The Mobile Economy
Asia Pacific 2017

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with almost 300 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

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Executive Summary

Mobile adoption rising, but growth slowing

Asia Pacific has been the biggest contributor to global subscriber growth in recent years and still has considerable room for growth over the rest of the decade. As of the end of 2016, there were 2.7 billion unique subscribers in Asia Pacific, accounting for two thirds of the region's population. More than half the world's mobile subscribers live in Asia Pacific – mostly in China and India.

Although the region has reached its peak in terms of subscriber growth, Asia Pacific will account for almost two thirds of new subscribers globally by 2020, with most of the incremental growth coming from the two dominant markets, India and China. By 2020 there will be more than 3.1 billion mobile subscribers in the region, or three quarters of the population.

4G growing and 5G coming soon

Over the last few years there has been a dramatic shift towards higher speed mobile technology in Asia Pacific. In 2016, mobile broadband (3G and above) became the dominant technology, accounting for just over half of total connections across the region, up from 20% in 2012. 2016 was also the year 4G connections overtook 3G connections.

Australia, South Korea and Japan (the top three markets worldwide in terms of 4G penetration) will continue to be market leaders in terms of 4G uptake, but China will also play a major part, surpassing 1 billion 4G connections (three quarters of the total connections base) during 2018. Other previously 'laggard' 4G markets such as Malaysia, Indonesia, Myanmar, the Philippines and India are now beginning to see an accelerating migration to 4G, driven by ongoing network investment by

mobile operators, increased competition, falling device prices and growing consumer appetite for higher speed mobile. Overall in the region, 4G will account for 48% of total connections by 2020.

Asian markets are driving the development of 5G mobile technologies, with commercial deployments planned in South Korea in 2019 and Japan and China in 2020. These early 5G networks will be deployed in dense urban areas as mobile operators look to offer increased performance and supplement existing mobile broadband capacity. In the early years following the initial launches, operators in 16 other countries across Asia Pacific are expected to deploy 5G services, covering a third of the region's population by 2025. By this time, 5G connections (excluding IoT) are anticipated to reach 670 million across the region, accounting for just under 60% of global 5G connections.

Challenging environment leading to modest revenue growth

Revenue growth in Asia Pacific has slowed sharply in recent years, reflecting declining subscriber growth (particularly in the region's developed markets), increasing competition in certain markets, growing adoption of IP messaging services and a challenging macroeconomic environment. In the region as a whole, total revenues grew by 3% in 2016, down from 9% in 2013.

The region faces challenges that will see growth remain in low single digits, including regulatory pressures (e.g. in China) and new operator launches (e.g. in Myanmar, Singapore and the Philippines) that will increase competition and put further pressure on revenues and margins. Overall, total revenues are expected to grow by 1.7% in 2017, and

by an annual growth rate of 2.3% between 2016 and 2020.

Capex levels are likely to stabilise in 2017 after falling sharply in 2016, largely due to 4G network rollout in China nearing completion. Investments will grow modestly to 2020, with mobile operators, particularly in many developing countries in the region, continuing to invest in mobile broadband networks. Towards the end of the decade, mobile operators in some of the more developed markets are likely to begin investing in preparation for 5G network launches, which could drive an increase in overall capex levels.

Mobile contributing to jobs and economic growth

In 2016, mobile technologies and services generated 5.2% of GDP in Asia-Pacific, a contribution that amounted to around $1.3 trillion of economic value. In the period to 2020 we expect this to increase to $1.6 trillion (5.4% of GDP) as countries benefit from the improvements in productivity and efficiency brought about by increased take-up of mobile services and adoption of new mobile technologies such as M2M.

The mobile ecosystem also supported approximately 16 million jobs in 2016. This includes workers directly employed in the ecosystem and jobs that are indirectly supported by the economic activity generated by the sector. In addition to the mobile sector's impact on the economy and labour market, it makes a substantial contribution to the funding of the public sector, with approximately $166 billion raised in 2016 in the form of taxation.

Mobile driving engagement and innovation in the region

As smartphone adoption continues to rise in the region (just over half of total connections were smartphones at the end of 2016) and as more users come online, an increasing range of mobile services are being consumed, including video, social media, e-commerce and financial services. Of all the regions, Asia Pacific as a whole will undergo the largest shift in consumer behaviour by 2030 as multiple drivers take hold, including rising smartphone and mobile internet adoption, improved affordability and the regionalisation of online content.

There is a burgeoning digital commerce market in Asia Pacific, particularly in developing countries of the region where mobile is often the only access point for the internet and thus the primary platform through which online commerce transactions are completed. Mobile operators are playing a key role in enabling the digital commerce opportunity by providing access to digital services, facilitating digital payments and user authentication, and accelerating the digital commerce ecosystem through partnerships with service providers and via financial investments.

Mobile operators in the region are also increasingly collaborating with tech start-ups to help scale innovative and sustainable mobile services. By supporting these new digital players, operators are helping bring the most impactful mobile solutions to the people and places that need them most, and generating the greatest socioeconomic impact.

Mobile is essential to addressing social challenges

The large-scale societal adoption and use of digital technologies is a key driver of measurable economic, social and cultural value, including increased productivity, a rise in employment rates, improved security, and greater capacity to tackle social and environmental issues. Mobile internet penetration in Asia Pacific has doubled over the last five years, reaching just under half of the population by the end of 2016.

However, there are still 2 billion people without access to the mobile internet. As challenges around infrastructure, affordability, consumer readiness and content are addressed, an additional 600 million people are expected to gain access to the mobile internet across the region by the end of the decade, bringing the total to 2.6 billion, and accounting for just over 63% of the population.

Mobile is also playing a key role in tackling various social and economic challenges as outlined by the UN's Sustainable Development Goals (SDGs), including poverty, health, education, gender equality, employment, safer cities, climate change and identity. Mobile technology provides access to tools and applications that help address these issues, and enables new technologies and innovations to build more efficient and environmentally sustainable societies.

Rethinking regulation for the digital age

This large and diverse region encompasses a wide array of countries at different stages of digital development. By developing national roadmaps that ask what the future looks like for them and how they get there, policymakers and regulators can more readily pinpoint the practical steps needed to enable the development of robust and progressive digital ecosystems. A coherent and feasible digital strategy is essential for enabling the three broad and interrelated components of a digital society: digital citizenship, digital lifestyle and digital commerce.

A central objective of regulatory policy should be to promote innovation in the digital ecosystem. Given that the digital economy is characterised by competition between new players and the traditional telecoms operators, legacy regulatory frameworks centred on the telecoms sector impose an uneven playing field where the telecoms operators are subject to rules and scrutiny that do not apply to their competitors.

There are a number of areas of particular focus for regulatory modernisation. For example, in the rapidly developing area of IoT devices and services, which can provide socioeconomic benefits for citizens and businesses in the region, regulatory flexibility is critical. Regulating too soon risks suppressing the diverse range of services that will be developed, while a pro-investment and pro-innovation policy can help maximise the opportunity that IoT offers. Another key area for the mobile industry concerns the impact of consolidation on mobile markets. Whereas mergers between mobile operators continue to be closely scrutinised, the same level of scrutiny does not appear to be levelled at their competitors in the digital economy.

MOBILE ECONOMY ASIA PACIFIC

Unique mobile subscribers

2016
2.7 billion
4.2% CAGR 2016–20

2020
3.1 billion

66%
PENETRATION RATE
75%

SIM connections

2016
4.2 billion
3.8% CAGR 2016–20

2020
5.1 billion

98%
PENETRATION RATE*
111%

*Excluding M2M

ACCELERATING MOVES TO MOBILE BROADBAND NETWORKS AND SMARTPHONE ADOPTION

Mobile broadband connections to increase from 53% of total in 2016 to
72%
by 2020

By 2020, there will be
3bn
smartphones, growth of 1 billion from the end of 2016

Mobile data traffic to grow by a CAGR of
4.2%
over the period 2016–2020

Source: Ericsson

Data growth driving revenues and operator investments

Operator total revenues

2016
$432 billion
2.3% CAGR 2016–20

2020
$473 billion

Operator CAPEX of up to **$270 billion** for the period 2017–20

Mobile contributing to economic and social development across the world

DIGITAL INCLUSION
Delivering digital inclusion to the still unconnected populations.

MOBILE INTERNET PENETRATION
50% 2016 ●——————● 2020 63%

FINANCIAL INCLUSION
Delivering financial inclusion to the unbanked populations. As of May 2017 there were

76 live mobile money services in 22 countries

INNOVATION
Delivering innovative new services and apps. Number of M2M connections to reach
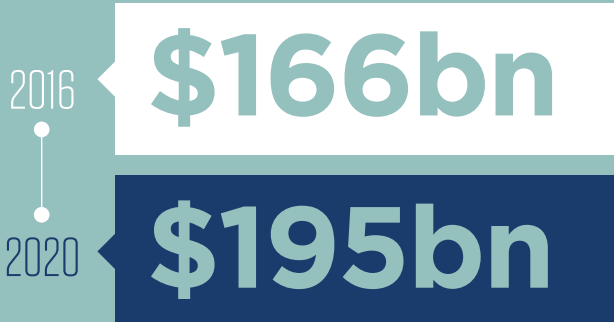
476 million by 2020

Mobile industry contribution to GDP

2016 **$1.3tn** 5.2% GDP

2020 **$1.6tn** 5.4% GDP

Public funding

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

2016 **$166bn**

2020 **$195bn**

Employment

Jobs directly supported by the mobile ecosystem

2016 **6.4 million**

2020 **7.9 million**

Plus an additional **9.5 million** indirect jobs supported in 2020

1
Industry
overview

1.1
Mobile adoption still rising, but growth slowing

At the end of 2016, there were 2.7 billion unique subscribers[1] in Asia Pacific, accounting for two thirds of the region's population. The region is home to two of the most populous nations in the world – China and India, which together account for two thirds of the region's subscribers, and a third of the global total. Over half the world's mobile subscribers live in Asia Pacific.

Asia Pacific has been the biggest contributor to global subscriber growth in recent years and still has considerable room for growth over the rest of the decade. Since 2012, when half the region's population subscribed to mobile services, the region

has gained 690 million subscribers, and by 2020 another 460 million will be added, bringing the total to more than 3.1 billion.

Meanwhile, multiple SIM ownership has seen a decline in recent years, after increasing steadily in the earlier stages of mobile growth. It is forecast to continue to decline out to 2020 as markets, particularly developed ones, become saturated, and use of IP messaging apps offering cross-network communication grows. At the end of 2016, there were 4 billion connections[2] across Asia Pacific, or 1.5 SIM cards for every subscriber. This equates to a connection penetration in Asia Pacific of 98%.

Figure 1

Unique subscribers in Asia Pacific

Unique subscribers (m)　　　Penetration (% population)

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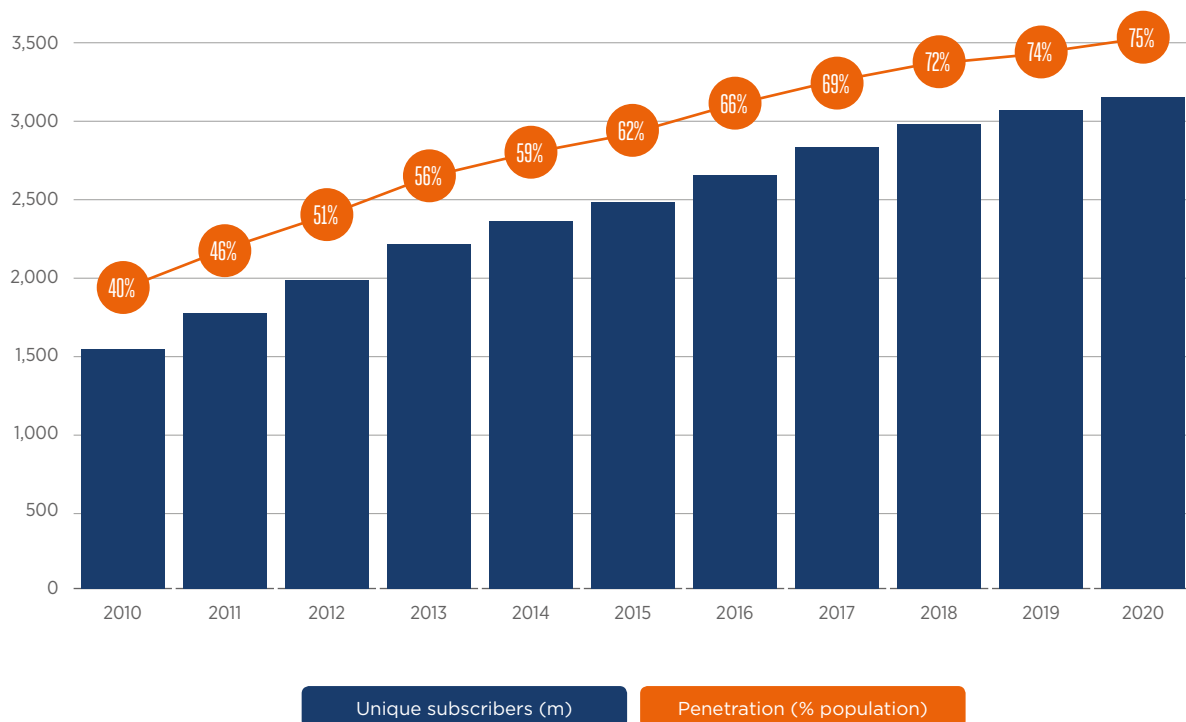
1. Unique users who have subscribed to mobile services at the end of the period, excluding M2M. Subscribers differ from connections such that a unique user can have multiple connections.
2. Unique SIM cards (or phone numbers, where SIM cards are not used) that have been registered on the mobile network at the end of the period. Connections differ from subscribers such that a unique subscriber can have multiple connections. Excludes M2M.

Asia Pacific will account for almost two thirds of new subscribers globally by 2020, and will have the second highest growth of any region (behind Sub-Saharan Africa), with a compound annual growth rate (CAGR) of 4.2% between 2016 and 2020. The region's subscriber base will grow faster than the global average, and by 2020 three quarters of the population will subscribe to mobile services (compared to 72% globally).
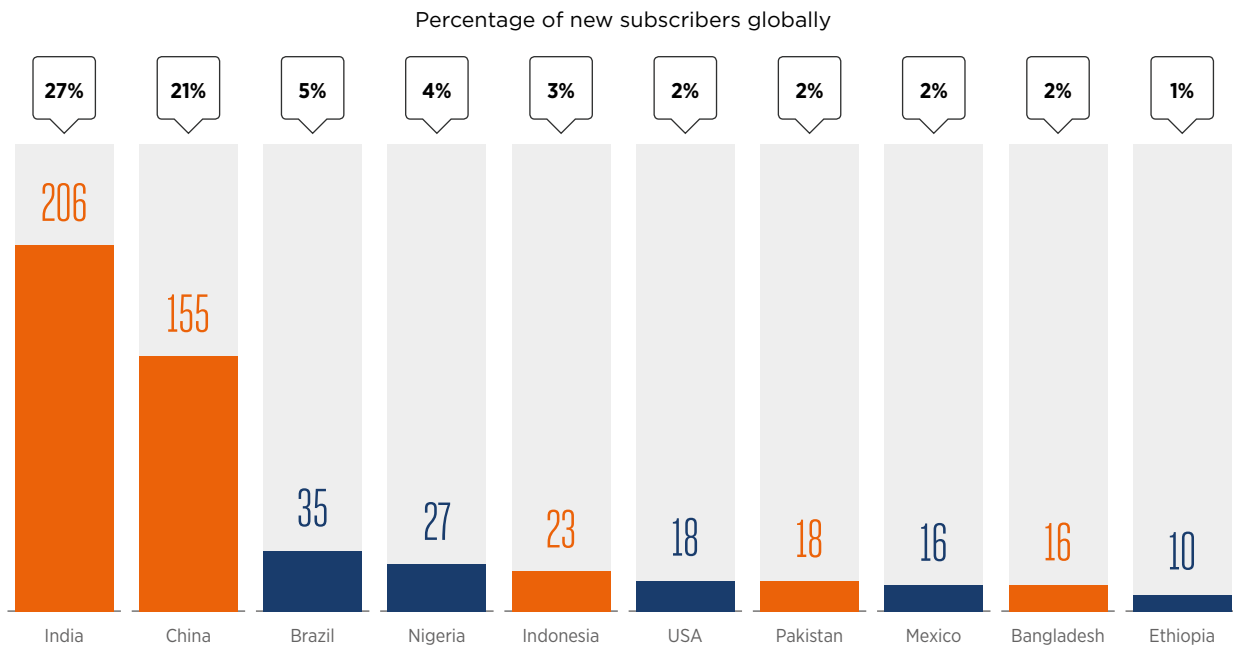
Of the top 10 markets across the world in terms of subscriber growth over the next five years, five are in Asia Pacific. Four fifths of the region's incremental growth by 2020, and almost half of the global total, will come from the two dominant markets, India and China. India is expected to add 206 million new subscribers by 2020. With the penetration rate by that date of only 65%, there will still be considerable scope for growth. China will add another 155 million subscribers by the end of the decade, bringing its total to 1.2 billion, or 86% of the population.

Figure 2   Source: GSMA Intelligence

Global markets by additional subscribers, 2016–2020

(Million)

Percentage of new subscribers globally

	India	China	Brazil	Nigeria	Indonesia	USA	Pakistan	Mexico	Bangladesh	Ethiopia
%	27%	21%	5%	4%	3%	2%	2%	2%	2%	1%
Million	206	155	35	27	23	18	18	16	16	10

Despite this, the region has reached its peak in terms of subscriber growth. Between 2016 and 2020, the subscriber base will increase by a CAGR of 4.2%, down from 7.7% over the previous four years. Much of this slowdown can be explained by the differing levels of market maturity across the region.

The region is home to four of the top five most penetrated markets in the world – Taiwan, Japan, Singapore and Hong Kong, and three countries (Australia, South Korea and New Zealand) have penetration rates of greater than 90%. These markets are already saturated, with minimal opportunity for future subscriber growth. In fact, subscriber numbers will actually decline in Japan over the next few years in line with the expected decline in the population. On average across the developed markets of the region, 94% of the population subscribe to mobile services, and this will only increase by one percentage point between 2016 and 2020.

The region is also home to markets with some of the lowest penetration levels in the world, including North Korea and some Pacific Islands. Meanwhile, some developing markets that witnessed strong growth over recent years are seeing declining growth as it becomes increasingly difficult to connect those yet to be connected. In Myanmar for example, the rapid growth in the subscriber base between 2012 and 2016, primarily due to the liberalisation of its telecoms market in 2014 and subsequent heavy investment from the mobile operators and competitive prices, has resulted in the country "catching up" with its regional peers (even leap-frogging in some cases – for example, in smartphone adoption). Overall, the developing Asia Pacific markets will see average subscriber penetration grow from 64% in 2016 to 74% by 2020.
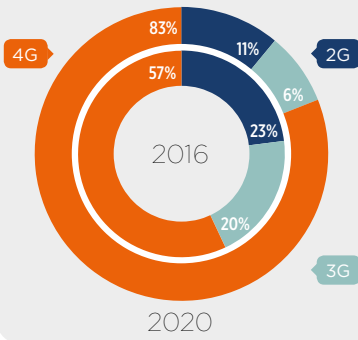
ASIA PACIFIC

CHINA

JAPAN

SOUTH KOREA

INDIA

MYANMAR
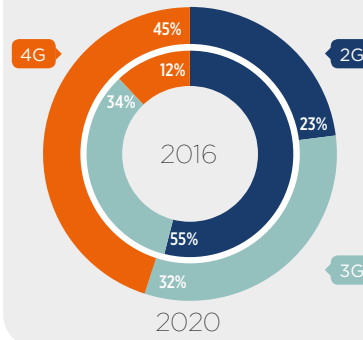
PHILIPPINES

MALAYSIA

INDONESIA

China

TECHNOLOGY MIX

4G
2G
3G

83%
57%
11%
6%
23%
20%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
76% 86%

SMARTPHONE ADOPTION
2016 ⟶ 2020
71% 74%

Indonesia

TECHNOLOGY MIX
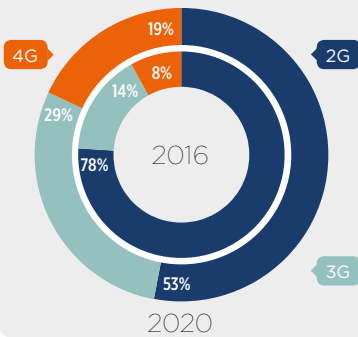
4G
2G
3G

45%
34%
12%
23%
55%
32%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
79% 84%

SMARTPHONE ADOPTION
2016 ⟶ 2020
52% 67%

India

TECHNOLOGY MIX

4G
2G
3G

19%
8%
14%
29%
78%
53%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
51% 65%

SMARTPHONE ADOPTION
2016 ⟶ 2020
28% 49%

Malaysia

TECHNOLOGY MIX

4G
2G
3G

48%
31%
16%
23%
45%
35%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
77% 80%

SMARTPHONE ADOPTION
2016 ⟶ 2020
69% 76%

Japan

TECHNOLOGY MIX

4G
2G
3G

92%
69%
1%
7%
2%
29%

2016
2020
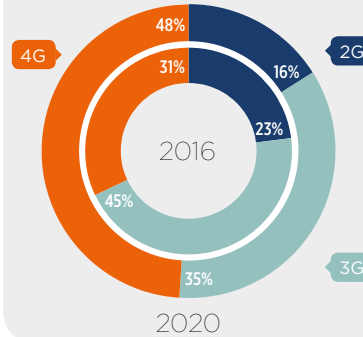
SUBSCRIBER PENETRATION
2016 ⟶ 2020
95% 96%
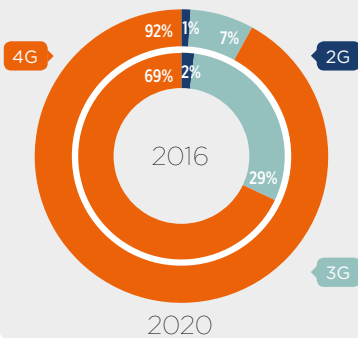
SMARTPHONE ADOPTION
2016 ⟶ 2020
53% 73%

Philippines

TECHNOLOGY MIX

4G
2G
3G

26%
45%
6%
28%
49%
46%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
73% 75%
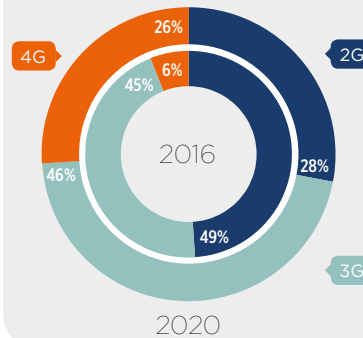
SMARTPHONE ADOPTION
2016 ⟶ 2020
59% 71%

South Korea

TECHNOLOGY MIX
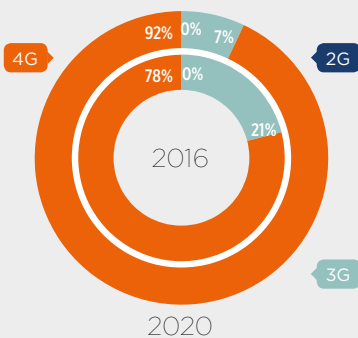
4G
2G
3G

92%
78%
0%
7%
0%
21%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
93% 95%

SMARTPHONE ADOPTION
2016 ⟶ 2020
80% 85%

Myanmar

TECHNOLOGY MIX

4G
2G
3G

34%
45%
10%
16%
45%
50%

2016
2020

SUBSCRIBER PENETRATION
2016 ⟶ 2020
47% 59%
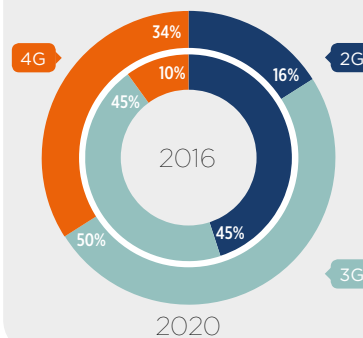
SMARTPHONE ADOPTION
2016 ⟶ 2020
70% 73%

1.2
Technology shift ongoing

4G growing and 5G coming soon

Over the last few years there has been a dramatic shift towards higher speed mobile technology in Asia Pacific. In 2016, mobile broadband (3G and higher) became the dominant technology, accounting for just over half of total connections across the region, up from 20% in 2012. 2016 was also the year the number of 4G connections overtook 3G connections, driven by rapid rollout of 4G networks: 22 LTE networks were made live during 2016 in Asia Pacific, bringing the total (as of March 2017) to 106 (17% of the global total) across 37 countries. Newer developments in network technology are now also being deployed: there are currently 36 live LTE Advanced networks in 18 countries in Asia Pacific, and 34 networks have launched VoLTE services across 15 countries.

Rapid rollout of 4G in Vietnam

As an example of Asian mobile operators prioritising 4G, Vietnamese mobile operator Viettel announced the commercial launch of its 4G LTE network in April 2017, having rolled out 36,000 4G base stations and 320,000km of domestic fibre backbone in just six months. The network claims 'nationwide' coverage of 95% of the population, including all provinces and cities, as well as remote, mountainous and island communities.

With download speeds of 30–50 Mbps and tariff packages that are '40–60% cheaper' than 3G tariffs, Viettel wants to ensure that everyone, including poor people in remote and mountainous areas, has access to high-speed mobile internet services without worrying about high costs. Viettel is also aiming to lay the foundation for wide application of mobile technology in several sectors including healthcare, education, agriculture, tourism and e-government, and is assisting the Vietnamese government on a project to boost digital literacy in the country.

Figure 3   Source: GSMA Intelligence

Technology migration in Asia Pacific

Percentage of connections

2G   3G   4G
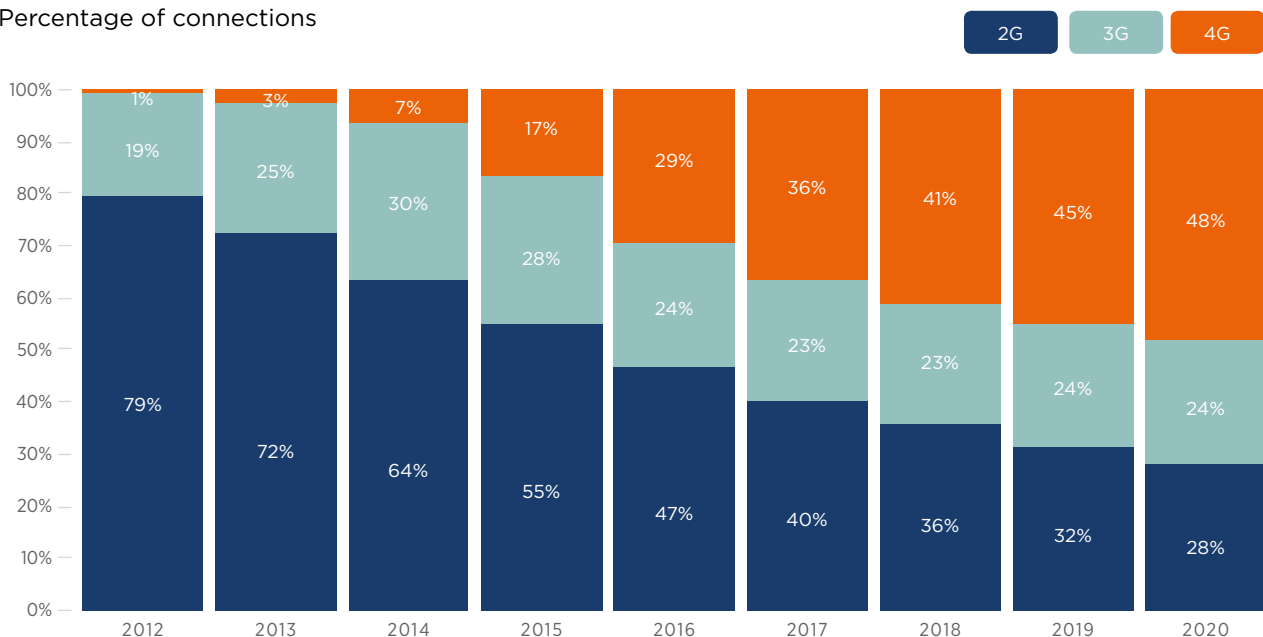
Asia Pacific accounts for nearly two thirds of global 4G connections, and is home to the top three markets worldwide in terms of 4G penetration – South Korea (78% of total connections in 2016), Japan (69%) and Australia (65%). These will continue to be market leaders in terms of 4G uptake, but China will also play a major part, surpassing 1 billion 4G connections (three quarters of the total) during 2018, and reaching 83% by 2020. Other previously 'laggard' 4G markets such as Malaysia, Indonesia, Myanmar, the Philippines and India are now beginning to see an accelerating migration to 4G, driven by a number of factors including ongoing network investments by mobile operators, increased competition, falling device prices (particularly from regional vendors) and growing consumer appetite for higher speed mobile. Overall in the region, 4G will account for 48% of total connections by 2020.

Asian markets such as South Korea, Japan and China are driving the development of 5G mobile technologies, in a similar way to how Europe pioneered 3G and North America led 4G. With high or rapidly growing levels of 4G adoption, supportive governments and ambitious launch targets (linked to flagship sporting events), operators in these countries are challenging North American counterparts such as Verizon, which is initially focusing on 5G as a fixed-wireless solution.

The following look set to host the first commercial 5G network deployments:

- KT is promising to showcase the world's first 5G pilot service using 28 GHz at the 2018 PyeongChang Winter Olympics. KT plans to follow this pre-commercial service, the specification for which it hopes will become part of the global standard for 5G, with nationwide commercial deployments in 2019.

- In May 2017, NTT DoCoMo, in collaboration with Nokia and Intel, began testing 5G applications in the Tokyo metropolitan area, starting with the key interoperability testing of multi-vendor technology using the 4.5 GHz frequency band. The plan is to ensure that 5G network infrastructure is in place ready for full commercial deployments, to be showcased at the 2020 Tokyo Olympics.

- China Mobile has announced plans to launch large-scale, pre-commercial, 5G field trials in 2019, laying the groundwork for a 2020 commercial launch. The trial is expected to cover 100 sites, and 10,000 5G base stations will be deployed by 2020 for the commercial launch.

These early 5G networks will be based on 3GPP Release 15 and will be deployed in dense urban areas as mobile operators look to offer increased performance and supplement existing mobile broadband capacity. 5G's next phase, based on 3GPP Release 16, will bring further enhancements to mobile data, and the rest of the commercial requirements including massive IoT and critical communication services.

In the early years following the initial launches, operators in 16 other countries across Asia Pacific are expected to deploy 5G services. Rollout will likely be at a similar rate to the deployment of 4G, covering a third of the region's population by 2025. Adoption will scale rapidly, as device vendors see the technology as a means to differentiate handsets, while the fact that average selling prices for smartphones have declined since the launch of 4G means affordability will prove less of a barrier to ownership. 5G connections (excluding IoT) are anticipated to reach 670 million in Asia Pacific by 2025, accounting for just under 60% of global 5G connections.

5G take-up in Asia Pacific

5G connections (million)   5G coverage (percentage of population)
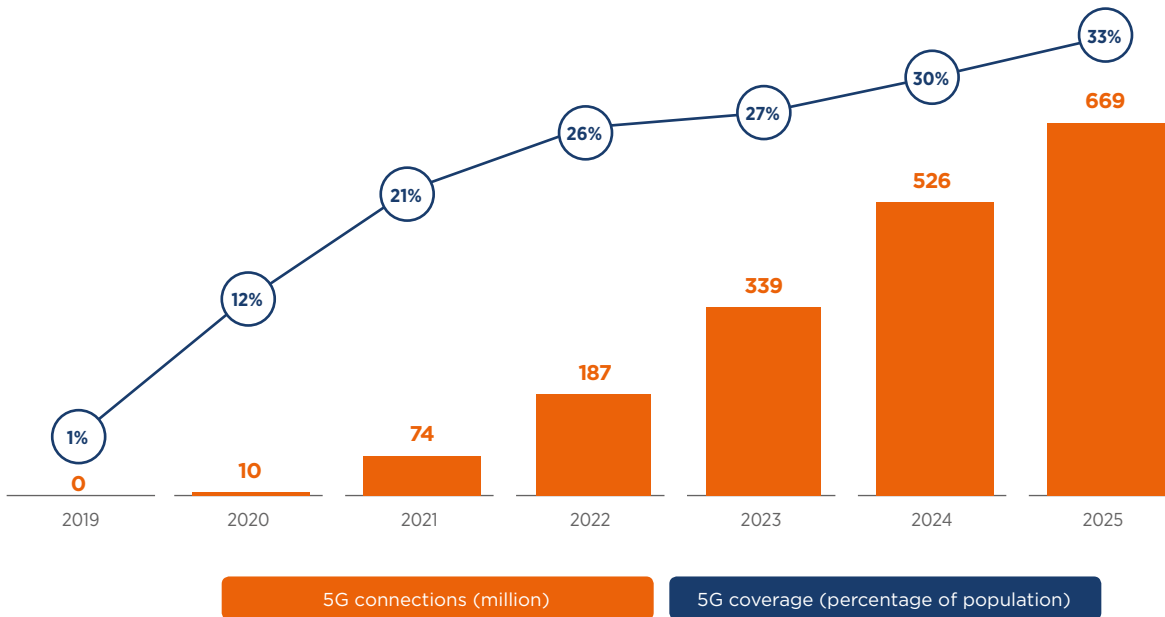
Smartphone adoption rising

By the end of 2016, the number of smartphone connections in Asia Pacific surpassed 2 billion, just over half of total connections. Three of the top five markets globally in terms of smartphone adoption are from Asia Pacific, namely Singapore (83%), Australia (80%) and South Korea (80%). However, other more developing markets such as China, India, Indonesia and the Philippines have been the main drivers of growth, adding more than 210 million smartphone connections between them in the last year alone. During 2016, India overtook the US to become the second largest smartphone market in the world (behind China) and, with adoption at just under 30%, will be the main driver of smartphone growth in the region over the next few years, adding 360 million smartphone connections by 2020.

Other markets that are expected to see rapid smartphone growth over the next few years include Bangladesh, Nepal, Pakistan and Vietnam, as the devices and data services become more affordable (smartphone ASP in Asia Pacific is forecast to drop below $200 in 2017[3]), digital literacy improves and more locally relevant content is made available. By 2020 there will be just under 3 billion smartphone

connections in Asia Pacific, accounting for just under two thirds of the region's total connections.

South Korea, Japan and China have been the traditional smartphone manufacturing hubs in the region, home to established brands such as Samsung, Sony and Huawei respectively. However, more recently a number of local smartphone manufacturers have been gaining share in countries such as India, the Philippines, Indonesia, Thailand and Vietnam. Further, as well as homegrown OEMs, India is becoming a hub for manufacturing of other brands due to policy changes that liberalised foreign direct investment (FDI) rules in the mobile sector. In October 2016, Huawei announced that it will start to manufacture smartphones in India in collaboration with the global electronics manufacturer, Flex India. Similarly, Chinese companies such as Xiaomi, OnePlus and Gionee are making their handsets at a Foxconn plant in Andhra Pradesh, and Wistron is manufacturing for companies such as LG, Oppo and HTC through its joint venture with Delhi-based Optiemus Infracom (Wistron is also expected to start assembling iPhones in India soon at its plant in Bangalore[4]).

3. Strategy Analytics
4. "Apple to Start Making iPhones in India Over Next Two Months", WSJ, March 2017
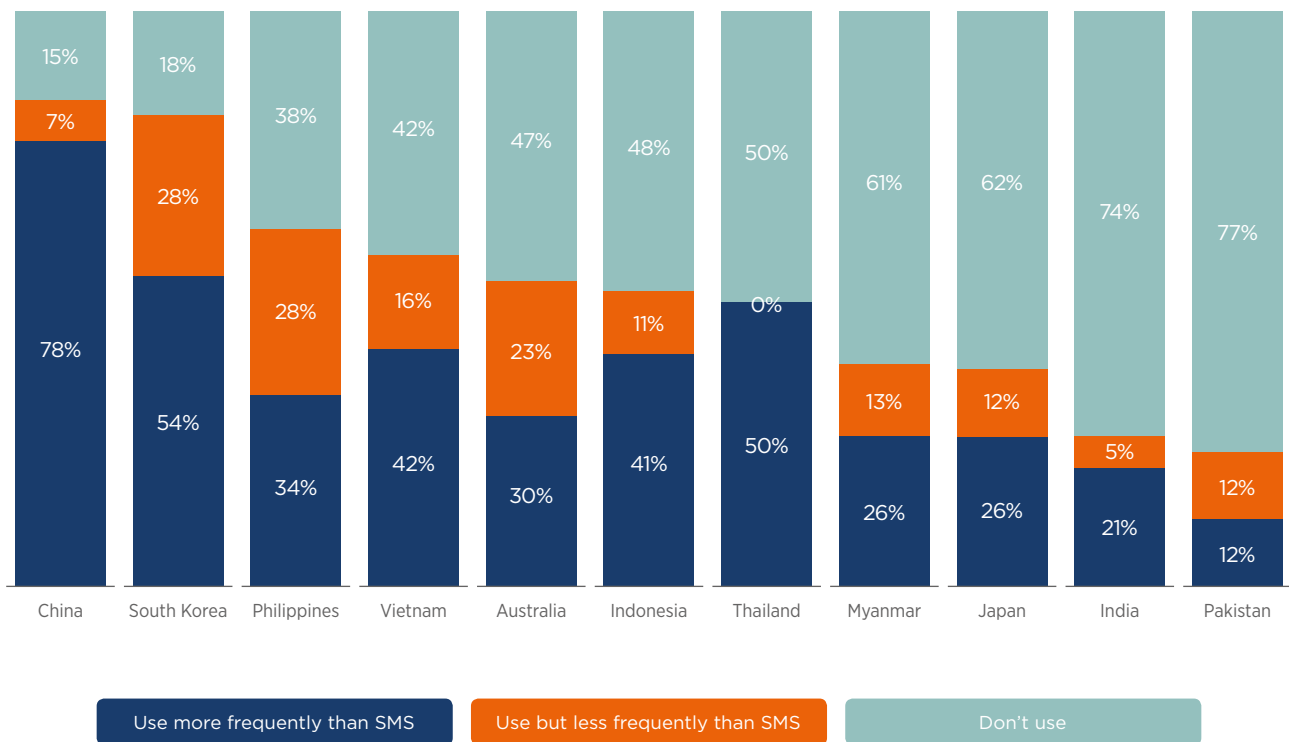
Advanced services leading to growth in data

As consumers migrate to mobile broadband and smartphone adoption grows, use of data services is also increasing. More and more people across Asia Pacific are using IP messaging apps such as Facebook, WhatsApp and local variants such as WeChat (in China), KakaoTalk and Line (primarily in South Korea and Japan respectively). On average across the region, just under two fifths of mobile phone owners use IP messaging apps more frequently than SMS, with a further 14% using them, albeit less frequently.[5]

Usage is particularly high in markets such as China and South Korea: in China, domestic messaging service WeChat is set to reach 1 billion users during 2017, and in South Korea, KakaoTalk is estimated to be used by more than 90% of smartphone owners. In all countries surveyed, usage has increased over the last year, most notably in the Philippines, Australia and Indonesia, where the proportion of phone owners using IP messaging services increased by 51, 22 and 14 percentage points respectively.

Figure 5   Source: GSMA Intelligence Consumer Survey 2016

IP messaging in Asia Pacific

Country	Use more frequently than SMS	Use but less frequently than SMS	Don't use
China	78%	7%	15%
South Korea	54%	28%	18%
Philippines	34%	28%	38%
Vietnam	42%	16%	42%
Australia	30%	23%	47%
Indonesia	41%	11%	48%
Thailand	50%	0%	50%
Myanmar	26%	13%	61%
Japan	26%	12%	62%
India	21%	5%	74%
Pakistan	12%	12%	77%

5. Source: GSMA Intelligence Consumer Survey 2016, average of 11 surveyed countries

The growth in high-speed network coverage and smartphone adoption is leading to a surge in the use of mobile data in Asia Pacific. Ericsson forecasts that total mobile data traffic will reach 19 EB per month by 2020 – an average annual growth rate of 51% (higher than the global average of 47%). By this time, Asia Pacific will account for just under half of global mobile data traffic, and an average mobile subscriber will consume 6 GB of data per month (a fourfold increase on 2016).

Growth in data traffic is leading to rapid growth in data revenues across the region. On average, data revenues grew by 19% in 2016 to reach $183 billion and 42% of total revenues, up from 34% in 2015 and 21% in 2012.

- China Mobile reported that revenue from data services grew by 30% annually in 2016, representing 63% of total telecoms revenue. In this period, wireless data traffic revenue overtook traditional business revenue (including voice and SMS/MMS) for the first time and became the biggest revenue source for the company.
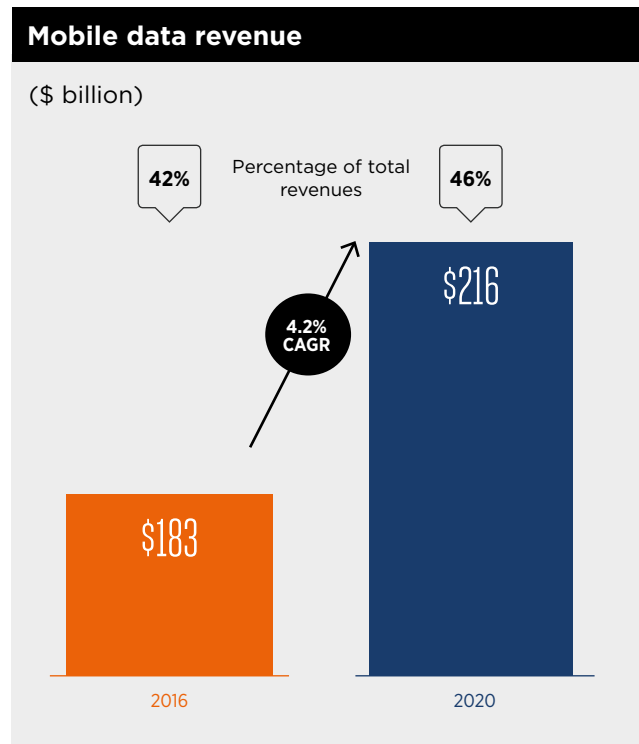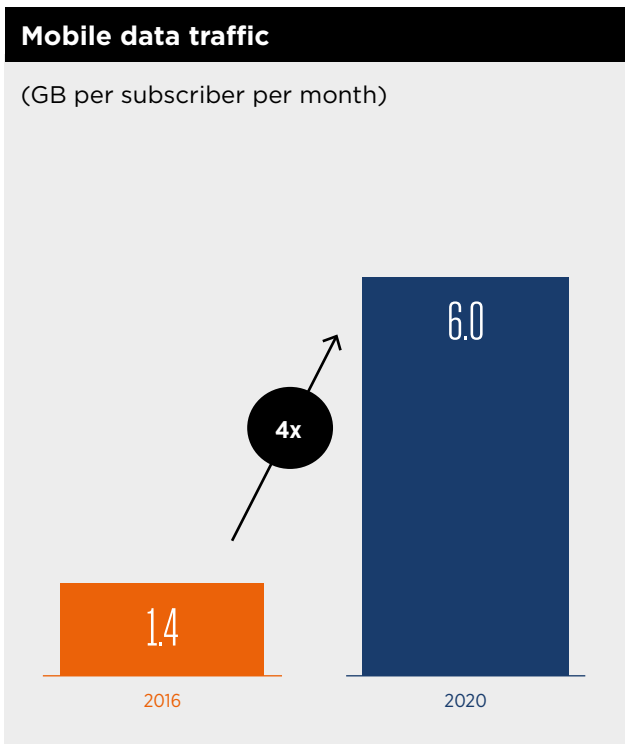
- In Indonesia, XL's U900 strategy (i.e. offering 3G in the 900 MHz band) has significantly improved 3G coverage and quality outside of Java. Coupled with rapid growth in smartphone adoption and data subscribers (an annual increase of 11 percentage points for both in Q4 2016), data revenue grew by 35% in Q4 2016 compared to the same period in 2015, and accounted for 46% of total revenues, up from 30% the previous year.

- In Japan and South Korea, 2016 saw data account for more than half of total revenue for the first time, reaching 52% and 56% respectively. This was due to a large 4G subscriber base (68% and 78% of total connections) and a continuous increase in data usage. KT for example reported that its customers were using an average of 5.5 GB per month in Q4 2016, up from 4.4 GB in Q4 2015 and 3.3 GB in Q4 2014.

As smartphone uptake continues and usage of additional services grows, by 2020 mobile data revenue will have grown by an annual average of 4.2% to $216 billion, accounting for 46% of total revenues.

Figure 6 Source: Ericsson, GSMA Intelligence

Mobile data in Asia Pacific to grow rapidly

Mobile data traffic

(GB per subscriber per month)

4x

6.0 — 2020
1.4 — 2016

Mobile data revenue

($ billion)

42% — Percentage of total revenues — 46%

4.2% CAGR

$216 — 2020
$183 — 2016

1.3.
Revenue and investment trends

Revenue growth in Asia Pacific has slowed sharply in recent years due to declining subscriber growth (particularly in the region's developed markets), increasing competition in certain markets, growing adoption of IP messaging services and a challenging macroeconomic environment. Across the region as a whole, total revenues grew by 3% in 2016, down from 9% in 2013. Key drivers include the following:

- The launch of Jio in India in September 2016, offering cut-price 4G services, put significant pressure on the revenues of incumbent operators: Q4 2016 total revenue in India declined for the first time by 0.1% annually, compared to annual growth of more than 6% for the three quarters previously.

- In Australia, the mobile industry is still 'adjusting' after the decision in the second half of 2015 by the Australian Competition and Consumer Commission to cut termination rates: total revenues declined by 10% annually in 2016.

- In Singapore and the Philippines, total revenues declined by 4.7% and 4.5% respectively in 2016 due to intense competition on data tariffs and the continued cannibalisation of traditional revenue streams by data services.

Looking ahead, the ongoing migration to 4G and growth in data traffic across the region will help offset the decline in traditional revenue (from sources such as voice and SMS). Additionally, Australia will see revenues return to growth, and a number of other markets will contribute to overall growth in revenue, including Bangladesh, Indonesia, Singapore and Thailand.

However, the region faces a challenging climate that will see growth remain in low single digits. Chinese mobile operators for example are facing difficult market conditions that could impact results in the future, including cuts in long-distance call tariffs and the elimination of domestic roaming charges (which generate as much as 10% of net profits), as well as a government push to increase access to high-speed data and reduce charges further. Additionally, new operator launches are expected in several markets across the region, including Myanmar, Singapore and the Philippines, which will increase competition and put further pressure on revenues and margins. Overall, total revenue is expected to grow by 1.7% in 2017, and by an annual growth rate of 2.3% between 2016 and 2020.

Revenue trends in Asia Pacific

($ billion)

| | Total revenue | | Annual growth |

Overall capex in the region fell sharply in 2016, largely due to 4G network rollout in China nearing completion. Chinese capex accounted for more than half the regional total in 2015. By almost halving in 2016 ($23.4 billion compared to $46.2 billion in 2015), this resulted in overall capex in the region declining by a quarter.

Capex levels are likely to stabilise in 2017 and grow modestly to 2020, with mobile operators, particularly in many developing countries in the region, continuing to invest in mobile broadband networks: 71 4G LTE networks are planned to launch across 27 countries over the next few years. Towards the end of the decade, mobile operators in some of the more developed markets are likely to begin investing in preparation for 5G network launches, which could drive an increase in overall capex levels.

2

Mobile contributing to growth, innovation and social development

2.1.
Mobile delivering growth and jobs

The mobile ecosystem consists of mobile network operators, infrastructure service providers, retailers and distributors of mobile products and services, handset manufacturers and mobile content, application and service providers. The direct economic contribution to GDP of these firms is estimated by measuring their value added to the economy, including employee compensation, business operating surplus and taxes. In 2016, the total value added generated by the mobile ecosystem was around $411 billion (or 1.6% of GDP), with network operators accounting for well over half of this.

Figure 8   Source: GSMA Intelligence

Direct GDP contribution of the mobile ecosystem

(2016 $ billion, % 2016 GDP)

246 0.97%	Mobile operators
79 0.31%	Device manufacturing
37 0.15%	Distributors and retailers
31 0.12%	Content, applications and other services
19 0.07%	Infrastructure providers
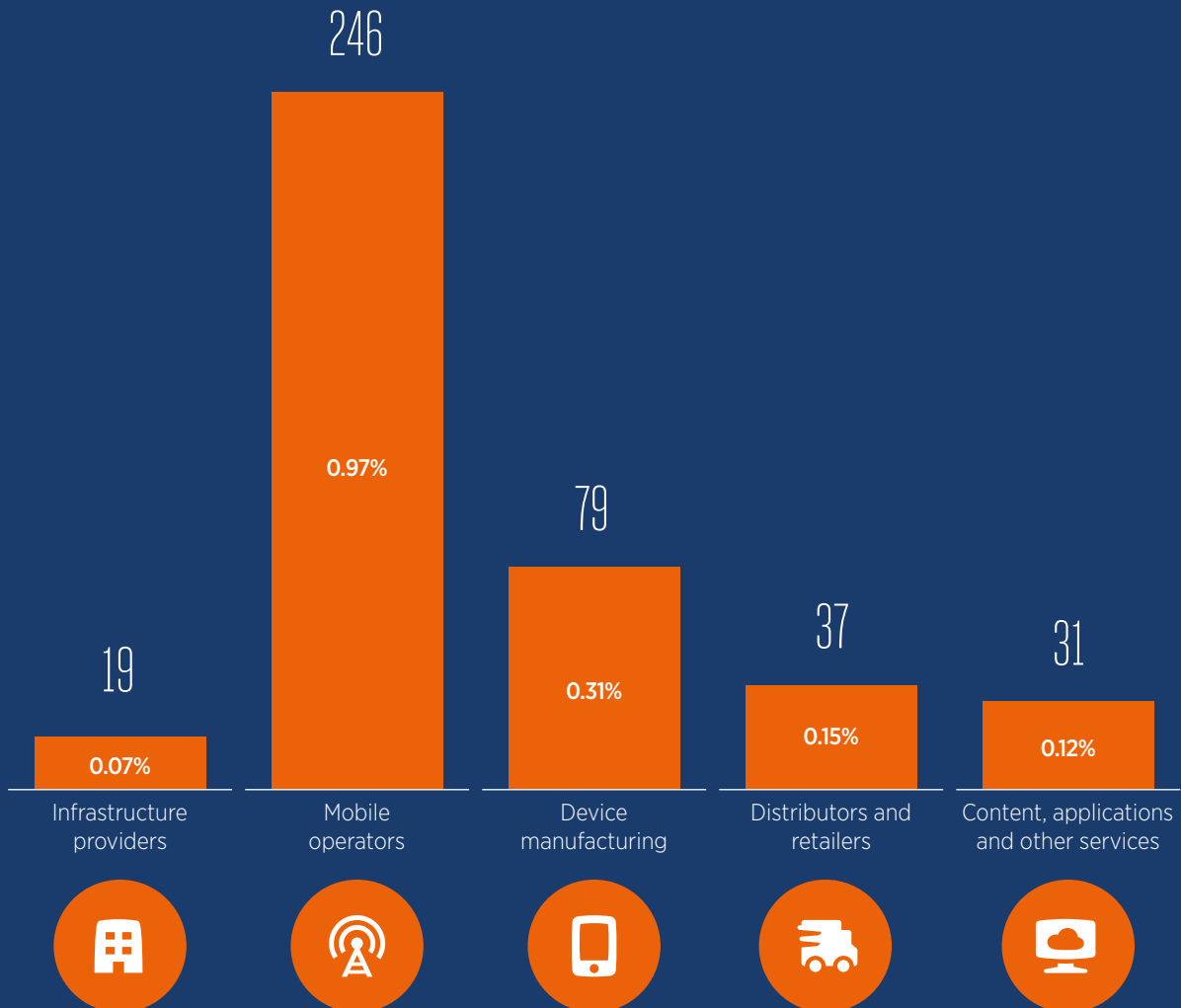
Indirect and productivity impacts of mobile technology

In addition to their direct economic contribution, firms in the mobile ecosystem purchase inputs from their providers in the supply chain. For example, handset manufacturers purchase inputs from microchip providers, and content providers require services from the information technology sector. Furthermore, some of the profits and earnings generated by the ecosystem are spent on other goods and services, stimulating economic activity in those sectors. We estimate that in 2016 this additional economic activity generated a further $142 billion in value add (or 0.6% of GDP) in the region.

The use of mobile technology also drives improvements in productivity and efficiency for workers and firms. There are three ways in which this takes effect:

• The first is the use of basic mobile voice and text services, which allows workers and firms to communicate more efficiently and effectively (for example, reducing unproductive travel time). The majority of countries in Asia Pacific have high levels of market penetration, meaning a large proportion of people benefit from this. However, in some Pacific countries (for example Micronesia and Kiribati) there is still scope to improve productivity in this way.

• The second is the use of 3G and 4G technology, which allows workers and firms to use mobile data and internet services (for example, facilitating improved logistics in services and manufacturing). The impact of mobile internet is particularly significant in developing countries where fixed broadband penetration is relatively low, such as India, Indonesia and Laos.

• The third is the next generation of mobile services, in particular M2M and the Internet of Things. As these technologies become increasingly adopted, we expect them to drive significant benefits via cost savings and efficiency gains in areas such as manufacturing, logistics and retail. As such services are still in the early stages of development, this impact was limited in 2016 but it will grow in the coming years, particularly in countries that are likely to be early adopters of the technology such as South Korea and Japan.

We estimate these productivity impacts were worth around $766 billion in 2016 (or 3% of GDP). Overall, taking into account the direct, indirect and productivity impacts, in 2016 the mobile industry made a total contribution of $1.3 trillion to the Asia-Pacific economies in value added terms, equivalent to 5.2% of the region's total GDP.

Figure 9   Source: GSMA Intelligence

Total (direct, indirect and productivity) contribution to GDP

2016 $ billion, % 2016 GDP

	DIRECT	INDIRECT	PRODUCTIVITY	TOTAL IMPACT
	411	142	766	1,318
	1.6%	0.6%	3.0%	5.2%
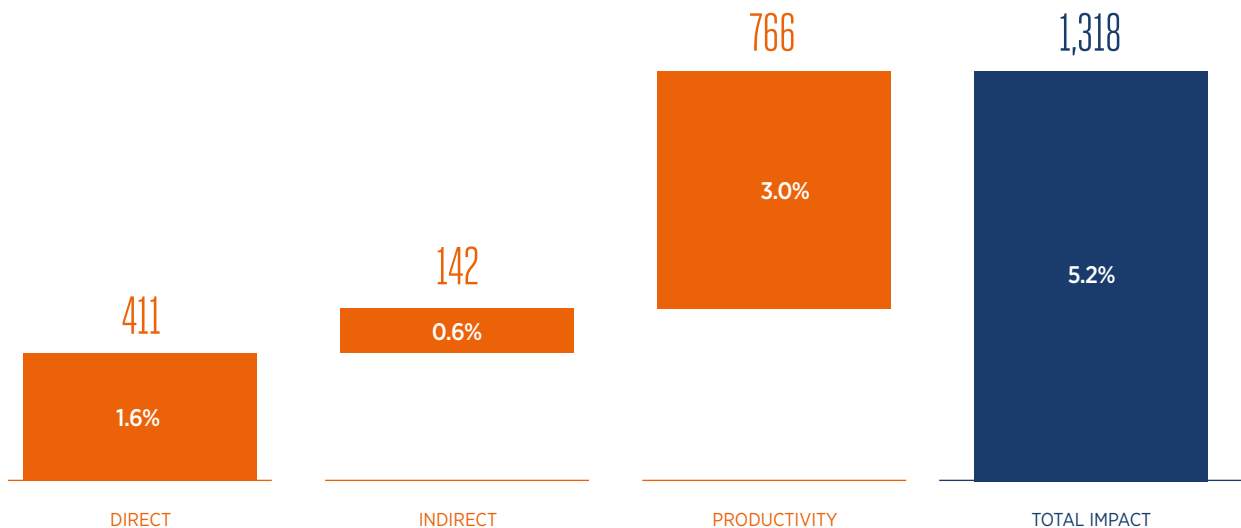
Note totals may not add up due to rounding.

Employment

In 2016 mobile operators and the ecosystem provided direct employment to approximately 6.4 million people in the region. In addition to this, economic activity in the ecosystem generates jobs in other sectors. Firms that provide goods and services as production inputs for the mobile ecosystem (for example microchips, transport services etc.) will employ more indiv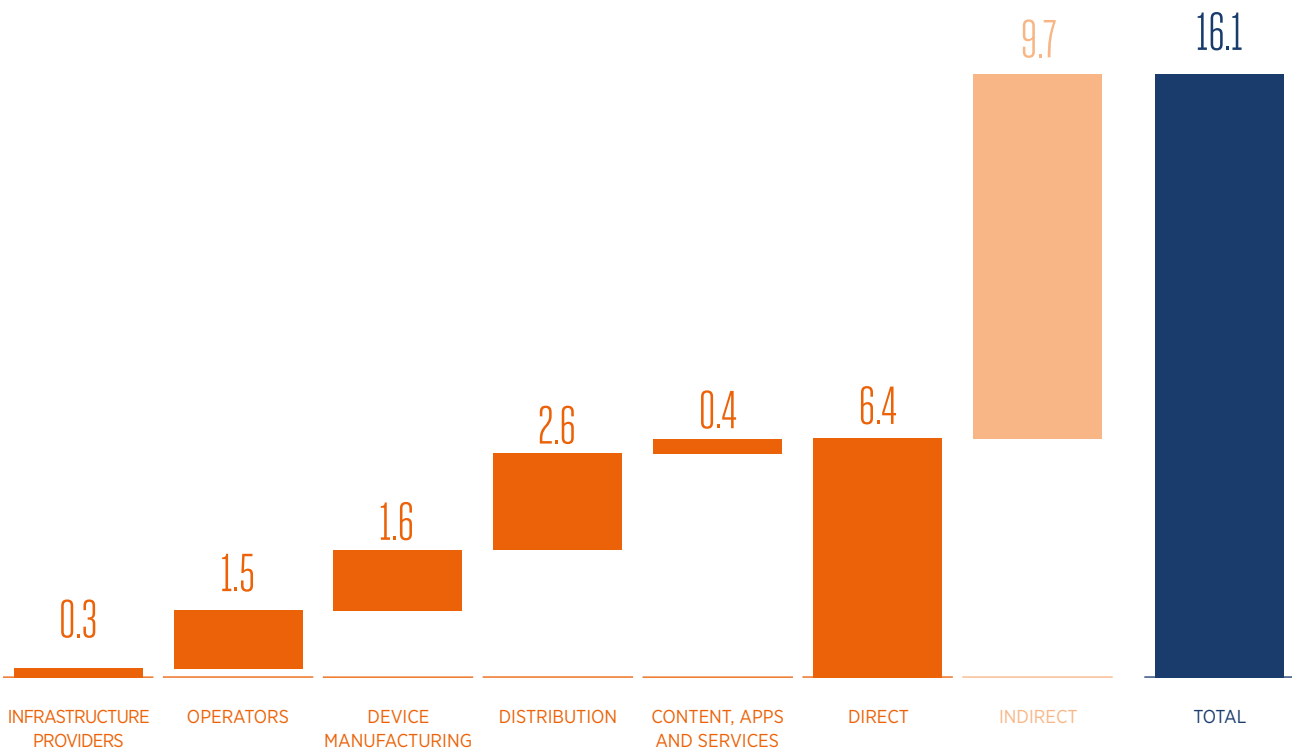iduals as a result of the demand generated by the mobile sector. Furthermore, the wages, public funding contributions and profits paid by the industry are spent in other sectors, which provide additional jobs. We estimate that in 2016, around 9.7 million jobs were indirectly supported in this way, bringing the total impact (both direct and indirect) of the mobile industry to around 16 million jobs.

Figure 10   Source: GSMA Intelligence

Employment impact

Jobs (millions)

INFRASTRUCTURE PROVIDERS	OPERATORS	DEVICE MANUFACTURING	DISTRIBUTION	CONTENT, APPS AND SERVICES	DIRECT	INDIRECT	TOTAL
0.3	1.5	1.6	2.6	0.4	6.4	9.7	16.1

Note totals may not add up due to rounding.

Public funding contribution

The mobile ecosystem also makes a significant contribution to the funding of public sector activity in the region through taxation. For most countries, this includes val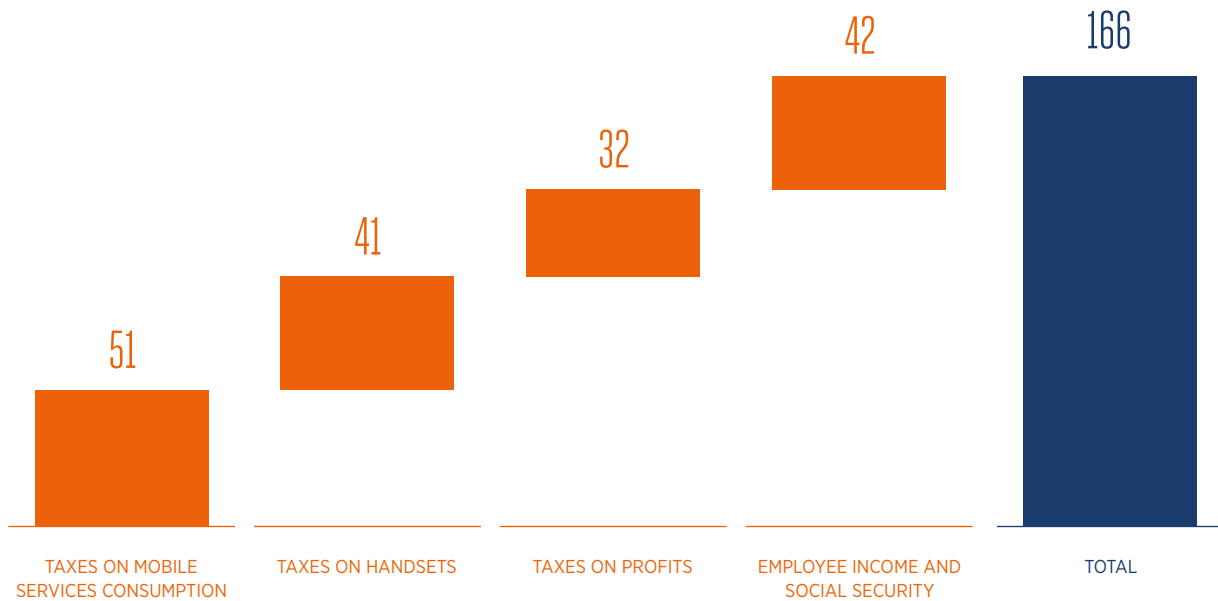ue added tax, corporation tax, income tax and social security from firms and employees. We estimate that the ecosystem made a tax contribution to the public finances of the region's governments of $166 billion in 2016.

Figure 11   Source: GSMA Intelligence

Contribution to public funding

2016 $ billion

51	TAXES ON MOBILE SERVICES CONSUMPTION
41	TAXES ON HANDSETS
32	TAXES ON PROFITS
42	EMPLOYEE INCOME AND SOCIAL SECURITY
166	TOTAL

Outlook and trends for 2016–2020

Going forward, we expect the economic contribution of the mobile industry in Asia-Pacific will continue to increase. In value-added terms, we estimate that the ecosystem will generate around $1.6 trillion by 2020 (5.4% of GDP). Much of this increase will be driven by improved productivity, particularly from the adoption of mobile internet by some of the offline population and also as countries adopt new technologies such as M2M.

2.2
Mobile as the platform for innovation across Asia

2.2.1

The GSMA Global Mobile Engagement Index

The Global Mobile Engagement Index (GMEI) measures the level of engagement of smartphone and non-smartphone users across a range of use cases and services. The higher the score, the more likely consumers are to regularly engage in using mobile services. The Index has been built based on inputs from the GSMA Intelligence annual Consumer Survey, which covers 56 countries worldwide – representing 80% of the global population. It is based on the computation of two scores for each country surveyed:

- **a usage score** – the average number of mobile use cases adult phone owners engage in

- **a frequency score** – how often they engage in the use case on average.

Consumers are divided into four segments based on their mobile engagement levels: 'Aficionados' (early adopters), 'Pragmatists' (early majority), 'Networkers' (late majority) and 'Talkers' (laggards).[6]

Stark contrast in user engagement across Asia Pacific

Asia Pacific is a region of contrasts in terms of the level of mobile user engagement across countries and by developed and developing economies. South Korea has the highest level of user engagement (joint first place with Qatar) of the 56 surveyed countries, while the average GMEI score in developed Asia Pacific markets[7] is 2.6 times greater than those in developing markets.[8] Mobile users in fast-growth mobile markets such as India, Myanmar and Pakistan are among the least engaged. Part of this difference can be explained by varying levels of smartphone adoption: smartphone user engagement is typically twice the level for non-smartphone users in Asia Pacific.

Table 1   Source: GSMA Intelligence

GMEI ranking of countries in Asia Pacific

(ranking of 56 countries surveyed)

Rank	Country	Engagement score
1	South Korea	5.0
7	Australia	4.5
25	Japan	3.0
28	China	2.6
33	Philippines	2.2
36	Vietnam	2.1

Rank	Country	Engagement score
40	Thailand	1.7
44	Indonesia	1.4
50	India	1.1
53	Myanmar	0.8
54	Pakistan	0.8

NB: The score accounts for smartphone and non-smartphone users and is weighted based on unique subscriber penetration

6. For more information, see GMEI 2017: Global Mobile Engagement Index
7. Developed Asia Pacific markets: South Korea, Australia and Japan
8. Developing Asia Pacific markets: China, India, Indonesia, Myanmar, Pakistan, Philippines, Thailand, Vietnam

Among smartphone owners, there is a similar level of user engagement across developed and developing Asia Pacific, albeit with differing use cases. Users in developed markets are typically more engaged in use cases such as financial services, navigation and digital commerce. In contrast, smartphone users in developing Asia Pacific are marginally more engaged in social networking.

Nevertheless, smartphone ownership is not always indicative of higher user engagement; there

are countries with high smartphone ownership where user engagement is low. In Myanmar, which liberalised its telecoms markets in 2014, more than half the population own a smartphone, but their user engagement is well below the developing average. Digital illiteracy and a lack of locally relevant content remain barriers to greater user engagement. The rapid adoption of smartphones in the country has outpaced the development of local content and services that drive high levels of user engagement.

Figure 12

Source: GSMA Intelligence

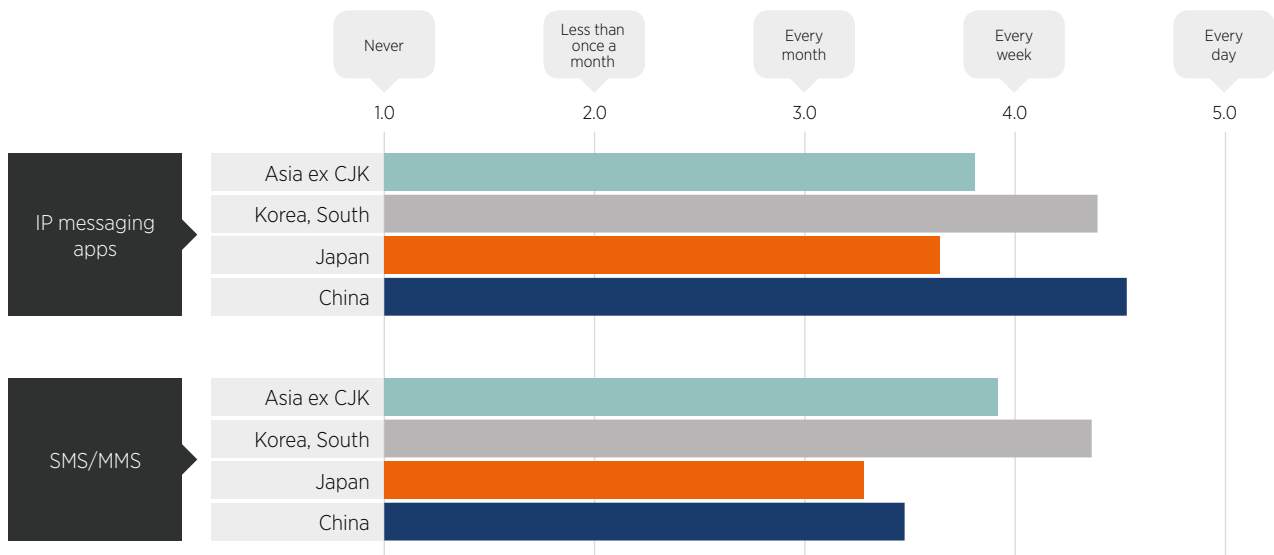## Mobile phone* users in developed Asian markets more frequently engage in a variety of use cases

Developed Asia Pacific

Developing Asia Pacific

FREQUENCY SCORE
1 (never)
5 (every day)
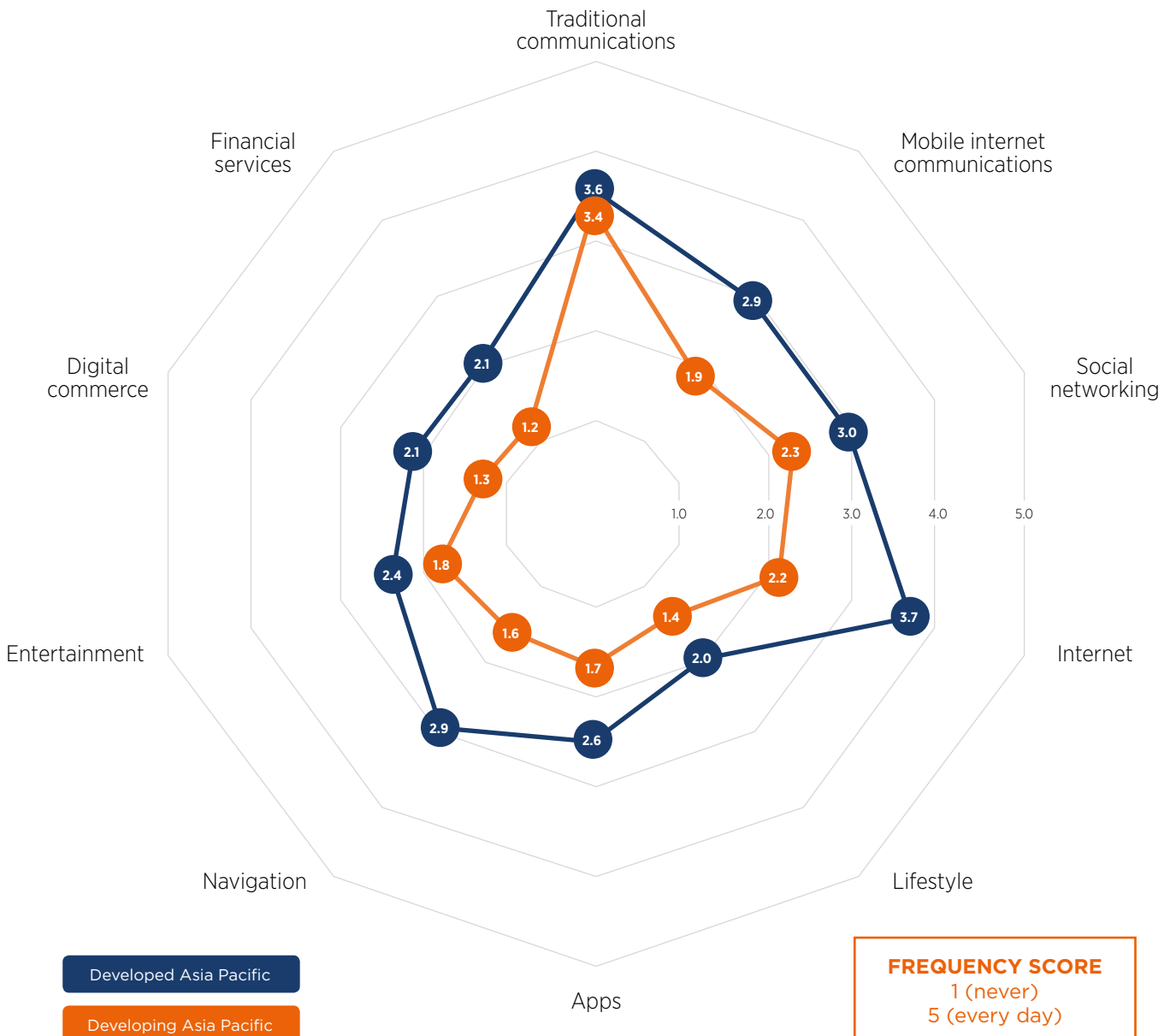
*Includes smartphone and non-smartphone

Smartphone users in China and Korea show high level of engagement with IP messaging

	Never	Less than once a month	Every month	Every week	Every day
	1.0	2.0	3.0	4.0	5.0

IP messaging apps
- Asia ex CJK
- Korea, South
- Japan
- China

SMS/MMS
- Asia ex CJK
- Korea, South
- Japan
- China

There remains rapid uptake in the use of IP messaging platforms in Asia Pacific, with the big three platforms of WeChat (China), Line (Japan) and KakaoTalk (South Korea). Reflecting this momentum, the GMEI shows that, on average, smartphone users in China and South Korea engage in IP messaging at least every week (Figure 13), marginally more frequently than the global average (frequency score of 3.9). In other countries in the region, services are used on average at least every month.

Smartphone users in China show a clear preference for mobile internet communication (including IP messaging, VoIP, email) over traditional forms (voice calls over cellular networks, SMS/MMS messaging), which contrasts with South Korea, where smartphone users are marginally more engaged with traditional communications services. Despite this, South Korea has a much larger proportion of mobile users that are Aficionados (users with the highest level of engagement across all use cases) than those in China, at 29% versus 8% of the user base.

Figure 14   Source: GSMA Intelligence

Country breakdown: percentage of mobile phone owners by segment
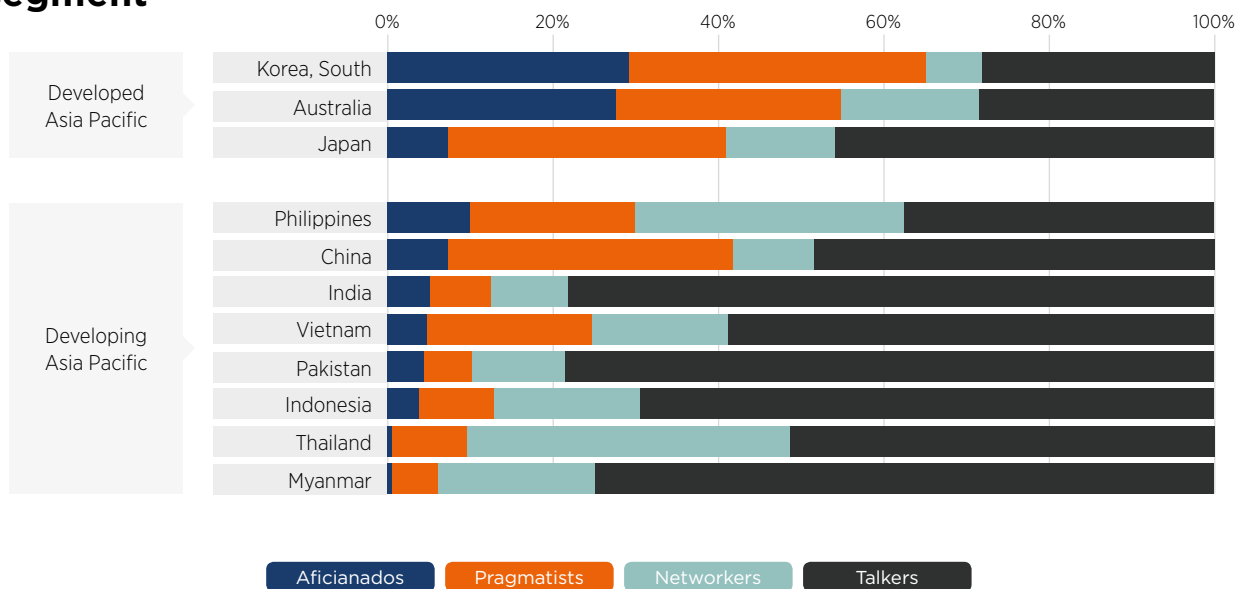
Mobile user engagement in Japan is lower than most developed countries; Aficionados (early adopters) only represent 8% of total mobile phone users. To some extent, this is due to the ageing population in the country, which tends to be less engaged than younger counterparts. However, this effect will lessen over time; as the younger generations transition to older age bands, the proportion of more highly engaged users will increase.

Although there is a direct correlation between age and mobile user engagement in the majority of countries, there are some exceptions. In South Korea, over a quarter of smartphone users are between 51 and 69 years old and these consumers use their mobile phones as much as those aged

between 18 and 34 years old to browse the web, read the news, download apps, get information about products and services, and use navigation apps.

The differences between these two countries can also partly be explained by Japan historically being a feature phone market, with smartphone adoption reaching 54% of total connections by the end of 2016 compared to 80% in South Korea. As well as mobile users in South Korea being more highly engaged, the average number of mobile apps installed is among the highest in the world – at more than 50, which is around 60–70% greater than in Japan.[9]
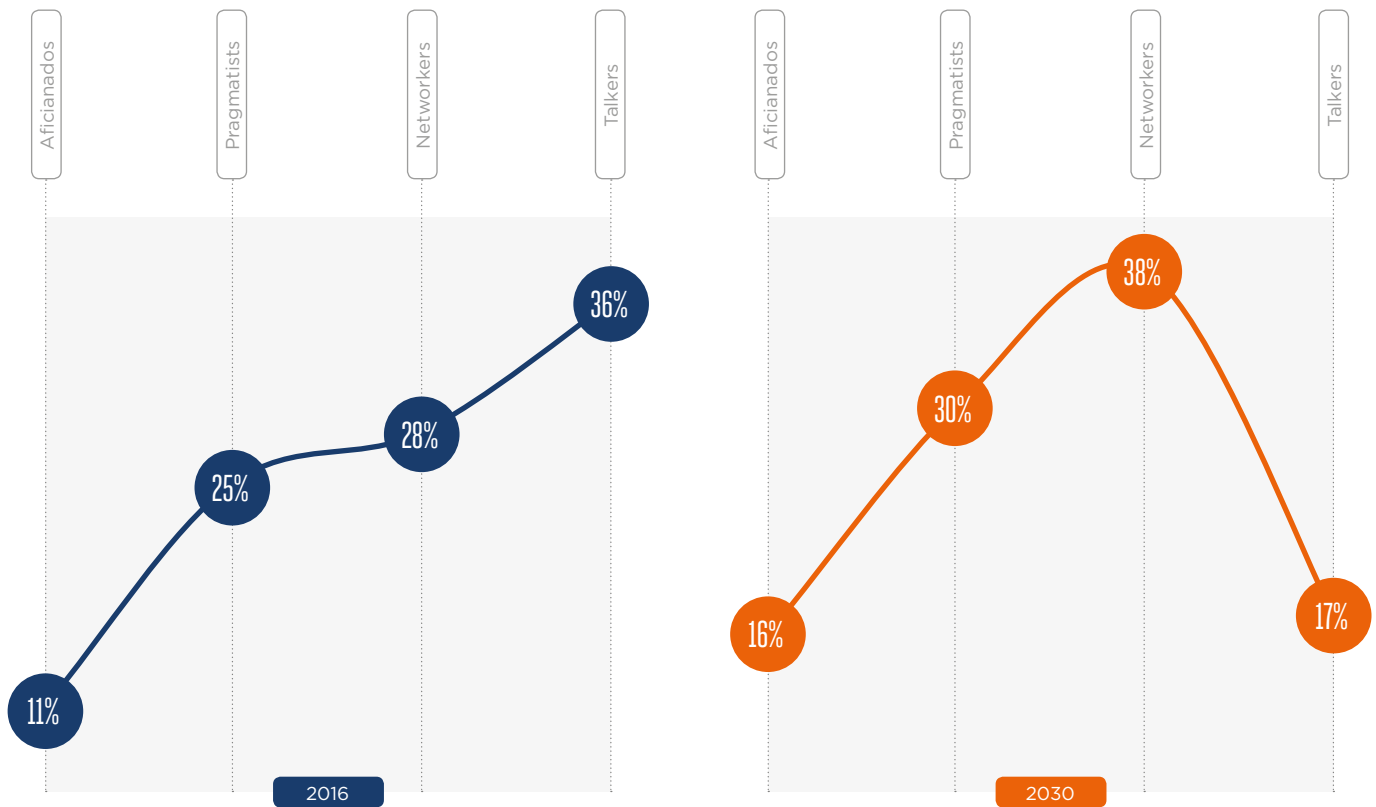
9. Based on analysis of Google's Mobile Apps in APAC: 2016 report

Asia Pacific will undergo the largest shift in consumer behaviour from 'Talkers' to 'Networkers'

Projected change in the segment profile in Asia Pacific

Looking at the Asia Pacific region more broadly, all the developing markets have a majority of users who are classified as 'Talkers' – those who show low usage levels across all use cases with the exception of traditional communications. For 'Talkers', mobile phones are essentially used to place a voice call or send an SMS and are predominantly connected to 2G networks. Nevertheless, most developing markets are rapidly transitioning to greater mobile internet engagement, driven by an array of factors including rising smartphone and 4G adoption,

improved affordability and the regionalisation of online content – particularly in India.

As such, Asia Pacific is forecast to undergo a radical shift in mobile consumer behaviour in the coming years, as its dominant mobile user segment will transition from 'Talkers' in 2016 to 'Networkers' in 2030. Indeed, by 2030, the proportion of consumers who mainly use their phones for voice and text is expected to decrease by 19 percentage points in the region.

2.2.2

Digital commerce in Asia Pacific

Digital commerce refers to everything that facilitates a commerce activity digitally, including access to marketplaces (e.g. e-commerce), services and payments replacing physical cash, and supply chain and distribution.

Digital commerce in Asia Pacific is reaching a tipping point. The region has rapidly become the world's largest retail e-commerce market, driven by the burgeoning economies in China, India, Japan and Korea. Moreover, a combination of market and demographic factors means that e-commerce in the region's developing markets, particularly in Southeast Asia, is primed for rapid growth. A Google study[10] estimates that the total first-hand e-commerce market in Southeast Asia is expected to reach around $88 billion by 2025 (a CAGR of 32%) with the potential to reach up to $120 billion. Given the lack of fixed line access in many of these markets, mobile is often the key access point for the internet; as a result, the share of e-commerce transactions completed through mobile grows ever larger.

However, there are a number of barriers to deal with that will determine the extent and pace of this growth in the coming years. In developing markets, the lack of robust transportation and logistics infrastructure continues to affect the entire digital commerce supply chain, despite considerable investment and a rapidly expanding logistics ecosystem. For example, Southeast Asian ride-hailing company Grab, Uber's biggest rival in the region, has raised more than $1.4 billion to date,[11] including a $750 million equity fundraising led by Softbank in September 2016. Grab currently operates in six markets[12] with plans for further expansion.

Underdeveloped financial infrastructure and lack of access to formal financial services in a number of developing markets mean that the majority of online transactions of physical goods are still completed in cash, with cash on delivery a common payment mechanism (for example, in Indonesia and Thailand). This also partly reflects a lack of consumer trust in the digital experience, with fear of fraud a particular issue.

While dominant players have emerged in some markets (such as Alibaba and JD.com in China), other markets are still developing; as a result, the e-commerce market structure remains highly fragmented in the region. In China, competition continues to heat up in the mobile payments market, and in early 2016 Apple Pay launched in the country. However, the Chinese payments market is still led by Alipay, run by Alibaba's Ant Financial, and Tencent's WeChat. Having scaled in China, Alipay now offers a broad range of financial products, it is rapidly expanding its service across Asia and in the last year moved into European and US markets through partnerships with financial institutions and point-of-sale terminal providers, enabling its base of more than 450 million active users to pay for services at select merchants when abroad.

With social media and messaging platforms such as WeChat and KakaoTalk augmenting e-commerce and payments capabilities, brand and marketing agencies are tapping into the huge distribution channels. Indeed, in 2015, approximately 30% of the volume of all online transactions in Southeast Asia were social sales[13], with the transactions completed through social media sites, blog shops and messaging apps.

10. e-conomy SEA: Unlocking the $200B Digital Opportunity, Google and Temasek, May 2016
11. Crunchbase
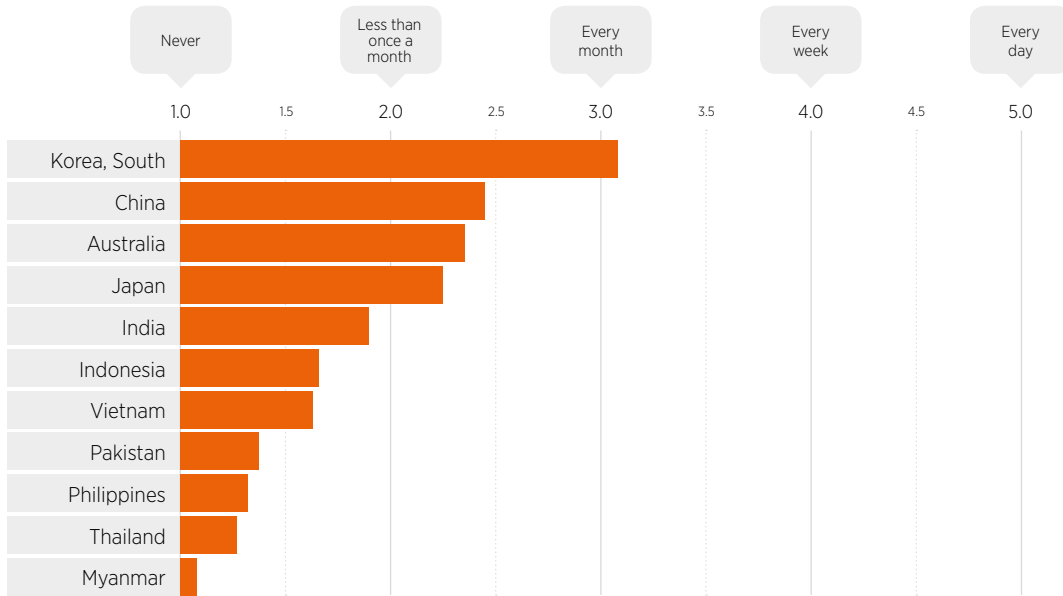12. Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam
13. Can Southeast Asia Live Up to Its E-commerce Potential? Bain & Co, March 2016

Smartphone users in developing markets show less tendency to order and purchase goods online using their mobile phone

Average frequency

The GMEI shows that 47% of smartphone users in Asia Pacific have used their mobile phone to purchase goods and services online. However, mobile user engagement with digital commerce use cases is the second lowest of the 10 use cases included in the GSMA Consumer Survey. Furthermore, there is a sharp contrast in the frequency with which consumers use their phones for these services. In most developing Asian markets, consumers sporadically use their mobile phone for ordering and purchasing goods online – on average less than once per month and often never – whereas in highly engaged countries such as South Korea, this is closer to every month on average.

The mobile operator role in digital commerce

Mobile operators are playing a key role in enabling the digital commerce opportunity in the region by providing access to digital services, facilitating digital payments and user authentication, and accelerating the digital commerce ecosystem through partnerships with service providers and financial investments. The rise of the mobile money ecosystem in the region has played an important role in improving financial inclusion. For example, between 2011 and 2016 active mobile money accounts in South Asia grew nearly 30-fold to just over 40 million, while in 2016 40% of all new registered mobile money accounts were from South Asia.[14]

With a growing number of government-supported digital identity initiatives in the region (for example in India, Pakistan, Singapore and Thailand), these accounts can increasingly be used to support digital commerce and the delivery of services. As a result, mobile operators can play an important role in supporting these initiatives given their strong position in the ecosystem and given that they retain a high level of trust among consumers. For example, the GSMA-backed user authentication

solution Mobile Connect enables mobile phone users to create a universal identity that will securely and safely allow them to access mobile and digital services.

Meanwhile, a number of operators in the region have set up e-commerce marketplaces and payment gateways to take advantage of the digital commerce opportunity. For example, SK Telecom's subsidiary SK Planet operates 11st, an online marketplace and the leading mobile commerce platform in South Korea.[15] Through a combination of the 11st mobile commerce platform, its loyalty programme (OKCashbag) and mobile wallet (Syrup Wallet), SK Planet is capitalising on the rise of online-to-offline commerce. Syrup Wallet augments advanced technologies such as Bluetooth low energy (BLE) and geo-tagging, which enables a more tailored in-store customer experience and offers rewards when customers enter a participating retail store that uses BLE beacons. More recently 11st introduced Baro – a chatbot that uses deep learning algorithms to help customers find the right item through its online commerce store – akin to a digital personal shopper.

14. State of the Industry Report on Mobile Money: Decade Edition 2006-2016, GSMA, February 2017
15. SK Planet also runs marketplaces in Turkey, Indonesia, Malaysia and Thailand

2.2.3

Supporting the development community

New and innovative digital players have often been successful in capitalising on the rapid growth of the digital ecosystem, capturing the opportunity at a faster pace, and even cannibalising some of the mobile operators' value-added services. This has led mobile operators to realise that collaboration efforts with tech start-ups are essential to their own development, allowing them to:

- drive user acquisition and retention by enhancing their product offering

- create new avenues of ARPU growth beyond access revenues

- improve customer engagement and customer satisfaction by modernising touchpoints and providing more relevant services to their customers

- generate cost efficiencies through digitisation of the core telecoms business.[16]

Additionally, in a virtuous circle, such collaboration is helping scale innovative and sustainable mobile services in emerging markets. By supporting innovators to secure the funding and direction they require, mobile operators are helping bring the most impactful mobile solutions to the people and places that need them most, and generating the greatest socioeconomic impact.

The development community is increasingly using mobile technology to deliver various initiatives and programmes across the region, and the mobile industry is helping in three ways: funding, either directly through corporate venture capital or via innovation funds; tech hubs and accelerator programmes; and APIs.

Funding

Recent years have seen a significant rise in mobile operators seeking to invest in start-ups to accelerate innovation and protect themselves from disruption. While most activity has been concentrated in developed markets, mobile operators in emerging markets have realised the potential of such investments: in 2015 alone, telecoms operators invested $3.2 billion in tech companies in emerging markets.[17]

- As part of a strategic partnership, Philippine telecoms operator PLDT invested €333 million ($445 million) in Berlin-based global incubator Rocket Internet, the largest and fastest growing retail e-commerce player outside the US and China, in August 2014. Rocket's e-commerce brands in Southeast Asia include Zalora and Lazada: the latter was acquired by Alibaba in early 2016, which purchased a $1 billion stake in the business for a foothold in the Southeast Asian market.

- Telkom Indonesia's venture arm, Metra Digital Innovation (MDI) Ventures is a $200 million fund with investments that include 'seven figures'[18] for Red Dot (an online payments company based in Singapore) and $25 million for 10 Indonesian start-ups during 2016.

- The GSMA Ecosystem Accelerator Innovation Fund[19] aims to build collaboration between start-ups and mobile operators, helping operators overcome challenges innovating in emerging markets, and start-ups overcome challenges preventing them from scaling. Supported by the UK Department for International Development, the first round of funding resulted in support for two start-ups from the Asia-Pacific region: Ruangguru, an education start-up from Indonesia, and payment platform eSewa from Nepal. The second round of funding will begin in June 2017.

16. Building synergies: How mobile operators and start-ups can partner for impact in emerging markets, GSMA, January 2017
17. Corporate venture capital: An opportunity for mobile operators and start-ups in emerging markets, GSMA, October 2016
18. Amount undisclosed
19. www.gsma.com/eainnovationfund

Tech hubs and accelerators

Tech hubs, incubators and accelerators provide start-ups with business support and services to help them scale, usually by facilitating access to critical resources such as skills, funding, technology, business network and digital tools. The GSMA has identified 287 active tech hubs, incubators and accelerator programmes across 13 countries in South and Southeast Asia, with India, Indonesia, Pakistan, Vietnam and Thailand particular hotbeds of activity.[20] Examples include the following:

• Telenor has numerous accelerator programmes across Asia, including Myanmar Accelerate, dtac Accelerate in Thailand, GP Accelerator in Bangladesh, Telenor Velocity in Pakistan and Digi Accelerate in Malaysia. As a specific example of successful collaboration, Telenor Velocity in Pakistan partnered with health start-up DoctHERs, which connects marginalised communities to health services via video consultation, while re-integrating female health professionals into Pakistan's medical workforce.

DoctHERs leverages Telenor's data analytics and consumer profiling capabilities to pinpoint the best locations for the teleclinics, and can reach customers through Telenor's location-based SMS services.

• In February 2017, Indosat Ooredoo's accelerator Ideabox announced three winners of its start-up bootcamp: Andalin, a service to help small and medium-sized enterprises deal with import and export customs; Ayo Slide, a mobile marketing platform that allows brands to advertise on users' lock screens; and Sevva, a rental marketplace platform. These start-ups will receive $50,000 of early-stage funding, mentoring with local and international mentors, access to an investor network, and a dedicated facility for the 120-day duration of the programme. They will also receive support from Ideabox partners, such as $80,000 worth of marketing credits from Facebook and $120,000 worth of IBM cloud infrastructure.

APIs

Application program interfaces (APIs) are bridges between mobile operators and start-ups that launch mobile services, allowing third parties to use certain mobile network functions within their applications, such as messaging, billing, location or mobile money to provide mobile services to their end users. For example, a start-up can offer SMS-based localised content to its users depending on their city or area, and then charge them by deducting the amount from their mobile airtime. Such a service would leverage three operator APIs simultaneously: SMS, location and direct operator billing. In emerging markets, where mobile operators are the main enablers of the digital economy, operator APIs are a powerful channel for unlocking creativity and giving the start-up ecosystem a boost.

• In the Philippines, Globe Labs, launched in 2008 (one of the first API programmes among emerging market operators), offers access to five types of API: SMS, location, billing, voice, and identity (through GSMA's Mobile Connect). One start-up using the APIs is Bustayo, a mobile web app launched in February 2016 that allows

users to book bus tickets and pay a reservation fee using their prepaid airtime (using Globe Labs' charging API). Users automatically receive a confirmation SMS (using Globe Labs' SMS API) and can collect their ticket from the bus terminal on the day of the trip, paying the bus operator directly.[21]

• In Sri Lanka, Dialog's Ideamart was created in 2012 with access to SMS, USSD, billing, location, subscription and IVR APIs via its self-service portal Idea Pro. In May 2016, Dialog announced that Ideamart was going to power Google's I/O Extended event for the next three years. As another example, Online Cabs is a mobile-based taxi booking service in Colombo, Sri Lanka, which has partnered with Ideamart to integrate its USSD, SMS, and location APIs. Users without a smartphone can book a taxi using either the USSD or SMS option. Their location is then automatically shared with the driver through the location API. The booking fee can then be deducted directly from the user's mobile airtime through the charging API.[22]

20. A few things we learned about tech hubs in Africa and Asia, GSMA, August 2016
21. The power of mobile operator APIs in emerging markets, GSMA, February 2017
22. APIs: A bridge between mobile operators and start-ups in emerging markets, GSMA, July 2016

2.2.4

Mobile underpinning development of smart cities

With one of the highest urbanisation rates in the world, Asian cities are increasingly congested: their transport and energy networks are under ever-increasing pressure. Consequently, they are facing pressing and complex challenges in the battle to improve the living standards of their citizens, such as reducing pollution and mitigating the consequences of climate change, and more efficiently managing the city's economic resources.

City managers and local government decision-makers can address these challenges and generate significant social and economic benefits for their citizens and businesses through well-conceived, designed and implemented smart city services. For example, lives can be saved with IoT monitoring technology enabling faster emergency services response; damage caused by flooding can be avoided or minimised; fuel costs and carbon emissions can be reduced through efficient smart transport networks; and smart metering and smart building plans can generate energy savings of hundreds of GWh in large Asian metropolises.

Examples of such developments include the following:

- StarHub in Singapore has deployed a service called Grid 360 that allows the city to analyse different data sets, including aggregated and anonymous geo-location data, to understand crowd densities, travel patterns and the

group profile of traveling crowds. The insights are offered as an API service that both the government and public transport operators can use to understand how crowds move through the transport network.[23]

- Mobile operator FarEasTone has introduced the cellular vehicle probe (CVP) system in Taiwan, which monitors congestion by anonymously tracking mobile users using data communications among base stations. The information is then used to dynamically fine-tune traffic signal timings or identify how best to change road layouts.[24]

Mobile networks can support smart city deployments that are secure, scalable and robust. Mobile IoT networks are uniquely positioned to securely connect various sensors across cities and can support low power wide area (LPWA) technologies. These offer low power consumption, low module costs, optimisation for brief messages typical of IoT applications, good coverage, scalability, security, easy maintenance and integration with unified IoT platforms.

The GSMA report *Maximising the Smart Cities Opportunity: Recommendations for Asia-Pacific policymakers* identifies seven key recommendations for municipalities in the region looking to implement smart city solutions.

23. Singapore: Traffic Management case study, GSMA, September 2016
24. GSMA Smart Cities Guide: Traffic Management, GSMA, December 2016

Shanghai smart city

Shanghai is an important historical port city and now the hub of economy, finance and trade in China. It has a population of 24 million, a GDP per capita twice that of China's average, and a growing ICT sector that contributes around half of the city's economic output. With very high population density and a relatively developed economy, the city of Shanghai aims to explore new approaches to economic development, one of which is in the creation of a smart city.

Initiated in 2010, Shanghai's smart city development has so far been implemented in two phases. The first, between 2010 and 2013, focused on broadband and wireless infrastructure development, during which 98% of the city population was connected by 3G and 4G networks, and city-wide free WLAN was deployed in more than 900 key areas such as airports, bus stations, and business & cultural centres. The second phase, running to 2016, focused on the promotion of the smart city via the LIVE Shanghai Campaign, which aimed to raise awareness of the benefits of four aspects of the smart city:

1. **Smart living:** the application of ICT to the everyday lives of the city's population, in areas such as health, education, care of the elderly and transportation. For example, a clinical diagnosis and treatment system has been set up between all key hospitals and primary medical service centres in Shanghai, which uses dynamically updated medical records allowing doctors to see their patients' medical histories and citizens to access their own health information via the internet. Meanwhile, using a mobile app, citizens can check the status of around 950 bus routes and 200 downtown parking spaces to help with their daily commute.

2. **Smart economy:** the development of the industrial internet and new ICT-related business sectors around e-commerce, internet-based finance, the sharing economy and cyber-based mass entrepreneurship.

3. **Smart city management:** using ICT services to improve city planning, resource management, environment protection and public security.

4. **Smart governance:** creation of one-stop e-government services for both citizens and businesses.

The third phase, which will run until the end of the decade, will aim to enhance existing ICT infrastructure with new technologies such as 5G, SDN and NFV, IoT, big data and cloud computing.

2.3
Mobile addressing social challenges

2.3.1

The GSMA Mobile Connectivity Index

Digital technology is evolving rapidly, leading to the emergence of new services and applications that are transforming the way people live, work, play and communicate. The large-scale societal adoption and use of digital technologies is a key driver of measurable economic, social and cultural value, including increased productivity, a rise in employment rates, improved security, and greater capacity to tackle social and environmental issues.

The penetration of the mobile internet in Asia Pacific has doubled over the last five years, reaching 48% of the population by the end of 2016. By the end of the decade, an additional 600 million people are expected to gain access to the mobile internet across the region, bringing the total to 2.6 billion, and accounting for just over 62% of the population.

However, despite the impressive progress, this will still leave a huge digital divide in many parts of Asia Pacific, particularly in the developing countries. Across the region, there are 2 billion people – half of the population – without access to the mobile internet. In order to understand the reasons behind this connectivity gap, the GSMA Mobile Connectivity Index measures how the key enabling factors for mobile connectivity differ across markets, helping focus the efforts and resources of the mobile industry and wider international community on the right projects in the right markets at the right time, so progress towards universal connectivity can be as swift and economically sustainable as possible.[25]

Figure 17   Source: GSMA Intelligence

The Mobile Connectivity Index in Asia Pacific

Leaders

Fast transitioners

Transitioners

Emerging

Discoverers
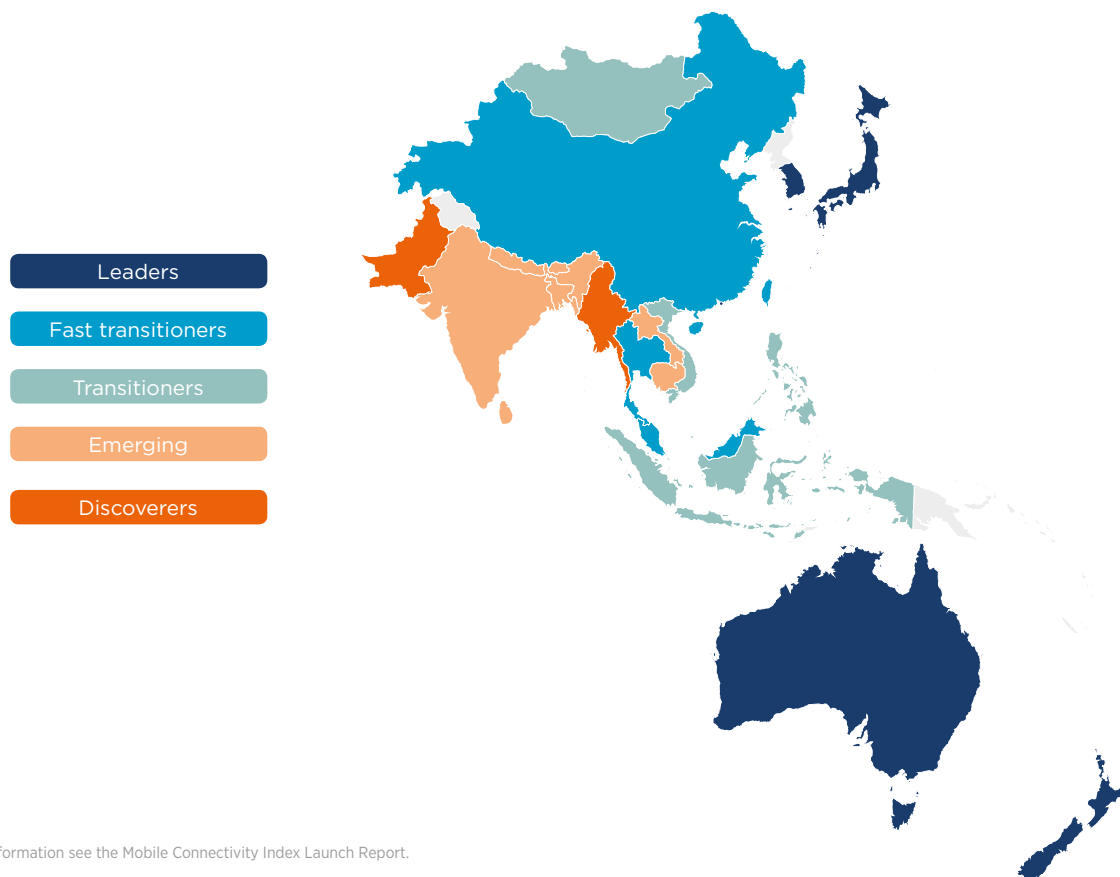
25. For more information see the Mobile Connectivity Index Launch Report.

The index is built around four key enablers of mobile internet connectivity, which are critical to creating the right conditions of supply and demand for mobile internet connectivity to flourish.

- **Infrastructure:** the availability of high-performance mobile internet network coverage

- **Affordability:** the availability of mobile services and devices at price points that reflect the level of income across a national population

- **Consumer readiness:** citizens with the awareness and skills needed to value and use the internet and a cultural environment that promotes gender equality

- **Content:** the availability of online content and services that are accessible and relevant to the local population.

The Asia Pacific region is unique in its diversity, in that it is home to countries that sit in every cluster of the Connectivity Index. From Australia, a 'Leader' country with the highest Index score of any country globally, to the 'Discoverer' countries Myanmar and Pakistan that sit towards the bottom of the global ranking. Of the 2 billion unconnected across Asia Pacific, the vast majority (85%) live in five countries – India, China, Indonesia, Pakistan and Bangladesh. Each of these countries faces challenges around the four key enablers of mobile internet connectivity.

Table 2   Source: GSMA Intelligence

Factors behind the connectivity gap

	Mobile Connectivity Index	Infrastructure	Affordability	Consumer readiness	Content	Mobile Internet penetration	Unconnected population (m)
Asia Pacific	56	48	66	69	50	50%	2,029
China	61	43	69	72	65	67%	453
Indonesia	54	40	69	69	44	40%	156
Bangladesh	41	33	56	52	30	33%	109
India	38	25	58	43	33	35%	871
Pakistan	34	23	55	25	41	31%	134

Many countries in Asia Pacific face issues around infrastructure, and this is a key factor behind the large connectivity gap in the region. The challenges, however, differ from market to market:

- **Low 2G coverage:** Idea Cellular in India and Jazz Pakistan have reported 2G population coverage of only 83% and 80% respectively, well below the 95% that most countries exhibit.

- **Low 4G coverage:** in Indonesia, Pakistan and Bangladesh, only around 50%, 35% and 4% of the population have access to 4G services respectively (the regional average is 75%).[26]

- **Spectrum issues:** all five countries have still not completed the digital switchover process, and are therefore yet to allocate spectrum in the digital dividend band (700 MHz) to mobile services. This band is key to bringing affordable 4G mobile broadband services to all parts of Asia Pacific – from urban centres to rural villages. These countries, as well as many others across the region, are now at a disadvantage when it comes to supporting rapidly growing mobile broadband uptake and usage as well as advanced 4G, and in future 5G, services.

Affordability is generally less of an issue in these countries compared to the regional average, given that ARPU levels are relatively low (Bangladesh, India, Indonesia and Pakistan have among the lowest ARPU levels in the world), and smartphones are available for less than $50. However, due to the wide income distribution and high poverty rate in some of these countries, particularly in India and Pakistan, affordability is a critical issue for those at the bottom of the pyramid, for whom mobile ownership can account for as much as a fifth of their average income.

Without the necessary skills and supporting cultural environment, individuals will not understand how to use the mobile internet or appreciate how it can benefit them. Individuals, especially women, might also find themselves prevented from accessing the mobile internet. It is therefore important to consider the skills and education levels of a country, as well as the degree of gender equality in education, finance and in the labour market: these factors influence

the 'Consumer readiness' indicator of the Mobile Connectivity Index.

India and Pakistan have particular challenges in this regard, where the literacy rate is between 55% and 70%, and only half the population have at least some secondary education or participate in the labour market. Further, gender inequality is a particular issue in these countries: female literacy is between 40% and 60%, the male to female ratio of secondary education is nearly 2:1, and female labour force participation is below 25%.[27] As for digital literacy, 40% and 50% of mobile phone owners who don't use the mobile internet in Pakistan and India respectively state that they have trouble understanding how to use a mobile handset.[28]

Finally, content is another major issue, particularly in India and Bangladesh. In India, which has 23 official languages and around 100 other major languages[29], availability of content in the local language is a particular issue: just under half of mobile phone owners state a lack of content in their own language as a reason why they do not use the mobile internet.[30] Additionally, the Index highlights that of the top 100 apps available in the country, only around a quarter are accessible (i.e. available in local languages). In Bangladesh meanwhile, the Mobile Connectivity Index points to a low proportion of ccTLDs (country code top-level domains), indicating a low level of domestic website creation, and similar to in India, only a third of the top 100 apps are available in local languages. Further, engagement in social media is low in India and Bangladesh, with only 13% of the population in both countries using social networking services on their mobile phones. This is compared to 34% on average across Southern Asia, and 57% in China.[31]

China outperforms the regional average in most indicators except for infrastructure, where network quality and performance are issues. However, despite its relatively high mobile internet penetration, China is still home to the second largest population of unconnected individuals given the total population of almost 1.4 billion; every percentage point increase in mobile internet penetration will connect an extra 14 million people.

26. While India scores low on the Infrastructure indicator, 4G networks have since been rapidly rolled out reaching over 80% of the population. This will have a positive impact on the country's Infrastructure and overall index score.
27. World Bank
28. GSMA Intelligence Consumer Survey 2016
29. Census of India 2001
30. GSMA Intelligence Consumer Survey 2016
31. We Are Social

2.3.2

Realising the UN Sustainable Development Goals

The GSMA and mobile operators are united in support for helping achieve the UN's Sustainable Development Goals (SDGs) in Asia Pacific. Mobile is already playing a key role in tackling various social and economic challenges around poverty, health, education, gender equality, employment, safer cities, climate change and identity.

1 NO POVERTY

No poverty
End poverty in all its forms everywhere.

MOBILE OPERATOR INITIATIVES

The contribution that the mobile industry makes to economic growth has been highlighted in a number of international studies; for example, The World Bank found that a 10% increase in mobile penetration is associated with a 1.35% increase in GDP for developing countries.[32]

CASE STUDY

Khushaal Zameendar, Pakistan

Telenor Pakistan launched its Khushaal Zameendar (Prosperous Landlord) mobile agriculture service in December 2015. The service is now empowering more than 2 million farming households by improving access to timely and actionable information for sustainable impact through better yields and increased income for the rural family. The service offers access to agricultural advisory information via IVR, SMS and twice-daily outbound alerts.[33]

3 GOOD HEALTH AND WELL-BEING

Health
Ensure healthy lives and promote well-being for all.

MOBILE OPERATOR INITIATIVES

Mobile is having a profound impact on the healthcare industry. With more than 1,200 initiatives deployed to date, mobile health initiatives are delivering health services to people and places previously unreached, providing healthcare to those who need it most.

CASE STUDY

Mobile Obstetrics Monitor, Indonesia

In January 2016, Philips and Telekom Indonesia signed an agreement with Sijunjung Regency in West Sumatra, Indonesia, for full-scale commercial implementation of its Mobile Obstetrics Monitoring (MOM) telehealth service in the region. MOM is a software solution (app-based, delivered via smartphone) for community healthcare workers. Patients don't need to use the app. It is designed to help reduce maternal mortality rates through early monitoring and risk stratification.

32."Economic impacts of Broadband" in Information and Communications for Development: Extending reach and increasing Impact, Qiang and Rossotto (with Kimura), 2009
33. Telenor Pakistan uses Data Science and Analytics to boost mAgri uptake, GSMA, October 2016

4 QUALITY EDUCATION

Education
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

MOBILE OPERATOR INITIATIVES

Mobile operators are working to help students and teachers integrate mobile technologies into the classroom. Mobile also enables access to greater learning opportunities for youth in urban hubs and remote locations.

CASE STUDY

Connect To Learn, Myanmar

Connect To Learn is a public-private venture with a range of partners. Some 21,000 students will benefit in the first two years, of which more than half are girls. The initiative aims to improve access to the internet, deliver teacher training and enable students in Myanmar to experience a 21st century education. This scheme aims to make a significant difference in a country where only 54% of secondary school-aged children are enrolled at a school, according to the World Bank.[34]

5 GENDER EQUALITY

Gender equality
Achieve gender equality and empower all women and girls.

MOBILE OPERATOR INITIATIVES

200 million fewer women than men own mobile phones in low- and middle-income countries. The mobile industry is working to close this gender gap and deliver socioeconomic benefits to women, such as increased access to financial, health, education and employment services.

CASE STUDY

Project Sampark, India

In India women are 36% less likely than men to own a mobile phone. Project Sampark is a Telenor-led strategy to address this by overcoming the cultural barriers that stop women accessing mobile technology and services.[35]

34."Connect To Learn takes significant step toward reaching 21,000 students in Myanmar", Ericsson, January 2016
35. Uninor: Project Sampark, GSMA, July 2015

8 DECENT WORK AND ECONOMIC GROWTH

Employment
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

MOBILE OPERATOR INITIATIVES

The mobile industry creates jobs directly and indirectly through accelerating economic growth and enabling innovation.

The internet is the most important enabler of social development and economic growth of our time. Mobile connectivity is the primary method for connecting to the internet today and is a key driver of innovation.

CASE STUDY

Govi Mithuru, Sri Lanka

Seventy percent of the population in Sri Lanka live in rural areas and their main livelihood is agriculture. Dialog Sri Lanka's Govi Mithuru (Farmer's Friend, Uzavar Tholan in the Tamil language version) is an agriculture VAS commercially launched in October 2015. Farmers receive around five calls per week with timely advisory regarding land preparation, sowing, fertiliser management and pest control as well as information on family nutrition and healthy living. By December 2016, the service had acquired more than 250,000 registered users.[36]

11 SUSTAINABLE CITIES AND COMMUNITIES

Sustainable cities
Make cities and human settlements inclusive, safe, resilient and sustainable.

MOBILE OPERATOR INITIATIVES

Asia Pacific is the world's most disaster-stricken region, affected frequently by hydrological (e.g. floods, droughts, typhoons) and geophysical (e.g. earthquakes) disasters.

Mobile networks and the connectivity they provide can be a lifeline for those affected by natural disasters and other humanitarian emergencies. They are vital to facilitating access to information and coordinating assistance within affected populations and among governments, first responders and the international humanitarian community.

CASE STUDY

Extreme weather tracking, Taiwan

As part of a government initiative to improve its extreme weather response, the national Water Resource Agency (WRA) is working with the city of Tainan and mobile operator FarEastTone to improve flood control and disaster recovery.

By combining LTE mobile technology with advanced monitoring devices and surveillance technologies, the WRA and other agencies have better visibility of events as they unfold and are in a better position to plan and respond accordingly.[37]

36. Dialog Sri Lanka – putting farmers at the core of service design, GSMA, March 2017
37. Maximising the Smart Cities Opportunity: Recommendations for Asia-Pacific Policymakers, GSMA, May 2017

13 CLIMATE ACTION

Climate action
Take urgent action to combat climate change and its impacts.

MOBILE OPERATOR INITIATIVES

The mobile industry supports the development and support of IoT-facilitated environmental monitoring that enables governments and institutions to collect data critical to the management of climate change. The industry also contributes as a provider of emergency broadcasting systems that provide early warning for climate-related events, strengthening resilience to climate-related hazards and natural disasters.

CASE STUDY

Ericsson Connected Mangroves, Malaysia

Today, around half of Malaysian mangroves have been destroyed, which has caused coastal areas to be unprotected from environment risks. Connected Mangroves combines mobile, IoT and cloud technologies in a world-first project where mangroves are being monitored in real-time, enabling better management of new sapling growth.[38]

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Identity
Provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

MOBILE OPERATOR INITIATIVES

In Asia Pacific, around 850 million people (20% of the population) are estimated to be unregistered, including around 65 million children under the age of five.[39] Given its high global penetration levels and high population coverage, mobile technology has the potential to be leveraged as a trusted and robust digital identity solution for the underserved, leading to greater social, political and economic inclusion, and making individuals more visible to their governments where it matters most. Mobile-enabled digital identity solutions remove the need for individuals to travel to registration centres and can allow for much more efficient registration processes, while mobile operators are able to utilise their extensive networks of retail and distribution agents.

CASE STUDY

Birth registration, Pakistan

Telenor, in partnership with UNICEF, has developed a mobile solution that helps to digitally register births. Birth registration details are reported through authorised community members such as health workers and marriage registrars, or through Telenor Pakistan's agent network using an Android app. The data collected automatically populates a web-based dashboard, providing government ministries with real-time information on reported and registered births and up-to-date information on the status of each application. Telenor hoped to facilitate the registration of 700,000 births using this system by the end of 2016.[40]

38. Connected Mangroves Malaysia, UNFCCC
39. World Bank ID4D
40. Innovations in mobile birth registration: Insights from Tigo Tanzania and Telenor Pakistan, GSMA, January 2017

3

Regulation for the digital age

This report highlights the rapid pace of mobile internet uptake across Asia Pacific, with the broader mobile ecosystem now making an important contribution to economic growth as well as helping address a range of social and developmental issues. This large and diverse region encompasses a wide array of countries at different stages of digital development, with their own unique challenges and outlooks and therefore their own pathways to digital transformation.

Amidst this diversity, one thing is clear: successful national digital development policies must achieve overarching alignment and pursue tangible outcomes. This alignment needs to be realised across two dimensions:

- within government: the adoption of an integrated, whole-of-government approach that on a cross-sectorial basis aligns social, industry and fiscal policies

- between government and industry, taking into account regulatory policy and the business drivers that will help deliver it.

National roadmaps can be developed to ask the question: what does the future look like for us, and how do we get there from here? Policymakers and regulators can then more readily pinpoint the practical steps needed to enable the development of robust and progressive digital ecosystems.

3.1
What is a digital society?

The term 'digital society' refers to a modern society where citizens seamlessly interact with different aspects of their social and economic lives over digital channels, through a network of intelligently connected devices and interoperable services. Citizens of a digital society access and interact with a host of public and private services, including financial services, utilities, education, health and transportation, anytime and anywhere using digital technologies. Internet connectivity is a key requirement for a digital society. In many countries in the region, mobile is the main platform for internet access. In addition, the broader mobile ecosystem provides the devices, applications and services on which a digital society is built.

Government digitisation initiatives increase the level of engagement with citizens and businesses, and create broader societal value through improved service delivery and organisational performance. For example, improved access to healthcare and education via digital platforms has led to improved quality of life for individuals and their families in a number of countries, fuelling a virtuous cycle that boosts economic growth, creates more jobs and reduces poverty.

Based on the fundamental requirement of near-ubiquitous internet connectivity, a coherent and feasible digital strategy is essential to enable the three broad and interrelated components of a digital society: digital citizenship, digital lifestyle and digital commerce.

Digital citizenship:
Interaction between government, businesses and citizens specifically in the provision and use of public services over digital channels

Connected entities in a digital society – citizens, businesses and government – expect to access services online and transact electronically. For developing countries with large populations, digitisation offers the opportunity to improve the quality of data collection and management, and accelerate the provision of public services in areas lacking the necessary administrative infrastructure. Shifting public services to digital channels also generates considerable benefits for governments – particularly those around productivity enhancements and cost savings.

Accessing government services and conducting many other daily activities depends on citizens' ability to prove their identity. Although physical forms of identification, such as paper or plastic documents, have traditionally been used for identification and authentication, these are less relevant for accessing digital services and in any case have not been meaningfully accessible to large segments of the population in emerging markets. A secure and scalable digital identity ecosystem is essential to address this imbalance between the provision of digital services and the ability of citizens to identify themselves on digital channels.

Digital lifestyle:
Use of smart devices to access locally relevant content and non-core communications solutions that offer a more convenient experience

Access to affordable connected devices is a key factor for a digital lifestyle in any society. The digital lifestyle will be further enriched by realising the full potential of the Internet of Things (IoT) – the

intelligent connection of devices and appliances to the internet through multiple networks to produce a smarter outcome than the individual parts.

Asia Pacific is uniquely positioned to benefit from IoT, given the presence of a number of innovation centres in countries across the region, and local populations' huge appetite to rapidly adopt new technologies. Smart city initiatives are growing across the region, with innovative approaches emerging in South Korea, Singapore, Thailand, China and Indonesia among others. These new cities will revolutionise the way citizens and businesses access services in the urban environment, making cities more sustainable, efficient and desirable places to live.

In designing a smart city strategy, policymakers should consider that an integrated strategy for deployment, developed with core partners, enables services to be rolled out in a constructive way. A recent report by the GSMA (*Maximising the Smart Cities Opportunity*) highlighted seven key recommendations for developing smart city regulations[41]:

1. **Adopt an agile institutional framework and governance mechanisms:** an independent institutional framework should be created to ensure coordination and support throughout a smart city project's lifetime. Ideally, the agency will be independent from traditional city departments but made accountable to a governance body where the city institutions are represented.

2. **Appoint a CIO/smart city director with strategic vision:** a strong vision and strategy are key to the success of smart city projects. A CIO/smart city director should be a project leader with cross-functional skills, capable of defining a long-term strategy.

3. **Communicate effectively smart city project objectives and benefits:** a dialogue with the local community is essential to ensure effective smart city services design and functionality. Digital media provides an excellent opportunity to drive citizens' inclusion at each step of the service lifetime and highlight tangible benefits that the project will deliver.

4. **Promote technology investment in open and scalable systems:** avoid proprietary technologies that tie to a single provider. Standards-based solutions are the essential foundation on which

long-term development of a smart city can be built.

5. **Comply with privacy and security best practice and avoid defining specific rules:** take full account of privacy and security by relying on industry best practice and complying with national laws. The GSMA has worked extensively in these areas and makes available to policy makers and the industry ecosystem privacy tools, security guidelines and check lists.

6. **Make city data available to promote transparency and stimulate innovation:** cities generate a wealth of data. While protecting privacy, city managers should look to make data accessible to promote transparency and stimulate the creation of innovative services.

7. **Explore new models of funding:** smart city projects require significant initial investment. Smart city managers should explore public-private partnerships or alternative finance mechanisms such as municipal bonds, development banks and vendor finance.

Mobile operators can be knowledgeable partners to Asian cities and are well positioned to understand local dynamics, as well as international best practices. Most operators have a local presence and run advanced, secure networks designed to scale and support innovative smart city services.

IoT-based smart city applications raise the same types of cybersecurity issues as those for existing internet services – namely, how to protect the availability, identity, privacy and integrity of service components. One of the unique challenges of these services is how to achieve these properties in devices that most often are low in complexity, low power, have long lifecycles and are physically accessible to attack.

The GSMA has responded to this challenge by developing the GSMA IoT Security Guidelines.[42] The GSMA promotes a methodology for developing secure IoT services to ensure security best practices are implemented throughout the lifecycle of the service. The documents provide recommendations on how to mitigate common security threats and weaknesses within IoT services.

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41. Maximising the smart cities opportunity, GSMA, May 2017
42. See GSMA IoT Security Guidelines

Digital commerce:
Simplifying commerce by expanding access to marketplaces, replacing physical cash and facilitating the processing and delivery of orders over digital channels

Digital commerce covers all forms of digital payments and interactions with financial services, from payments to viewing and managing online bank accounts in a fast, transparent, secure and efficient manner. Digital commerce also extends the addressable market for goods and services by overcoming physical barriers, particularly in developing countries where considerable proportions of the adult population lack access to appropriate financial services and products, including savings, payments, credit and insurance, at a cost that is affordable to the customer and sustainable for the provider. Non-bank players, such as mobile operators, are increasingly using digital technologies to extend financial services to areas with underdeveloped financial infrastructure.

3.2
Structuring national digital society agendas

Government plays a fundamental role in establishing the environment and developing the momentum for a digitally empowered economy and society. For example, creating an open and level playing field to allow participants to innovate and reach underserved communities in areas such as mobile money is critical to advancing a digital society agenda, while failures of government to digitally transform themselves can lead to poor service delivery, inefficiency in public spending, privacy and security breaches, and loss of citizen trust. Beyond policy setting and regulatory design, governments also need to foster digital economic activities that benefit citizens and businesses. Specific steps can include the following:

Securing high-level political commitment to the digitisation strategy to ensure inter-agency cooperation. The cross-cutting nature of digital society agendas requires deeper coordination across government ministries and agencies and, increasingly, agency alignment and collaboration. Some governments have used a coordinating body with an overarching mandate to set priorities in the digital agenda and provide ongoing links and information flows between different ministries and across different levels of government. This has helped spur adoption and stimulate change, particularly in cases where that change is regulatory or legislative.

A good example of this approach is Thailand, which created the Digital Economy & Society Ministry in 2016. This has the authority to plan, promote, develop and implement activities related to a digital society and economy.

Moving government services online. Governments are typically one of the largest technology users in a country, and are therefore able to promote adoption and industry growth by delivering public services over digital platforms and by being a major buyer of digital technologies and services. The Australian government commissioned a study into the economic benefits of digitising customer transaction services for Australian federal and state government departments and is now pursuing a number of initiatives to realise this benefit.

Engage all stakeholders. Policymakers should work closely with industry, consumers and government agencies to establish an inclusive digital ecosystem that encourages greater uptake and usage of digital services. In Japan, the IoT Acceleration Consortium aims to increase investment into new IoT services through collaboration between the public and private sectors. The consortium has also signed agreements with several international partners to share information on the ecosystem, new practices and technological developments.

3.3
Policies and regulations for the digital age

A central objective of regulatory policy should be to promote innovation in the digital ecosystem. Given that the digital economy is characterised by competition between new players and the traditional telecoms operators, legacy regulatory frameworks centred on the telecommunications sector impose an uneven playing field where the telecoms operators are subject to rules and scrutiny that do not apply to their competitors.

In terms of the regulatory approach to the rapidly developing area of IoT devices and services, flexibility is critical. Regulating too soon risks suppressing the diverse range of services that will be developed. New specifications or standards are not needed at this time, as secure, cost-effective IoT services can be built using currently available solutions, standards and practices.

One key area of focus for the mobile industry concerns the impact of consolidation on mobile markets. Whereas mergers between mobile operators continue to be closely scrutinised, the same level of scrutiny does not appear to be levelled at their competitors in the digital economy. A number of countries have experienced a reduction in the number of network operators from four to three players, but in some countries merger proposals have been blocked by competition authorities or approved on the condition that the market retain four players.[43]

The evaluation of mergers in Asia (particularly in developing economies) can lead to uncertain outcomes when the jurisdiction of the competition authority, the regulator and the government is not clearly delineated. The GSMA report *A New Regulatory Framework for the Digital Ecosystem* lays out three key principles to establishing a modern regulatory framework:

- Redesign regulations and regulatory institutions around the concept of functionality, rather than legacy technologies or industry sectors. Regulation should be dynamic, focusing on ex post enforcement of broad rules rather than detailed ex ante prescriptions.

- Reform efforts should be broad-based and bottom-up in the sense of re-evaluating from a clean slate the need for regulation, its goals and the means by which those goals are accomplished.

- Policymakers need to establish clear and forward-looking policies that address key regulatory areas with direct implications for the creation, distribution and consumption of digital content and services. The aim should be to modernise traditional policies and frameworks.

The GSMA report *Resetting competition policy frameworks for the digital ecosystem* provides a number of specific recommendations to address common shortcomings in the design and enforcement of competition frameworks. A separate report, *Competition Policy: Case Studies from Asia and Sub-Saharan Africa* makes specific recommendations for the Asia Pacific region on how to design an appropriate competition policy framework.

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43. For example, in the European Union, see cases M.6497 for Austria in 2012, M.6992 for Ireland in 2014, M.7018 for Germany in 2014 (mergers approved with commitments), M.7612 for UK in 2016 (merger blocked), M.7758 for Italy in 2016 (merger approved on condition that the market retain four players).

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