 89%

Taiwan, Province of China

TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2019 — 2025

90% 92%

SMARTPHONE ADOPTION

2019 — 2025

79% 88%

*Percentage of total connections

01

The mobile market in numbers

1.1
Growth is limited: 60 million new subscribers by 2025

Figure 1

Source: GSMA Intelligence

Little growth remaining in an increasingly saturated market

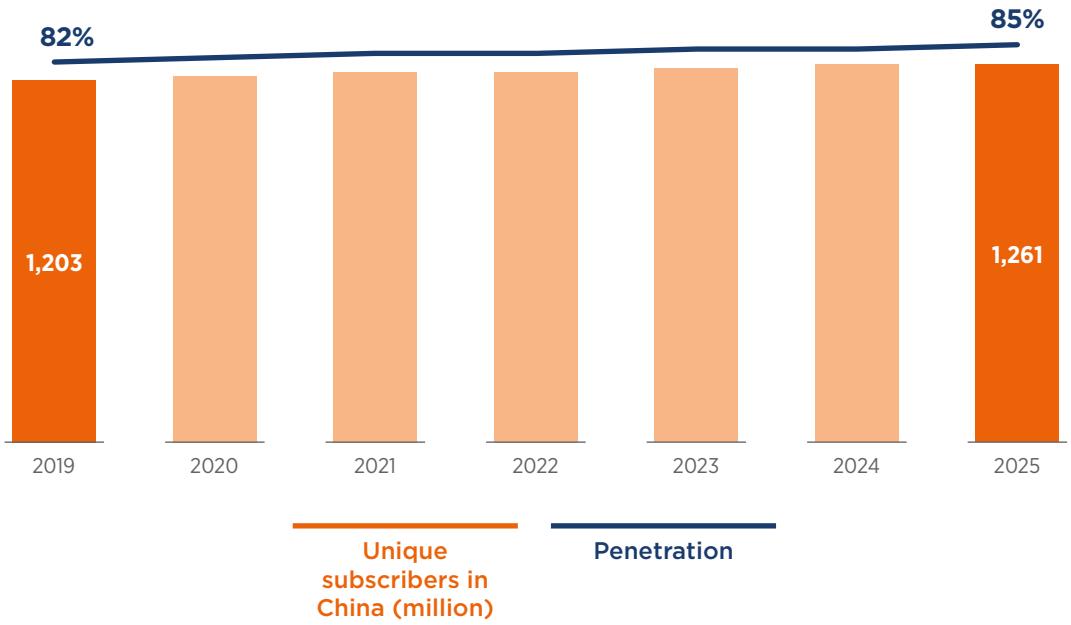
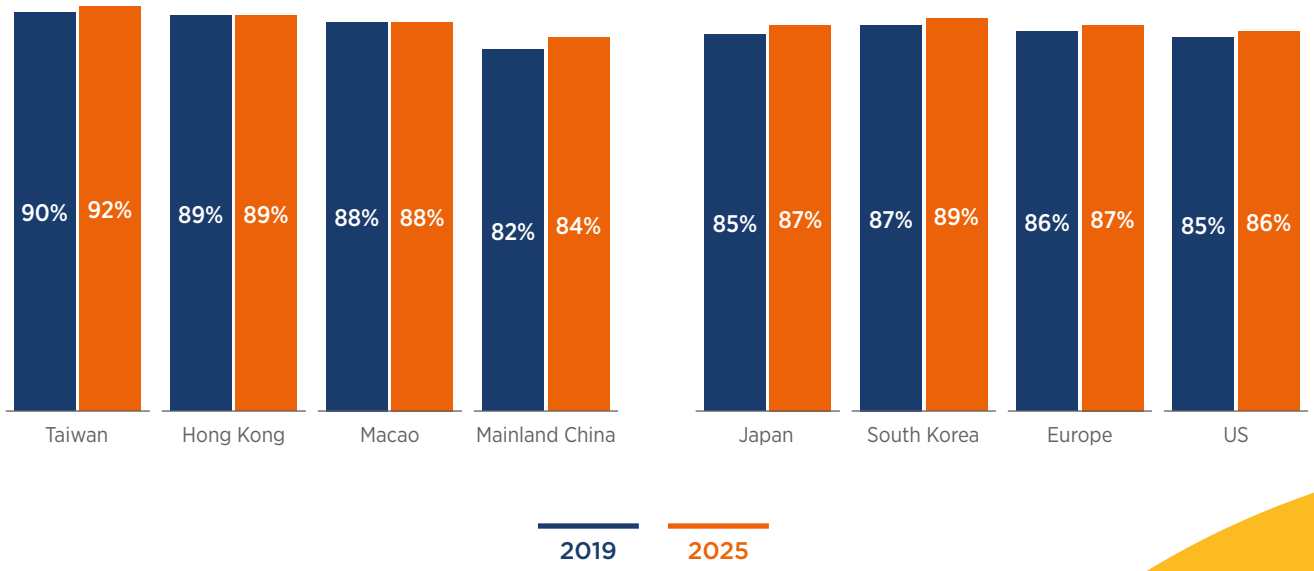


Figure 2

Source: GSMA Intelligence

High unique mobile subscriber penetration places China among the world's most developed markets

% population



1.2
China to dominate the global 5G stage

Figure 3

Source: GSMA Intelligence

4G dominates, but 5G will ramp up quickly: 70% of global 5G connections in 2020 will come from China

% connections in China (excluding licensed cellular IoT)

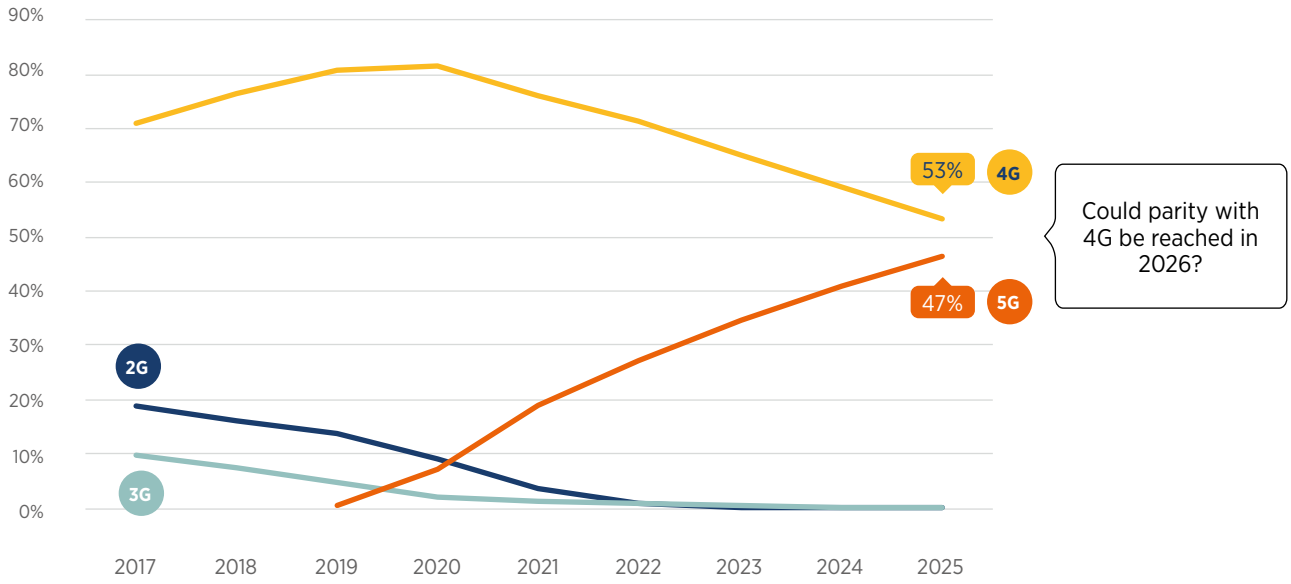


Figure 4

Source: GSMA Intelligence

Along with other north-east Asian markets and the US, China will lead the rest of the world in terms of 5G adoption

5G adoption in 2025 (% total mobile connections)

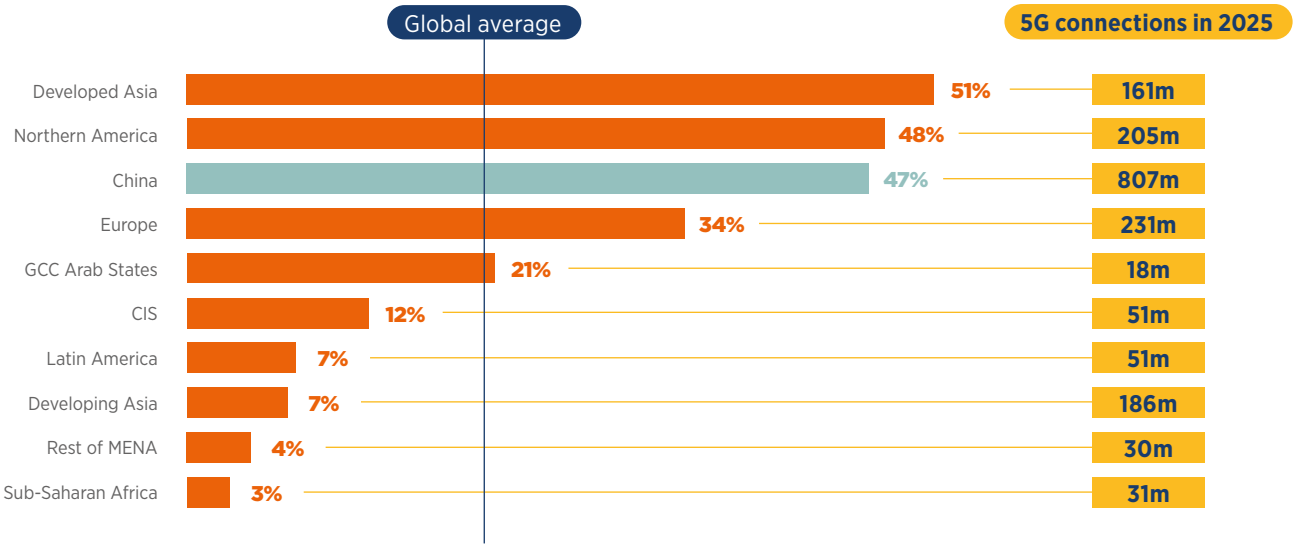
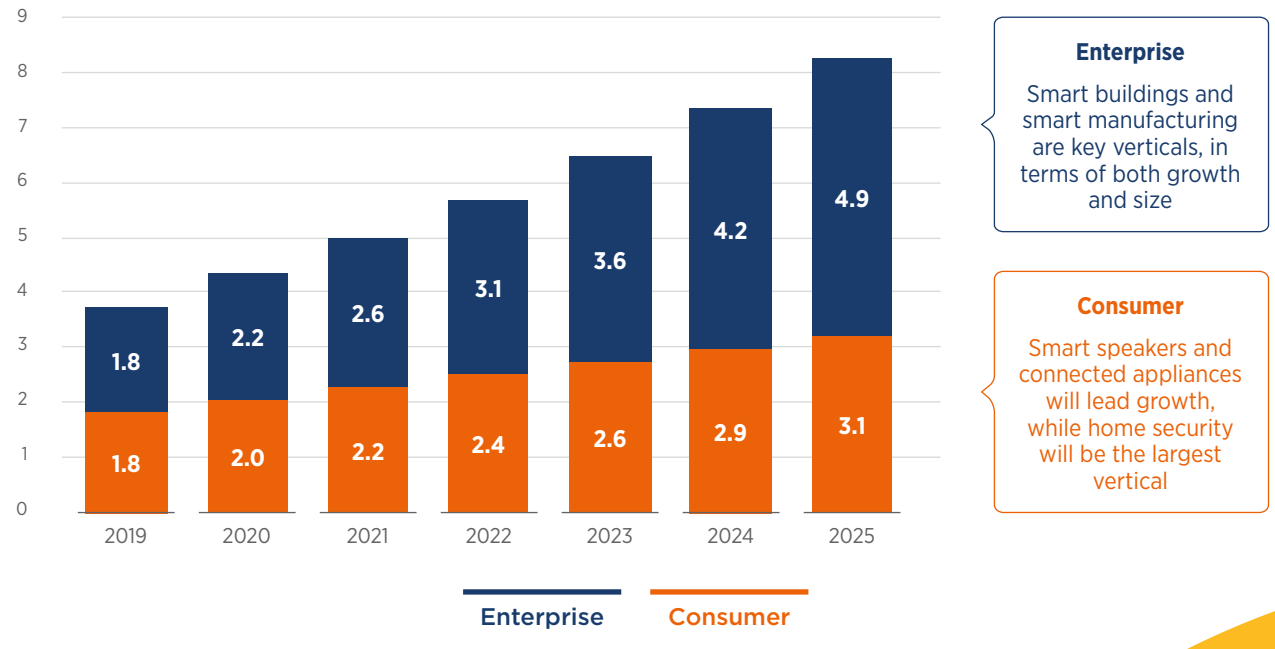


Figure 5

Source: GSMA Intelligence

IoT connections will more than double across China by 2025 to reach 8 billion; most of the growth will come from enterprise

Billion



1.3
Financials to recover in 2020 and 2021, with modest growth to 2025

Figure 6

Source: GSMA Intelligence

Total mobile revenues dropped to $171 billion in 2019, due to market saturation, increasing competition and the country's 'speed upgrade and tariff reduction' policy

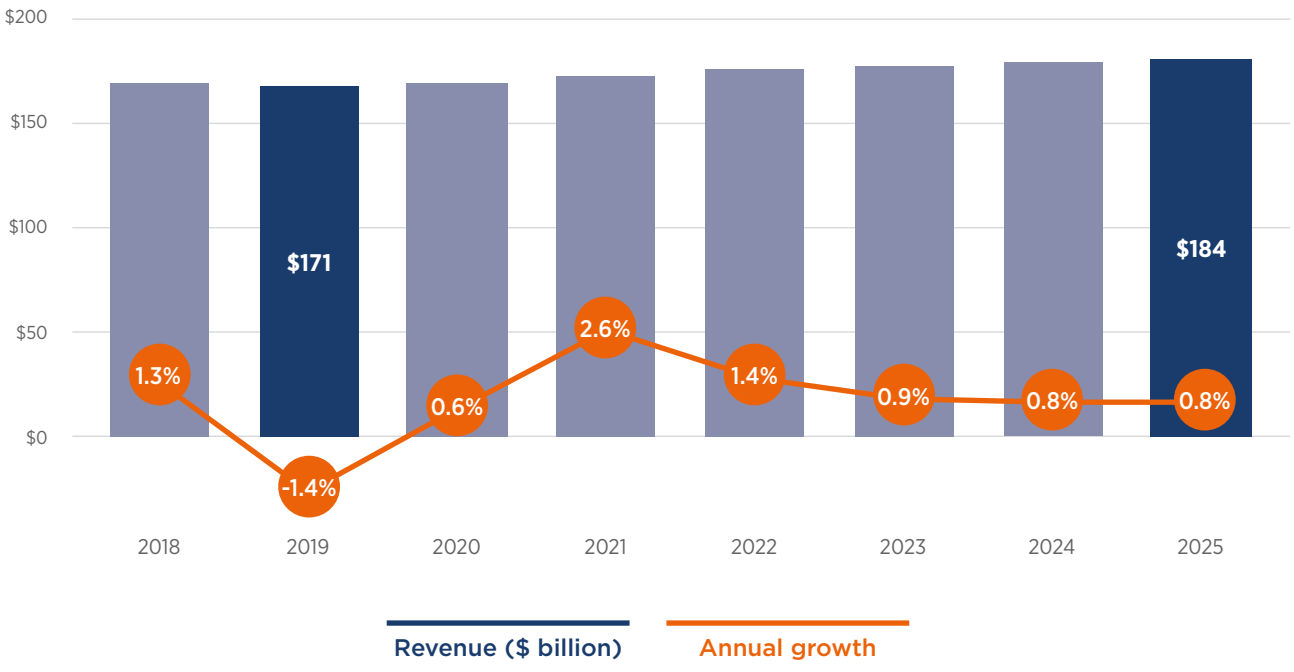
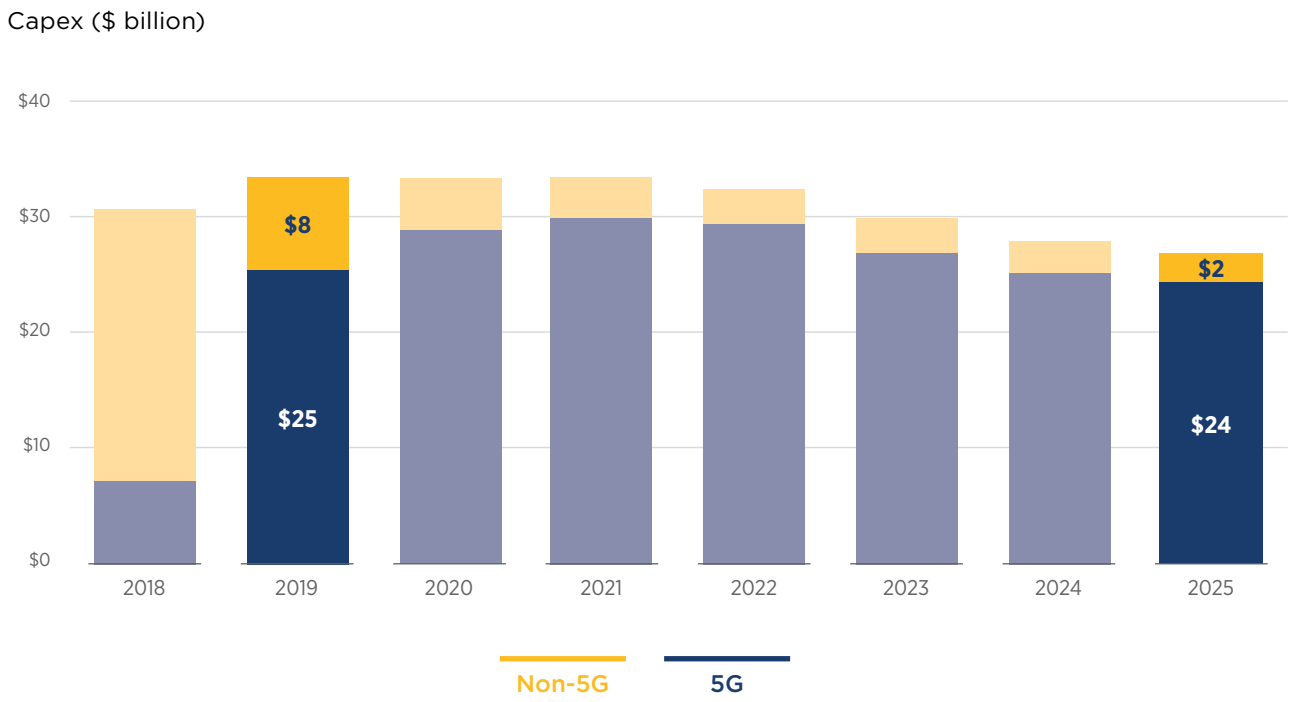


Figure 7

Source: GSMA Intelligence

Chinese operators will invest more than $160 billion in their 5G networks between 2020 and 2025; 90% of their total capex and 19% of global 5G capex



02

Key trends shaping the mobile industry

2.1
A 5G reality check: learnings one year on

Enterprises are taking tentative steps into the 5G era

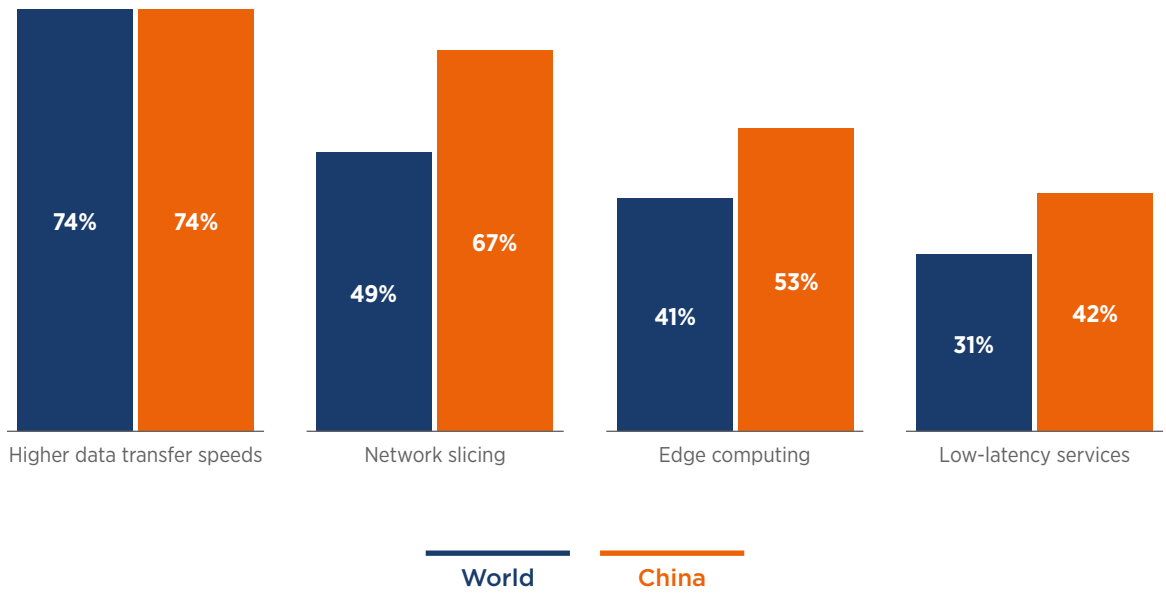
Companies across a range of verticals (such as manufacturing, power generation and aerospace) are evaluating their options for digitising product assembly and general operations management. This presents an opportunity for operators that can offer 5G with complementary infrastructure for low-latency services (such as data centres close to the edge) and analytics. However, while a majority of enterprises recognise the benefits of speed gains brought about by 5G, other improvements (such as network slicing, edge computing and low-latency services) are not widely appreciated, with many believing 4G is 'good enough'. China is a clear exception in this regard: early partnerships and trials from local operators have paid dividends, as evidenced by the widespread intent among companies in the country's industrial sector to use 5G.

Source: GSMA Intelligence IoT Enterprise Survey Q4 2018

Figure 8

Enterprise verticals are the real opportunity for 5G, with China racing ahead in this area

Which of the following 5G capabilities would make it compelling for your organisation to use 5G for future IoT deployments?
% of respondents, multiple answers possible



Consumers are increasingly aware of the benefits of 5G, but will they pay for it?

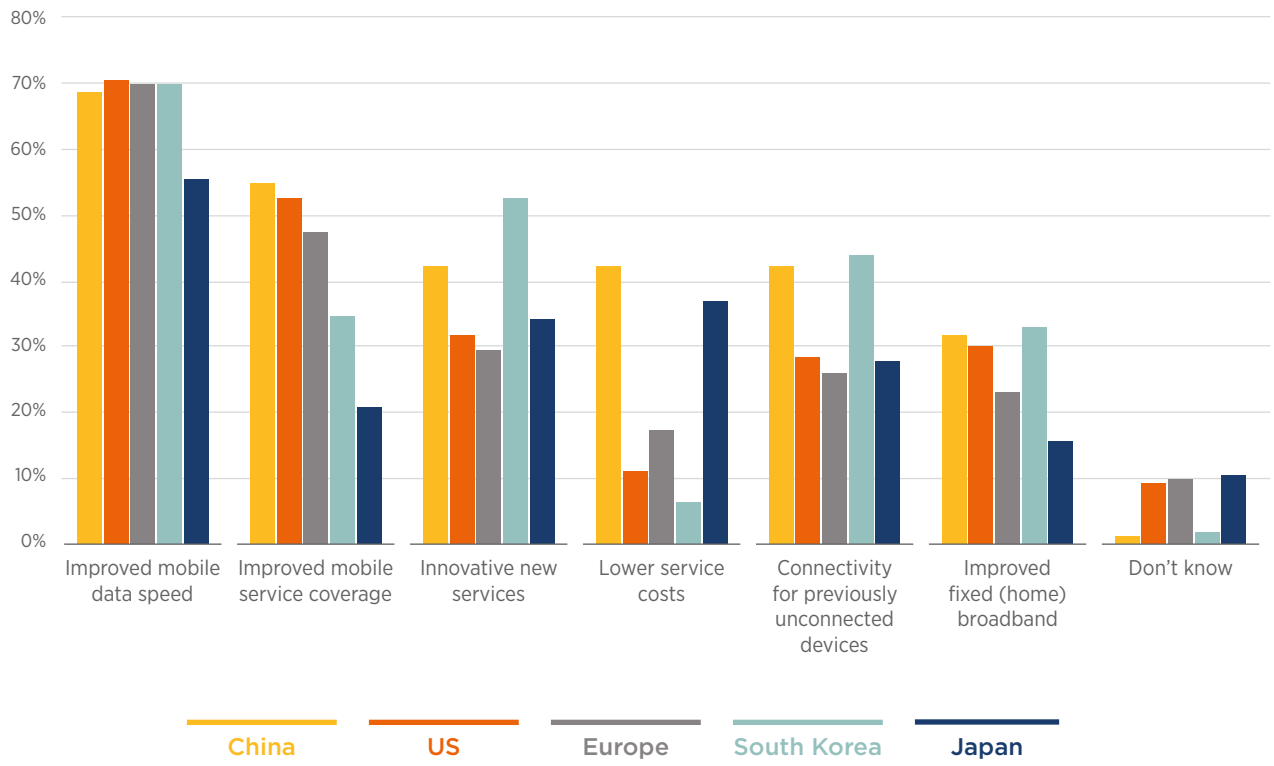
China was one of the first markets globally to launch 5G services, and consumer interest was high: the country's three mobile operators received more than 10 million registrations of interest for pre-orders of 5G packages and smartphones prior to launch. While not all of these have translated into actual connections (5G connections approached 5 million across China by the end of 2019), consumers in China are among the most excited by the prospect of 5G – more so than those in the US and Europe. 5G is still in its infancy though; as more tangible use cases are deployed, more consumers will appreciate the benefits of 5G.

Source: GSMA Intelligence Consumer Insights Survey 2019

Figure 9

Chinese consumers are more optimistic about the benefits of 5G than other markets, with greater expectations of lower service costs, innovative services and new connected devices

Question: "From what you know of 5G, what do you expect it will deliver?"
% respondents who have heard of 5G



Source: GSMA Intelligence Consumer Insights Survey 2019

Figure 10

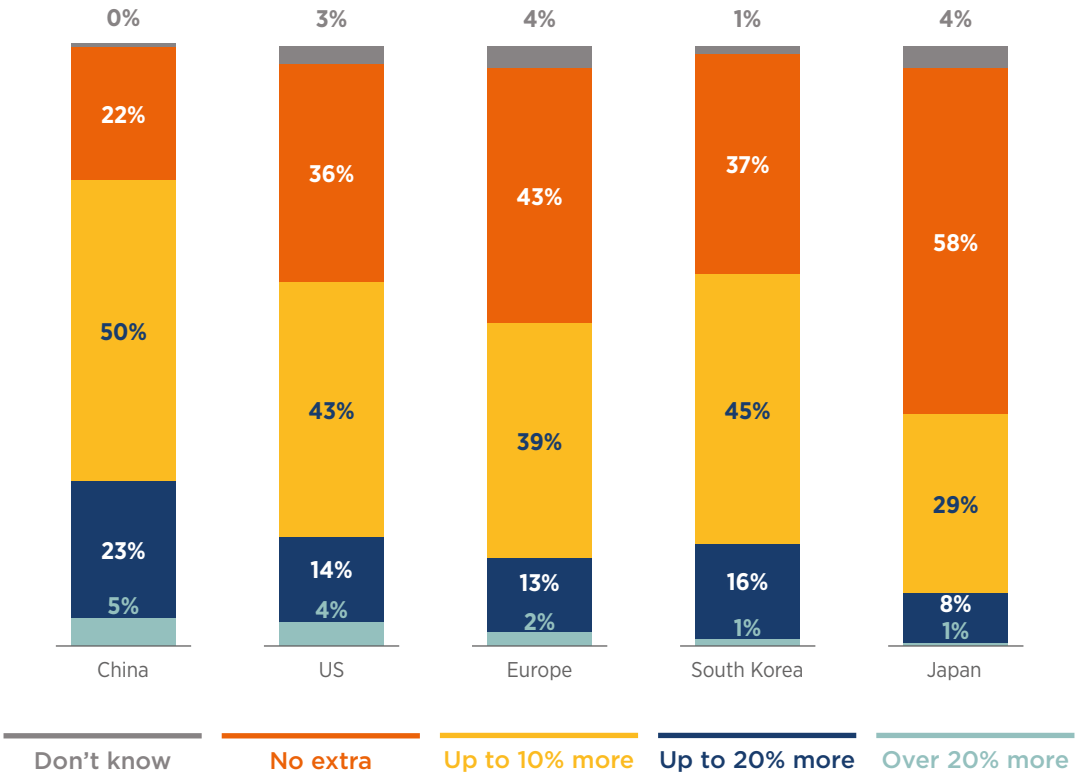
Consumers in China are likely early adopters, whereas demand is more muted in the US, Europe and Japan

Source: GSMA Intelligence Consumer Insights Survey 2019

Figure 11

Almost 80% of Chinese consumers who plan to upgrade to 5G are willing to pay more for it than they currently do for 4G – the highest percentage globally

Question: "How much extra would you be willing to pay for 5G?"
% respondents who intend to upgrade to 5G

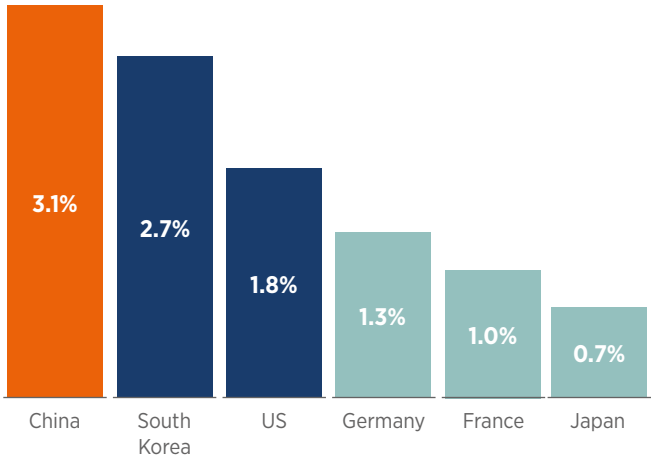


Source: GSMA Intelligence

Figure 12

China and South Korea lead in potential 5G consumer revenue uplift

Overall service revenue uplift from 5G (%)



Note: see Uncovering the impact of 5G on mobile revenue GSMA Intelligence, 2019 for more information and details on methodology.

- The projection for China is driven by a populace eager to upgrade to 5G (70%) and willing to pay more for it.
- Upgrade intentions in South Korea (as in the US) are slightly weaker comparatively, but consumers appear willing to pay for faster service.
- Expectations are more tempered in Europe and Japan, where only around 20% of people intend to upgrade from 4G. In Japan, this should rise in 2020 as marketing intensifies ahead of the 2020 Summer Olympic Games in Tokyo. In Europe, consumers are content with 4G speeds and reluctant to increase spend amid weak economic conditions across the EU.

2.2 The telco of the future

As we enter the 5G era, network innovation has never been greater. Over the last decade, the mobile network model has trended away from asset ownership to infrastructure sharing, in an effort to cut costs in a low-growth environment. 5G further complicates matters, bringing new ways of operating a network with or without licensed spectrum.

The 'unbundled' network breaks down entry barriers, which for operators means the following:

- infrastructure competition becomes harder, not easier
- capex will need to be spent more selectively, particularly for small cells
- 'frenemy'-style partnerships with adjacent sector competitors become the norm rather than the exception.

The implications are clear: operators need to evolve their networks to meet the demands of the 5G era and diversify their revenue streams to seek growth beyond core telco services.

Network transformation for the 5G era

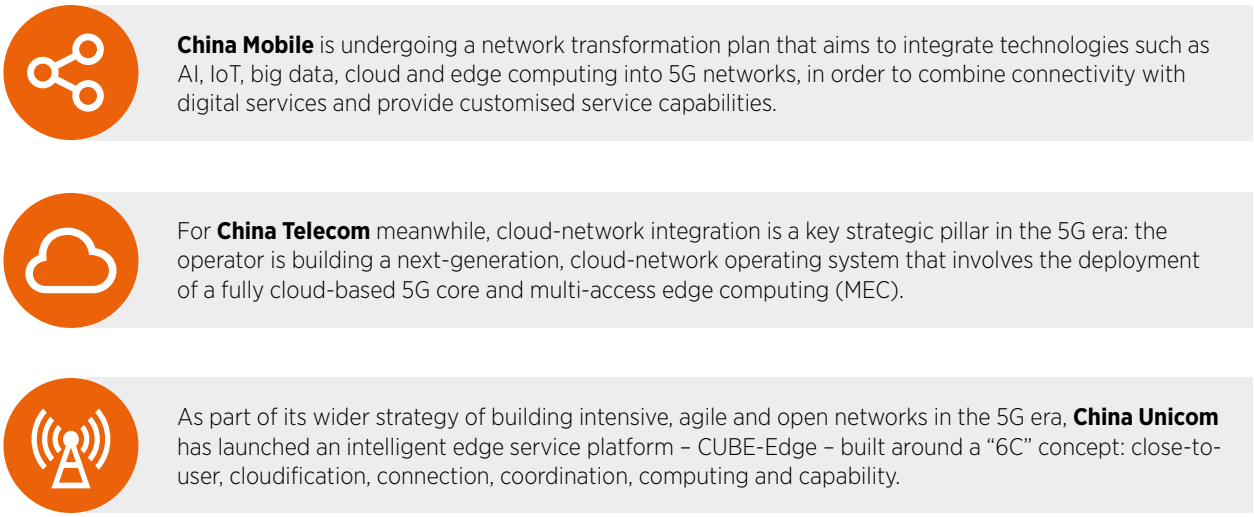
With the commercialisation of 5G and the introduction of mobile network innovations such as virtual RAN, edge networking and network automation, operators' decisions on network transformation strategies are more important than ever. Such decision-making is key to operators, their network infrastructure suppliers and the customers who will rely on the networks of tomorrow.

While this section reviews network transformation strategies from a global perspective, Chinese operators are surging ahead with their network transformation, as highlighted in Figure 13.

Source: GSMA Intelligence

Figure 13

Chinese operators have grand ambitions for their networks

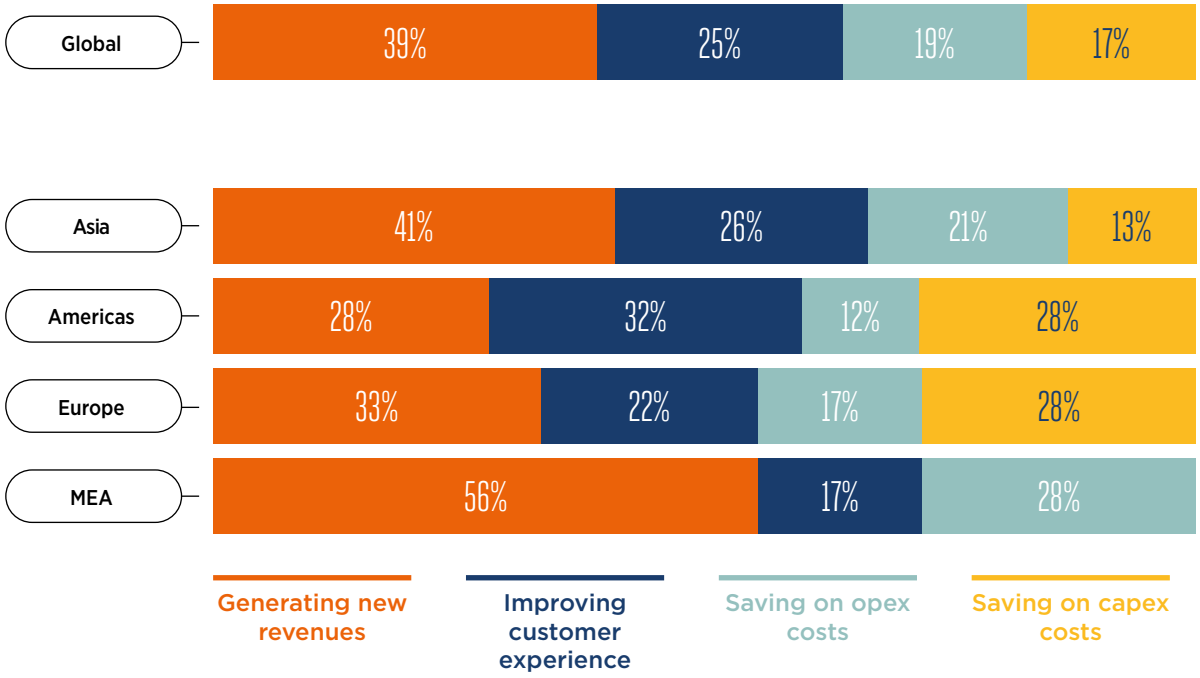


Source: GSMA Intelligence Network Transformation Survey 2019

Figure 14

Revenue generation and customer experience prioritised over cost-cutting as the primary stimulus for network transformation

What is the primary goal driving your network transformation strategy?
% of respondents



Source: GSMA Intelligence Network Transformation Survey 2019

Figure 15

Supporting new customers and network architectures are top priorities for RAN investments, while backhaul and virtualisation upgrades are crucial for the core network

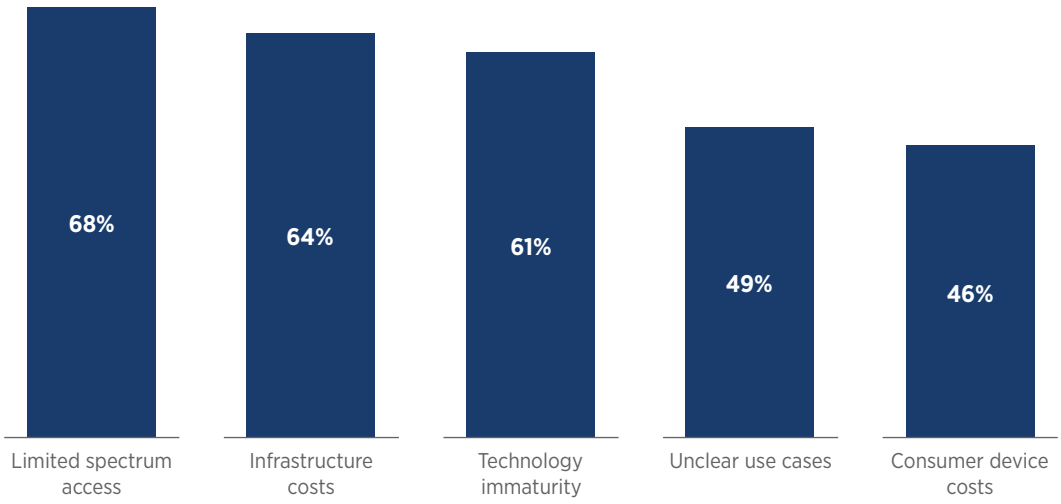
	Top ranked priorities for 5G investment	
	RAN	**Core**
Asia	1. In-building 5G coverage	1. Transport network upgrades
	2. RAN automation and planning tools	2. Network security upgrades
	3. New spectrum allocations	3. Virtualisation investments
Americas	1. In-building 5G coverage	1. Service core (IMS etc.) upgrades
	2. Network densification	2. NG core (service-based architecture) upgrades
	3. mmWave deployment	3. Transport network upgrades Edge computing
Europe	1. RAN automation and planning tools	1. Virtualisation investments
	2. Virtual RAN/OpenRAN	2. Service core (IMS etc.) upgrades
	3. New spectrum allocations	3. Network security upgrades
MEA	1. Virtual RAN/OpenRAN	1. Network security upgrades
	2. New spectrum allocations	2. Virtualisation investments
	3. In-building 5G coverage	3. Transport network upgrades

Source: GSMA Intelligence Network Transformation Survey 2019

Figure 16

Spectrum is the top concern for operators in the 5G era; cost and technology maturity barriers should resolve themselves over time, while use cases are becoming clearer

What is the greatest barrier to increasing your planned network investment in 5G?
% of respondents, multiple responses possible



The search for revenue beyond the core

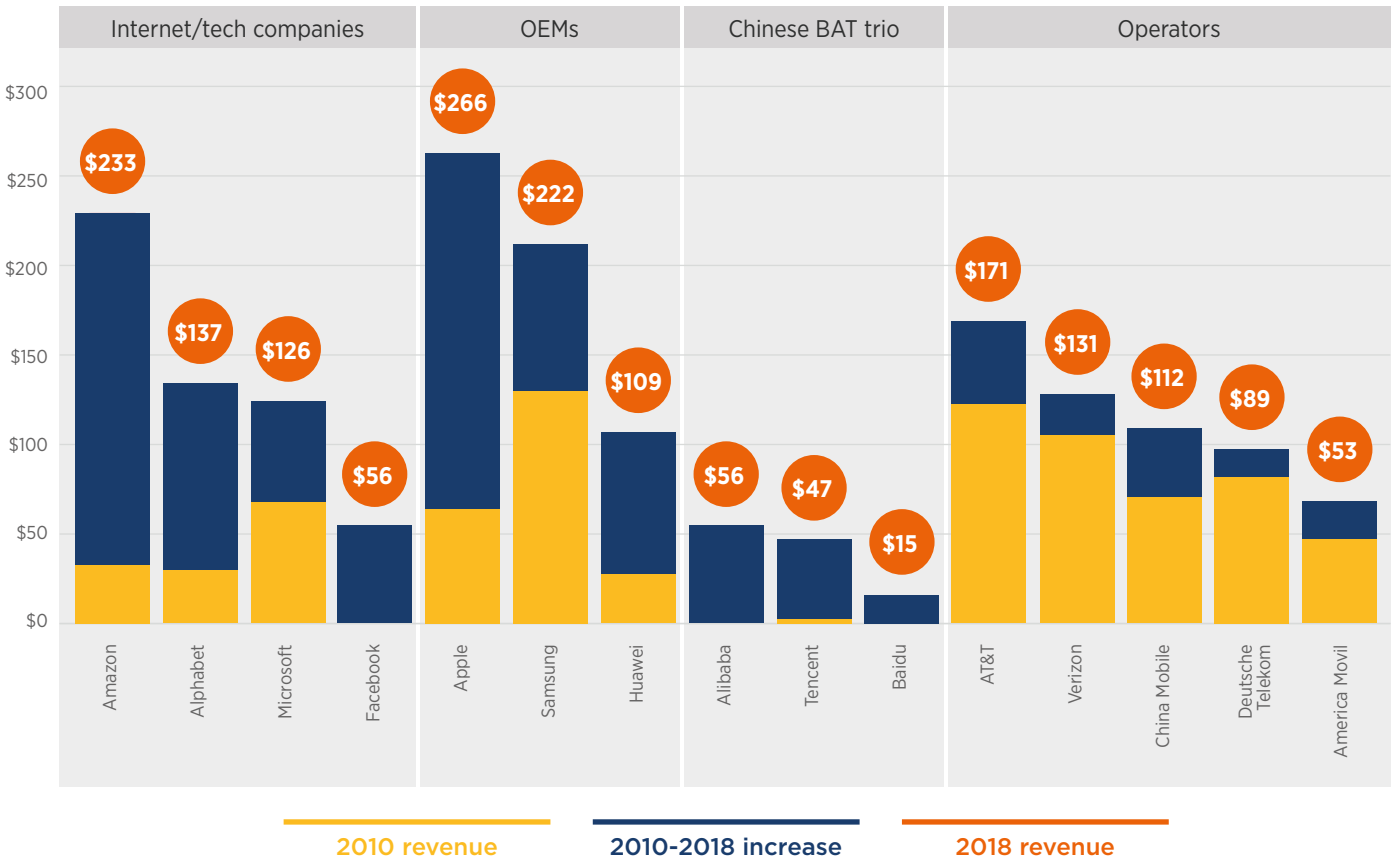
Over the last 10 years, the rise of the digital era (signified by the launch of 4G, growth of smartphone adoption and emergence of digital services) has allowed many companies in the wider tech and digital universes to reap the benefits of an expanding digital ecosystem. However, the pace and magnitude of revenue growth has varied significantly. Apple, Amazon and Alphabet each added $100–200 billion in revenue between 2010 and 2018, while Facebook, Alibaba and Tencent have reached considerable scale, with revenues now at around $50 billion. Meanwhile, mobile operators, which had their revenue boom in the previous decade, have experienced lower revenue increases since 2010.

Source: company reports, GSMA Intelligence

Figure 17

Operators have struggled to compete with the internet/tech giants in terms of revenue growth in the digital era

Revenue (billion)



Note: Annual figures based on fiscal year reporting periods. Revenue increase at 2018 constant forex.

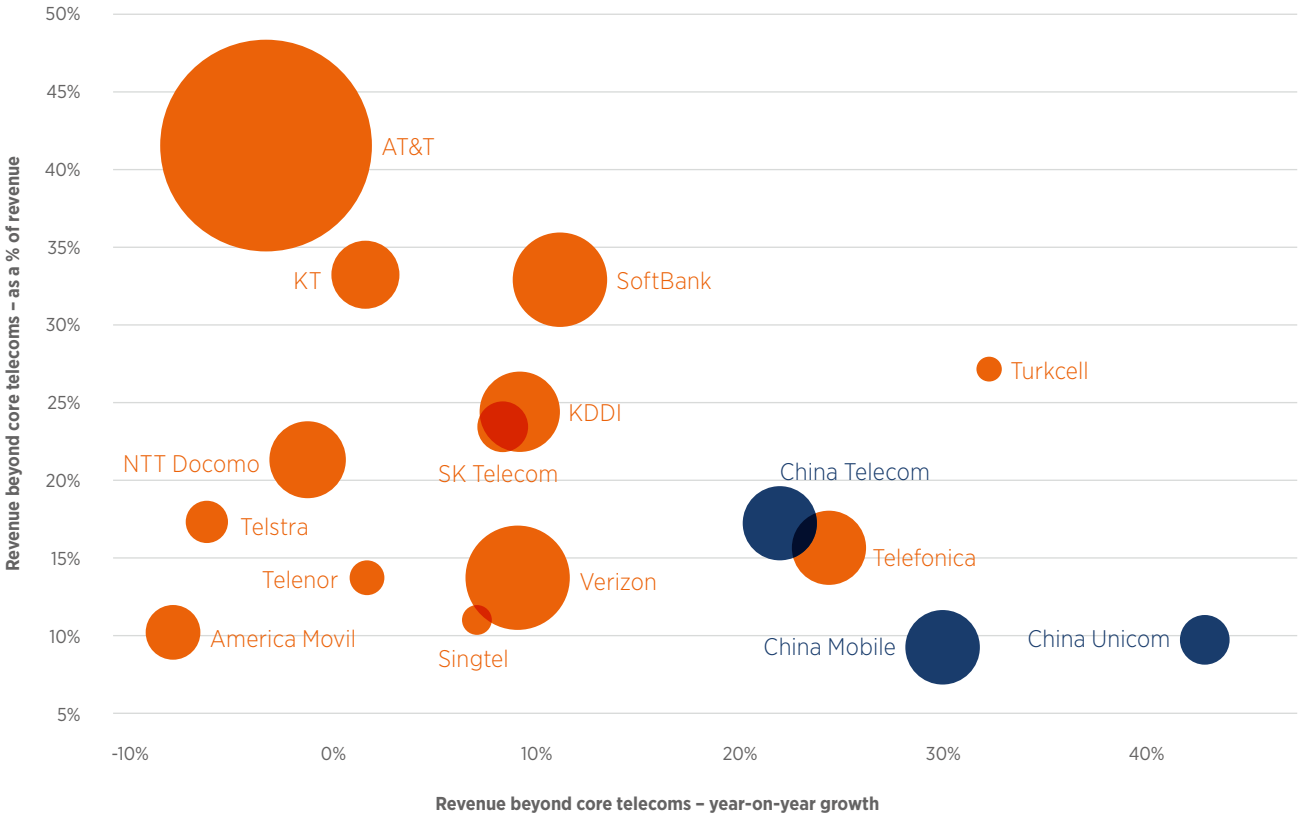
For most major operator groups around the world, core mobile and fixed services account for 80–90% of revenue, with non-telecoms at 10–20%. A few exceptions exist, namely AT&T and SoftBank (non-telecoms at around 40% and 30% respectively) but these are the result of M&A rather than organic growth.

China, meanwhile, leads on growth beyond core. Non-telecoms services – both for consumers and enterprises – generated a total of RMB144 billion ($22 billion) in revenue for the three Chinese operators (in aggregate) in 2018, growing around 30% year-on-year in local currency. This includes pay TV, content and advertising, IoT, enterprise solutions and the broader universe of digital services including finance, payments and lifestyle. China Mobile, China Telecom and China Unicom are betting on the digital transformation of industries and enterprises to grow their future revenues beyond connectivity.

Source: company reports and GSMA Intelligence

Figure 18

China leads on revenue growth beyond traditional telecoms services



Annual figures based on fiscal year
Bubble size reflects 2018 non-telecoms services revenue

2.3
Edge computing: China at the forefront of global developments

Edge computing is moving from concept to early-stage deployments as new use cases demand a more decentralised approach to computing and networking than a traditional, fully cloud-based model. Driven by the government's ambition to make China a global leader of new technologies and Industry 4.0, the country's ecosystem is looking to spearhead the development of edge computing. For more information, see the GSMA report *Edge computing in the 5G era: Technology and market developments in China.*

Figure 19

Source: GSMA Intelligence

A confluence of factors places China in a unique position to play a leading role in global edge computing development

China has made 5G a national priority

- 5G is the access technology that will drive edge deployments and use cases, and China will have the largest consumer market for 5G in the world: more than 800 million 5G connections by 2025.
- The three Chinese operators are demonstrating a clear commitment to rolling out standalone (SA) 5G networks, which offer a favourable environment for the deployment of edge computing technologies. China Telecom, for example, is leading the drafting of 5G standalone (SA) implementation guidelines.

Leadership role in new technologies and Industry 4.0

- Over the last few years, China has emerged as a leading place for testing and implementing new technologies, including early edge computing applications.
- Benefitting from the largest digital consumer base in the world, competitive costs, a large industrial sector and enormous economies of scale, the Chinese ecosystem is ramping up its technology leadership and innovation, giving rise to a large number of start-ups and innovative companies in mobile and beyond.

A diverse and highly active ecosystem driving edge development

- Many China-based companies are exploring opportunities for new services and solutions at the edge, including the three mobile network operators, major network vendors (Huawei and ZTE), smaller ICT companies, cloud and edge specialists, and enterprises from industry verticals.
- Ecosystem cooperation is also growing, driven by the work of local organisations such as the Edge Computing Consortium (ECC), the China Academy of Information and Communications Technology (CAICT), the China Communications Standards Association (CCSA) and the 5G Deterministic Network Alliance (5G DNA).

Operator intent to move beyond connectivity

- China leads on operator revenue growth beyond core telecoms services.
- All three operators are betting on the digital transformation of industries and enterprises to grow their future revenues beyond connectivity, positioning the integration of core networks, cloud and edge as a key technology enabler for companies looking to digitise their operations and services.

Figure 20

Source: GSMA Intelligence

Edge capabilities and key use cases in China: autonomous driving, smart manufacturing and gaming will lead the way

Source: GSMA Intelligence

Figure 21

Most industry players see edge computing as an opportunity to generate incremental revenue in the 5G era – but with different perspectives

Operators

- Edge computing plays into 5G's strengths, adding extra capabilities to the digital transformation of industries and enterprises, and pushing the boundaries beyond connectivity.
- Operators have a smaller presence in the cloud market than Alibaba and Tencent, so extracting new use cases from network slicing and the integration of cloud, edge and core telecoms networks offers more promise.
- Opening up the 5G network itself to third-party developers is another opportunity, with the aim of catalysing an ecosystem of 5G service development at the edge of the network.

Telecoms network vendors

- As the integration of new technologies such as edge computing and AI into networks grows in scale and complexity, vendors will increasingly be seen as key partners for operators and cloud companies looking to deploy edge computing.
- The challenge for vendors is to design not only truly seamless, end-to-end network transformation solutions, but also to develop a new B2B2B approach (vendor–operator–enterprise) on a larger scale, to help bridge the ICT and vertical industry worlds.

Major cloud providers

- For Alibaba, Tencent and other cloud companies, edge technology is an extension of their cloud capabilities and offerings. These companies have established experience working with Chinese enterprises from all industries, and have extensive cloud resources to build on.
- However, an edge computing ecosystem increasingly built around 5G poses new challenges, taking cloud companies into a new world of distributed computing that involves mobile connectivity and devices on a larger scale, and requires deep edge/cloud orchestration.
- At the same time, cloud providers are looking to leverage and integrate edge computing into their internet-based consumer services, such as cloud gaming.

Source: GSMA Intelligence

Figure 22

Chinese operators will likely deploy edge computing in three phases, reflecting the gradual rollout of 5G networks and the speed of the digitisation of industry

2018–2020	2021–2023	2024 and beyond
Wave 1: Trials and bespoke, small deployments	**Wave 2: Ramp-up**	**Wave 3: Mainstream**
Deployments are mostly private implementations, designed to serve the requirements of smart ports, smart campuses and smart factories, with edge infrastructure largely sited on-premises. Market education is key to bring enterprises on-board. The usefulness of edge computing is not a given; it needs to be proven for each use-case scenario.	As 5G deployments gain scale, edge use cases such as autonomous driving, sporting events and gaming are increasingly explored, with edge infrastructure deployed close to aggregation points of base stations, at district or city level or in regional data centres. The costs of operating a large number of micro data centres mean the cost of running applications is higher in the ramp-up phase when there are fewer tenants to spread computing loads across.	The maturity of 5G, lower cost of 5G devices and more established collaboration between the mobile industry and enterprises drive edge deployments on a larger scale. Further technology developments in autonomous driving and smart manufacturing create a more favourable environment and the need for edge deployments. The economics of edge computing improve as a result of larger scale; upgrades are made to increase efficiency (e.g. nano-processing), and market acceptance grows.

Source: GSMA Intelligence

Figure 23

Much work remains to help drive developments and adoption of edge computing in China over the next five years: recommendations for industry and policymakers

Technology developments	Clarify the most suitable deployment model for edge computing, and drive edge standardisation	Integrate edge computing into the wider 5G network investment roadmap	Address the issue of high energy costs related to cloud/edge computing and, more broadly, 5G networks
Market acceptance	Take industry collaboration to the next level, expanding edge computing discussions with vertical industries	Leverage enterprise awareness of edge computing to promote new trials and deployments	Increase focus on media & entertainment and smart cities
Policy and regulation	Establish clear and focused regulation that recognises the unique nature and challenges of edge computing		

03

Mobile contributing to economic growth and addressing social challenges

3.1
Mobile contribution to economic growth

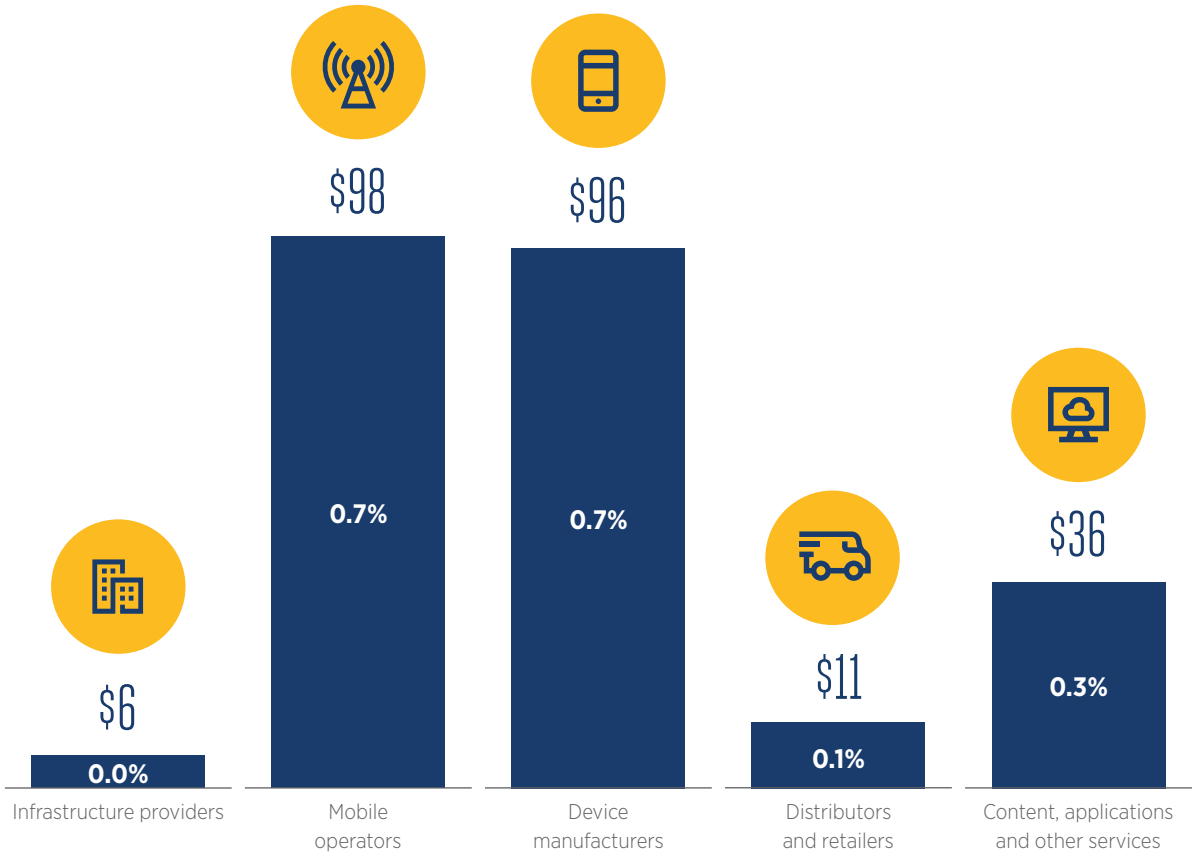
In 2019, mobile technologies and services generated 5.4% of GDP across China – a contribution that amounted to $759 billion of economic value added. The mobile ecosystem also supported 6.6 million jobs (directly and indirectly) and made a substantial contribution to the funding of the public sector, with almost $90 billion raised through general taxation. By 2024, mobile's contribution will surpass $900 billion as the region increasingly benefits from the improvements in productivity and efficiency brought about by the increased take-up of mobile services.

Source: GSMA Intelligence

Figure 24

The Chinese mobile ecosystem directly generated almost $250 billion of economic value in 2019, with mobile operators and device manufacturers accounting for the vast majority

$ billion, % of GDP 2019

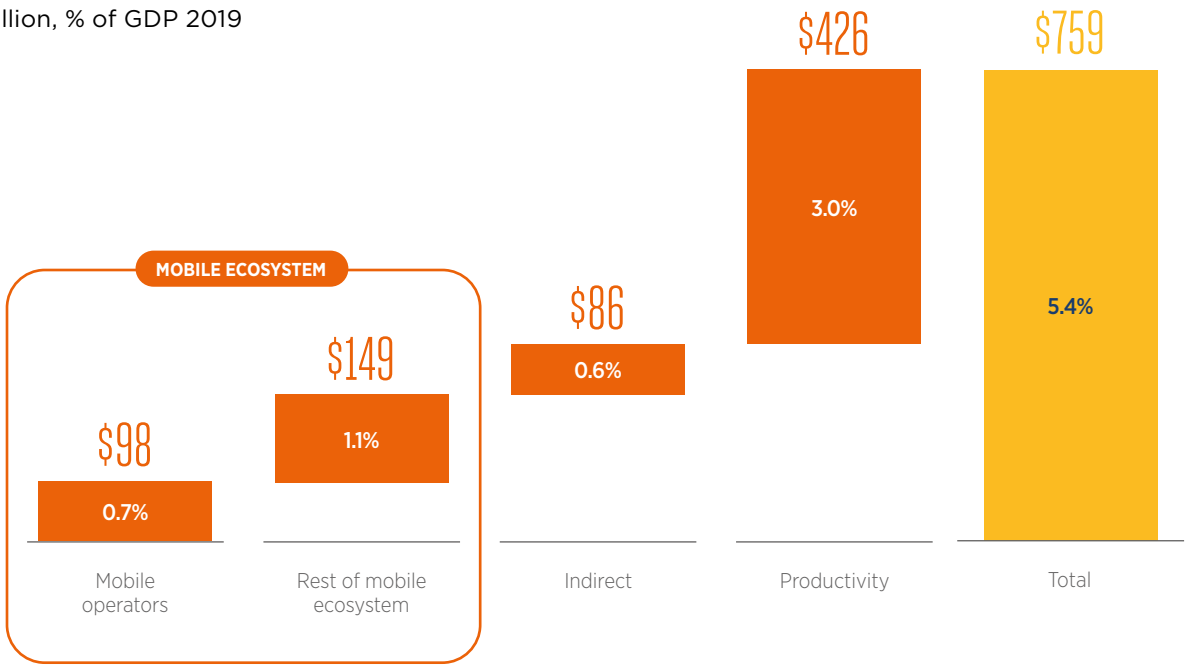


Source: GSMA Intelligence

Figure 25

Additional indirect and productivity benefits bring the total contribution of the Chinese mobile industry to $759 billion (5.4% of GDP)

$ billion, % of GDP 2019

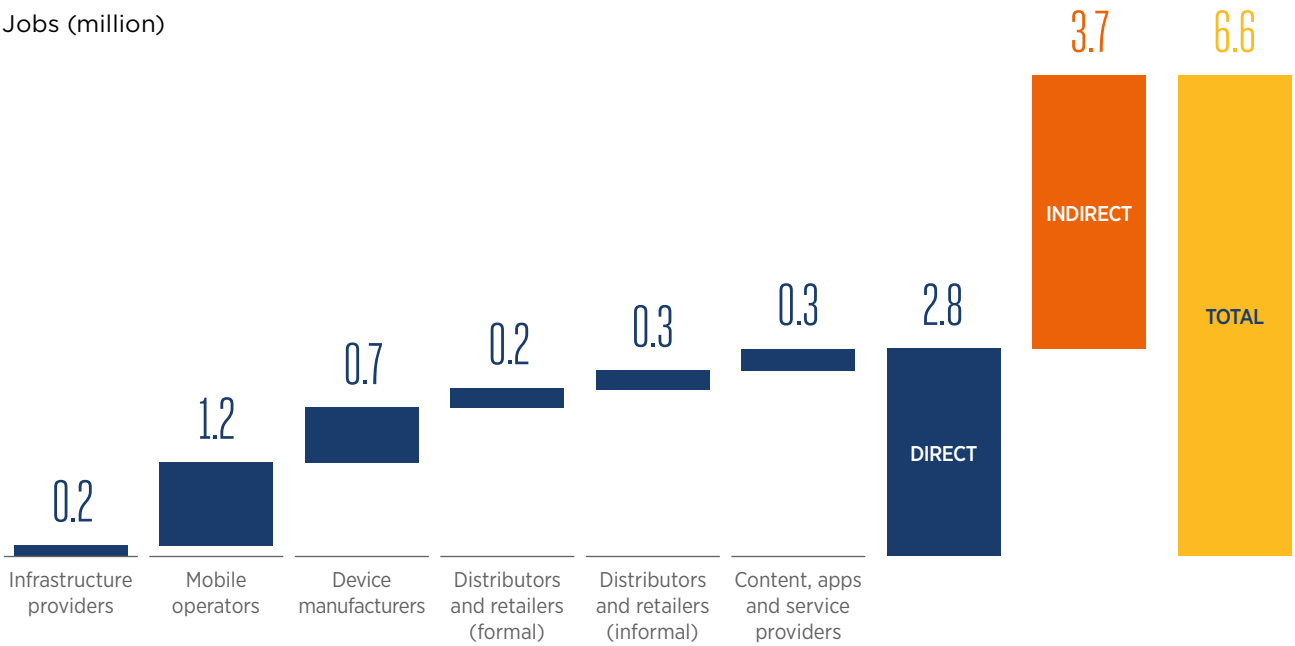


Source: GSMA Intelligence

Figure 26

The Chinese mobile ecosystem directly employs 2.8 million people, plus another 3.7 million indirectly through adjacent industries

Jobs (million)



Note: totals may not add up due to rounding

Figure 27

Source: GSMA Intelligence

In 2019, the Chinese mobile ecosystem contributed almost $90 billion to the funding of the public sector through general taxation

Billion

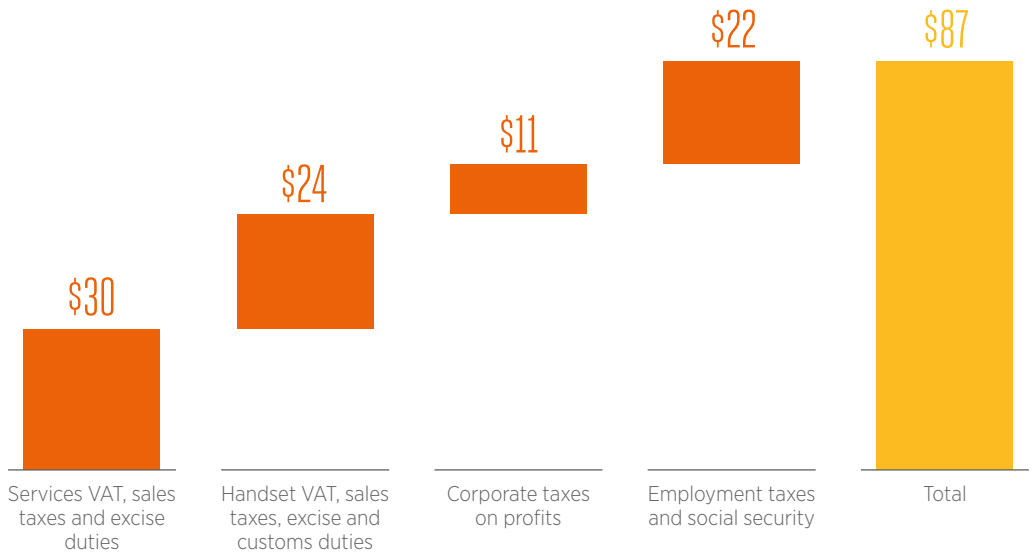
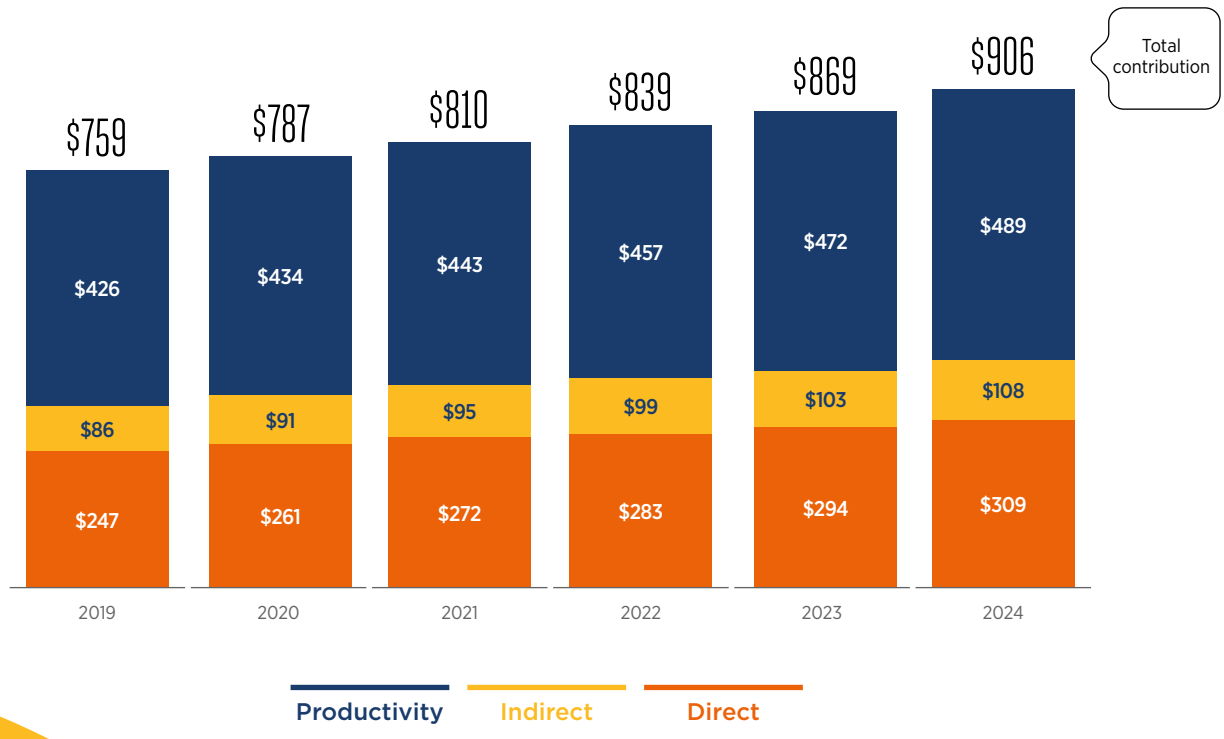


Figure 28

Source: GSMA Intelligence

Driven mostly by productivity gains, the Chinese economic contribution of mobile will surpass $900 billion by 2024

$ billion, % of GDP



3.2
Expanding the benefits of mobile internet

Mobile internet access continues to grow. Since 2012, the number of people subscribing to the mobile internet across China has doubled to more than 900 million (62% of the population). However, this leaves a large proportion of the population – more than half a billion people – unconnected.

The unconnected can be split into two groups: the 'uncovered' and the 'covered but not connected'. The 'uncovered' are those with no access to a mobile broadband network (3G and above): this is the coverage gap. The 'covered but not connected' are those who live within the footprint of a mobile broadband network but are not using mobile internet services: this is the usage gap.

As the key barriers to mobile internet adoption – infrastructure, affordability, consumer readiness, and availability of locally relevant content and services – are overcome over the next few years, the connectivity gap will continue to close. By 2025, nearly 260 million people across China will start using the mobile internet for the first time, almost halving the unconnected to 22% of the population.

Figure 29

Source: GSMA Intelligence

Mobile internet penetration in China has doubled since 2012, and the number of unconnected will almost half by 2025

People (million)

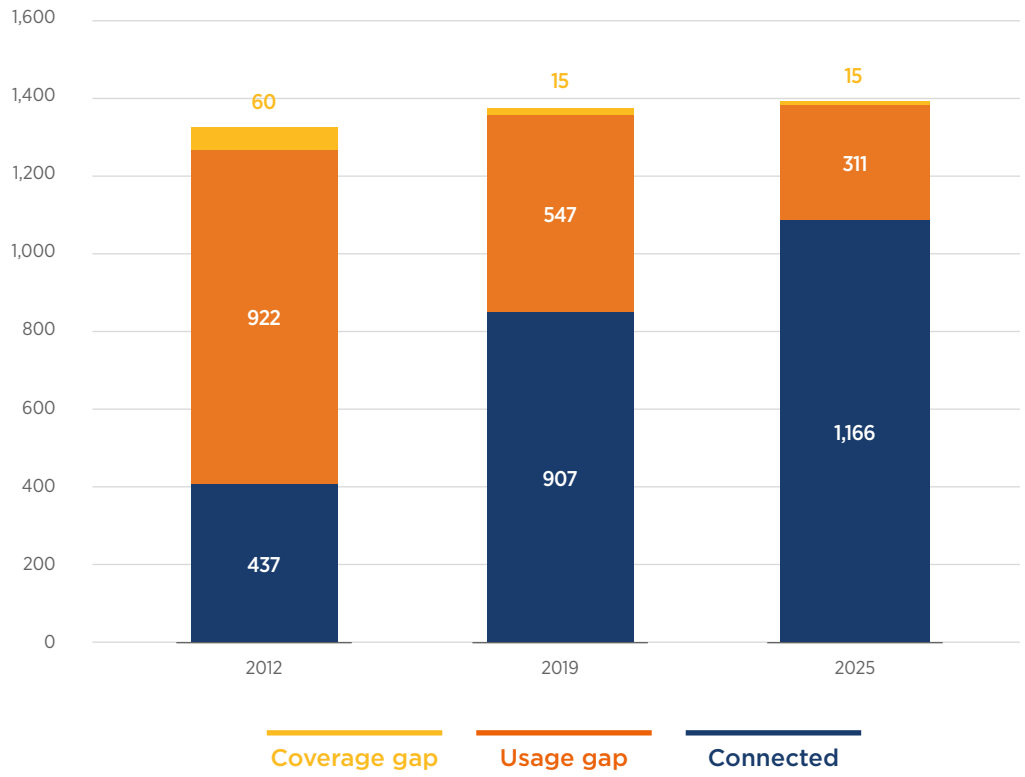
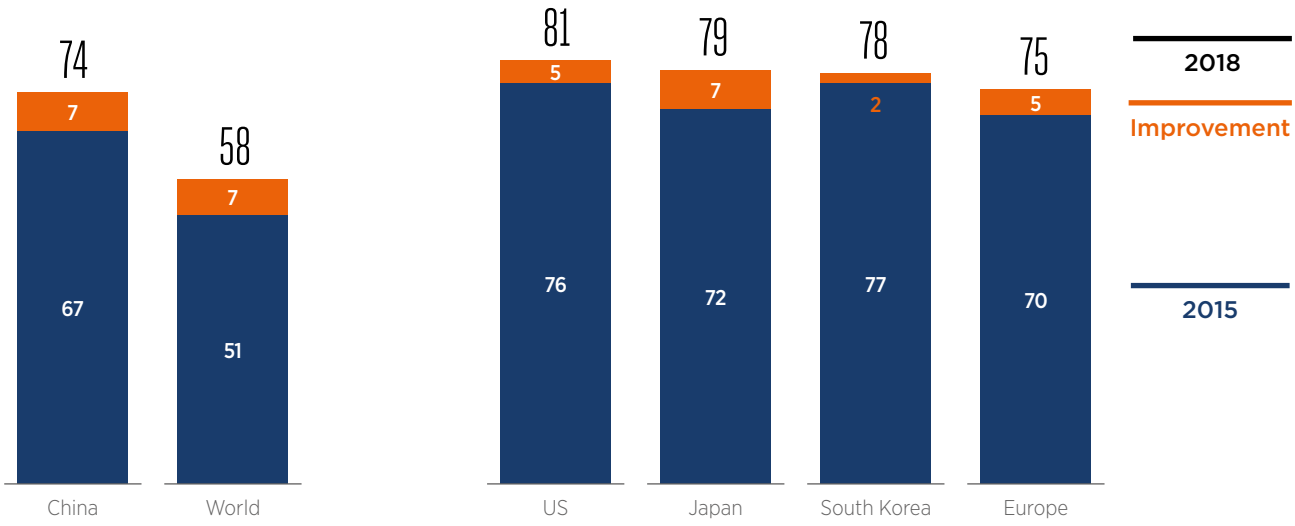


Figure 30

Source: GSMA

China's Index score is well ahead of the global average. However, it trails some leading markets, particularly in affordability and consumer readiness

GSMA Mobile Connectivity Index scores



Note: totals may not add up due to rounding

The GSMA Mobile Connectivity Index measures the performance of 165 countries (representing 99% of the global population) against key enablers of mobile internet adoption.

Figure 31

Source: GSMA Intelligence Consumer Insights Survey 2019

No single reason stands out for Chinese consumers not using the mobile internet, though affordability and relevance seem most pressing

Base: Adults aged 18+ who have used a mobile phone in the last three months but have never used it, despite being aware of the mobile internet (excludes mobile users who are not aware of mobile internet).

Percentages indicate the proportion of respondents who answered, "This is the most important reason stopping me" to the question, "Which one of those factors would you say is the single most important reason stopping you from using the internet on a mobile phone?" Eighteen different response options have been grouped into categories for this analysis.

3.3
Mobile delivering social impact

With 1.2 billion unique subscribers across China, and nearly 1.5 billion people covered by a mobile network, mobile is increasingly being used to access an array of life-enhancing services that contribute to and catalyse the achievement of the UN Sustainable Development Goals (SDGs).

In China, SDG 9 (Industry, Innovation and Infrastructure) remains the most impacted goal: 99% of the population are covered by 4G networks, underscoring mobile's role in providing critical infrastructure to spur innovation as well as inclusive and sustainable development. Mobile is also playing a key role in providing increased access to quality education (SDG 4), while helping reduce inequalities (SDG 10).

Figure 32

Source: GSMA

Mobile's impact on the SDGs in China, 2018

Despite the reach of mobile, much more can be done to leverage its power and support the delivery of the SDG 2030 targets. Crucial to this will be helping people realise the full benefits of using mobile and mobile internet services in terms of accessing health information, public services and digital payments, in both developed and developing countries. New technologies that are supported by IoT also need to achieve scale if mobile operators are to maximise their impact on the SDGs – for example, solutions in smart cities that can reduce pollution, and smart buildings and homes that can increase energy efficiency.

Deep dive on SDG 13: Climate Action

Climate change threatens sustainable development everywhere. Collaboration on a global scale is vital to mitigating the catastrophic impacts of the world's rising temperatures. While the mobile industry is not the largest contributor of carbon emissions compared to other sectors, it can be an important part of the solution. It can do this in three ways: enabling the global transition towards a zero-carbon economy; improving resilience to the effects of climate change; and reducing emissions and driving energy efficiency.

Helping to make net-zero a reality

Mobile technology's biggest impact on climate change is from its ability to enable other sectors of the economy to reduce their greenhouse gas (GHG) emissions. The mobile industry achieves this by providing connectivity for digital solutions that reduce energy use, travel and transport, or otherwise lower GHG emissions.

The impact of mobile-based solutions is closely linked to improvements in connectivity. Operators' networks offer a scalable, secure and standardised way to connect assets across a variety of services in an economically sustainable manner. This goes hand in hand with advancing mobile technology innovations in areas such as big data and IoT that can enable energy-efficient and environmental solutions across multiple sectors, including transport, manufacturing, agriculture and energy.

Improving resilience to climate change

Climate change has made weather patterns harder to predict and extreme events (such as droughts and floods) more frequent and severe, resulting in famine, hunger and displacement. The industry has an important role to play in adapting and responding to the effects of climate change. For example, mobile networks are facilitating access to information and coordinating assistance before, during and after climate-related emergencies. These efforts are often supported by operators' in-house disaster response teams, while mobile technology has rapidly become an attractive delivery channel for many forms of aid.

Driving energy efficiency

For most operators, the bulk of energy consumption (approximately 90%), and hence GHG emissions, within their own operations stems from the deployment and running of networks. Mobile operators are striving to minimise their own climate impact, embarking on an ambitious journey towards decarbonisation, but delivering a zero-carbon future will require timely and effective action in a number of areas:

1. **Energy efficiency:** As mobile use continues to grow at pace, so does the demand for energy, particularly from network infrastructure. With the risk of energy cost inflation in the future, operators' targets for reducing energy use and GHG emissions are intrinsically linked to the implementation of energy efficiency practices.
2. **Renewable energy:** Progressing towards zero carbon necessitates the industry make big strides in its migration to renewable energy sources, including wind, solar, biomass and hydropower. Against a backdrop of growing mobile data traffic, the switch to renewables also makes good business sense.
3. **Value-chain emissions:** Mobile operators have the potential, and responsibility, to positively influence emissions levels across the value chain. This means working with suppliers and customers to reduce emissions created in the production of goods (e.g. handsets and network equipment) and in the use of products by customers (e.g. the electricity used when charging mobile devices and other equipment).

Compared to the global carbon footprint of mobile networks themselves, the level of avoided emissions enabled by mobile communications technologies is 10 times greater.

The majority of these avoided emissions resulted from a decrease in electricity, gas and fuel consumption, either through the use of IoT technologies or changes in behaviour stemming from the use of smartphones.

The majority of avoided emissions from IoT technologies are primarily in:

- buildings (e.g. building management systems and smart meters)
- transport (e.g. facilitating the use of charging points and, through telematics, optimising routes/ vehicle fuel efficiency)
- manufacturing (e.g. storage and inventory management)
- the energy sector (e.g. smart grids).

The use of smartphones helps to avoid emissions by:

- reducing travel for commuting and leisure
- increasing the use of public transport with apps that provide real-time updates
- enabling accommodation sharing for short stays and holidays
- reducing travel through use of mobile shopping and mobile banking apps.

Digitisation is expected to disrupt all parts of the economy over the next decade. If suitable policy is implemented and sufficient investment is received, digitisation has the potential to be a key driver of low-carbon development. Mobile network-enabled technologies form an important part of the decarbonisation solution, as they facilitate rapid emissions reductions while improving quality of life and supporting economic growth. By 2025, the growth in smartphone users and number of IoT connections could result in a further doubling of the avoided emissions enabled by mobile technologies seen in 2018.[1]

1. For more information, see The Enablement Effect: The impact of mobile communications technologies on carbon emission reductions, GSMA, 2019

Source: operator websites

Figure 33

Operator initiatives for reducing climate impact

China Mobile	Through its "Green Action Plan", China Mobile is promoting a climate strategy with energy saving and emissions reduction at its core. It aims to reduce the environmental impact of its own operations and that of value-chain stakeholders, while helping to reduce customers' environmental impact through low-carbon ICT services.
China Unicom	Upholding the philosophy of green "information life", China Unicom is aiming to cut energy consumption in its own operations, reduce greenhouse gas emissions and enhance sewage and waste emission management in an effort to minimise its impact on the environment.
China Telecom	Through its "Administrative Measures on Energy Conservation, Emission Reduction", China Telecom has established an energy-saving and emissions reduction plan. In 2018, it increased investment in energy conservation and emissions reduction to RMB674 million (just under $100 million) – an increase of 27%. Much of this investment was to help China Telecom conserve natural resources: in 2018, its coal consumption decreased by 46% year-on-year, reclaimed water usage increased by 22%, and more than 100,000 tonnes of waste and used materials were recycled.
Chunghwa Telecom	As the largest mobile operator in Taiwan, Chunghwa Telecom aims to be a "Green Enterprise" that leads the industry towards environmental protection and sustainability via green operation. To efficiently monitor and manage energy utilisation and lower carbon emissions, Chunghwa Telecom laboratories developed the Environment ARtificer THeurgy (EARTH) system which has helped enhance the company's environmental management efficiency and reduce its energy consumption expense. Chunghwa also promotes paperless services, including electronic billing, automatic bill payment, consolidated billing and SMS billing, saving 560 million sheets of paper per year. Furthermore, the capacity of the company's self-built photovoltaic system reached 672 kWp by the end of 2018, and aims to reach 1,000 kWp by 2023.

04

Policies to accelerate digital development

4.1
Enabling China's 5G future

The success of 5G heavily relies on government support for timely access to the right amount and type of affordable spectrum, and under the right conditions. The Ministry of Industry and Information Technology set a good example by assigning the 2.6 GHz, 3.4–3.6 GHz and 4.8–5.0 GHz bands which became the basis of the fast-developing 5G networks across the country. The decision by the National Development and Reform Commission and Ministry of Finance to significantly reduce the frequency utilisation fees in the first six years[2] for these spectrum bands provided much needed relief to operators. In Hong Kong, the Communications Authority also auctioned the 3.3–3.6 GHz and 4.9 GHz bands to the industry at reasonable reserve prices and assigned the 26 and 28 GHz bands to the industry for free, following public consultation. These practices will no doubt allow operators to focus more on deployment and services, which will ultimately benefit consumers and businesses, contributing to overall social and economic improvements.

The above bands (mid-bands) are ideal for improving 5G coverage, speed and latency compared to 4G. However, 5G will need a comprehensive range of spectrum across sub-1 GHz, 1–6 GHz and above 6 GHz to realise its potential across the three key use cases – enhanced mobile broadband, ultra-reliable and low-latency communications, and massive machine-type communications. Spectrum above 24 GHz – the mmWave spectrum that was identified for IMT at the World Radiocommunication Conference 2019 – will be a critical component to enable super high speeds and ultra-low-latency applications.

Many independent research studies show that 5G will empower significant new opportunities for vertical industries. A recent GSMA report on the impact of mmWave 5G in China showed that the manufacturing sector among other vertical industries will receive the biggest improvements from the use of mmWave 5G (see Figure 34).

China is already a pioneer in the digitisation of manufacturing and industrial applications, and mmWave 5G will empower smart manufacturing to provide fast and reliable data flows across the factory floor and to various locations around the facility. mmWave spectrum can support the necessary network conditions for manufacturers to realise the full potential of interconnected devices and autonomous processes by providing higher-capacity, lower-latency mobile connectivity compared to some existing solutions using 5G in the mid-bands. mmWave applications that can help realise the full potential of 5G for China's "5G+Industrial Internet" plan include remote control systems, industrial robotics, high-speed imaging and autonomous transport in factories.

2. Fees for the first three years are waived, followed by a staged reduction of 25%, 50% and 75% for years four, five and six respectively. Full fees apply from year seven onwards.

Source: GSMA and TMG

Figure 34

mmWave 5G: contribution to GDP in China by 2034, by vertical

In light of the potential for 5G to bring significant benefits to vertical applications, some industry verticals may advocate access to dedicated spectrum. This presents a significant challenge as spectrum set-asides or exclusive spectrum for verticals may jeopardise the efficiency of spectrum allocation and risk spectrum remaining under-utilised.

Spectrum that is set aside nationally for vertical industries in priority 5G bands (e.g. 26 and 40 GHz) poses a threat to the wider success of 5G. Set-asides can limit the assignment of sufficiently large contiguous blocks to allow mobile operators to deliver the fastest 5G services and leverage their extensive network experience. In particular, regulators should avoid set-asides that mean they cannot make available around 1 GHz per operator in mmWave spectrum (e.g. 26 and 40 GHz).

More broadly, setting aside spectrum for restricted use cases can lead to inefficient usage. Vertical industries are unlikely to use spectrum in priority 5G bands widely across countries, so national set-asides are likely to go unused in many areas. Instead, mobile operators can provide customised 5G services for verticals, which can then benefit from the network slicing, small cells, wider geographical coverage, larger, more diverse spectrum assets and deployment experience at operators' disposal. Mobile operators are best placed to provide the range of services envisaged, including private networks with leased spectrum in cases where needed due to specific requirements from verticals.

mmWave will play an important role in the future success of 5G in China. The GSMA therefore recommends the following policy considerations:

- Continue to provide policy incentives by reducing frequency utilisation fees for mmWave spectrum, similar to those for the 2.6, 3.4–3.6 and 4.8–5.0 GHz bands.
- Allocate large and contiguous blocks of spectrum in the mmWave bands where possible – around 1 GHz per operator.
- Avoid spectrum set-asides for verticals in priority mmWave bands (e.g. 26 and 40 GHz). Sharing approaches such as leasing are better options where verticals require access to spectrum.

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