The Mobile Economy
2017

GSMA Intelligence

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.

For more information, please visit the GSMA corporate website at **www.gsma.com**

Follow the GSMA on Twitter: **@GSMA**

GSMA Intelligence is the definitive source of global mobile operator data, analysis and forecasts, and publisher of authoritative industry reports and research. Our data covers every operator group, network and MVNO in every country worldwide – from Afghanistan to Zimbabwe. It is the most accurate and complete set of industry metrics available, comprising tens of millions of individual data points, updated daily. GSMA Intelligence is relied on by leading operators, vendors, regulators, financial institutions and third-party industry players, to support strategic decision-making and long-term investment planning. The data is used as an industry reference point and is frequently cited by the media and by the industry itself. Our team of analysts and experts produce regular thought-leading research reports across a range of industry topics.

www.gsmaintelligence.com

info@gsmaintelligence.com

Contents

Executive Summary

Subscriber growth pivoting to Asia

By the end of 2016, two thirds of the world's population had a mobile subscription – a total of 4.8 billion unique subscribers. There is a clear geographic shift underway, with Asia Pacific set to account for two thirds of the 860 million new subscribers expected globally by the end of the decade. India, already the world's second largest mobile market, will be the primary driver of this growth, with 310 million new unique subscribers.

By 2020, almost three quarters of the world's population – or 5.7 billion people – will subscribe to mobile services. Regional penetration rates are forecast to range from 50% in Sub-Saharan Africa to 87% in Europe.

4G uptake driving surge in mobile broadband adoption

The generational shift to mobile broadband networks and smartphones continues to gain momentum. Mobile broadband connections (3G and 4G technologies) accounted for 55% of total connections in 2016 – a figure that will be close to three quarters of the connections base by 2020. The proportion of 4G connections alone is forecast to almost double from 23% to 41% by the end of the decade.

5G will see a major shift in how cellular networks are designed and what they are used for. Early deployments will focus on enhanced mobile broadband as the key customer proposition but 5G's capabilities will evolve over time. 5G networks are forecast to cover around a third of the global population by 2025, with adoption reaching 1.1 billion connections.

Mobile revenue growth outlook remains modest

Total mobile revenues reached $1.05 trillion in 2016, up 2.2% on 2015, marking the second consecutive year of rising revenue growth. Developing markets saw a notable improvement in growth rates as the macroeconomic headwinds eased and key markets such as China and India posted encouraging growth rates. However, the future outlook remains mixed, with increasing competition, regulatory intervention and slowing subscriber growth weighing on revenue growth.

Operators have invested $1.2 trillion in capex since 2010. With global mobile capex levels having peaked in 2015, they fell by 6% in 2016. Over the medium term, capex levels will continue to decline but at a slower rate, before returning to growth in 2020. Operators in advanced telecoms markets will begin to invest in the necessary infrastructure to support 5G towards the end of the decade, with any uplift in capex likely to occur as operators roll out 5G.

Shift in consumer engagement to mobile and the rise of the platform economy

The shift of consumer engagement to mobile is now manifesting itself in the rapid growth of messaging platforms, which are using their scale to monetise a growing range of services. With a global subscriber base that is soon to reach 5 billion, the mobile ecosystem has created a global digital platform that is increasingly connecting everyone and everything. The impact of this digital platform is felt across a broad range of sectors as companies reinvent their business models to offer new and innovative services.

Players across the broader mobile ecosystem have already adopted open innovation strategies and

embraced the power of collaborative partnerships, particularly those in the app economy and the mobile internet. Collaboration and open standards allow platforms to scale rapidly – a key success factor when competing digital platforms have already achieved significant scale. Mobile operators are developing new business models that leverage these trends to offer new platforms and services. As well as opening the door to new revenue streams, these trends will allow a faster pace of innovation and raise the prospect of a lower cost operating model for operators at a time when margins and cash flows remain under pressure.

Mobile contributing to jobs and economic growth

In 2016, mobile technologies and services generated 4.4% of GDP globally, equivalent to around $3.3 trillion of economic value. This is forecast to increase to more than $4.2 trillion (4.9% of GDP) by 2020, as countries benefit from the improvements in productivity and efficiency brought about by increased take-up of mobile services.

The mobile ecosystem supported approximately 28 million jobs in 2016. The mobile sector also makes a substantial contribution to the funding of the public sector, with approximately $450 billion raised in 2016 in the form of general taxation. In addition, almost $19 billion was raised in government revenue through spectrum auctions in 2016.

Mobile is essential to realising the SDGs and addressing social challenges

The UN Sustainable Development Goals (SDGs) and their associated targets outline a broad and ambitious agenda that integrates economic, social and environmental issues across all geographies and applies both to developed and developing economies. Mobile technology provides access to tools and applications that address a wide range of socioeconomic challenges as well as enabling new technologies and innovations to build more efficient and environmentally sustainable societies.

Mobile technology also plays a critical role in fulfilling the ambitions of universal internet access, closing the identification gap and expanding financial inclusion. The number of individuals accessing the internet over mobile devices has doubled over the past five years to 3.6 billion, and will rise to 4.7 billion, equivalent to 60% of the global population, by 2020. The spread of mobile and digital technologies offers a transformative opportunity to achieve development aims and improve access to a range of life-enhancing services.

Rethinking regulation for the digital age

The fundamental changes taking place in telecoms markets and adjacent sectors have major implications for all aspects of policy, including regulatory frameworks, anti-trust reviews and the way spectrum is allocated. In order to drive the transition to more connected societies, it is important that the regulatory environment continues to evolve.

Prescriptive regulatory frameworks, which were designed for a less dynamic era, can be redesigned to encourage innovation and investment. The new features of the digital market call for a different and more nuanced approach to competition policy. Governments should ensure their competition and regulatory frameworks reflect how the market has evolved and provide a sound foundation for ongoing competition, investment and innovation that benefits everyone. Furthermore, the release of harmonised spectrum – in the right frequencies, at

the right time, and under the right conditions – is crucial to the development of a rich and vibrant digital economy. In particular, governments need to identify now the harmonised spectrum that will be required to enable 5G to transform economies and societies for the better.

As the digital economy is increasingly global, governments across the world should seek to harmonise international privacy and data protection rules. This requires accountability mechanisms to protect individuals' privacy effectively and enable the cross-border data flows necessary to develop an efficient, global digital economy. The mobile industry is engaging with policymakers to make these mechanisms interoperable. Ultimately, global harmonisation will benefit businesses and consumers alike by creating a consistent and clear set of data protection and privacy rules that apply across international borders.

1
Industry overview

GLOBAL MARKET

Unique mobile subscribers

2016 **4.8 billion**

4.2% CAGR 2016–20

2020 **5.7 billion**

65%
PENETRATION RATE

73%

SIM connections

2016 **7.9 billion**

4% CAGR 2016–20

2020 **9.7 billion**

100%
PENETRATION RATE*

112%

*Excluding M2M

ACCELERATING MOVES TO MOBILE BROADBAND NETWORKS AND SMARTPHONE ADOPTION

Mobile broadband connections to increase from 55% of total in 2016 to

73%

by 2020

By 2020, there will be

5.7bn

smartphones, growth of 1.9 billion from the end of 2016

Mobile data traffic to grow by a CAGR of

47%

over the period 2016–2020

Source: Ericsson

Data growth driving revenues and operator investments

Operator total revenues

2016 **$1.05 trillion**

2.1% CAGR 2016–20

2020 **$1.14 trillion**

Operator CAPEX of up to **$700 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

48% 2016 ●——● 2020 60%

FINANCIAL INCLUSION
Delivering financial inclusion to the unbanked populations. As of December 2016 there were

277 live mobile money services in 92 countries

INNOVATION
Delivering innovative new services and apps. Number of M2M connections to reach

1bn by 2020

Mobile industry contribution to GDP

2016 **$3.3tn** 4.4% GDP

2020 **$4.2tn** 4.9% GDP

Public funding

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

2016 **$450bn**

2020 **$500bn**

Employment

Jobs directly and indirectly supported by the mobile ecosystem

2016 **28.5 million**

2020 **30.9 million**

Global

TECHNOLOGY MIX

2020
2016

41%
23%
2G
27%
4G
32%
45%
32%
3G

SUBSCRIBER PENETRATION

2016 — 2020
65% 73%

SMARTPHONE ADOPTION

2016 — 2020
51% 65%
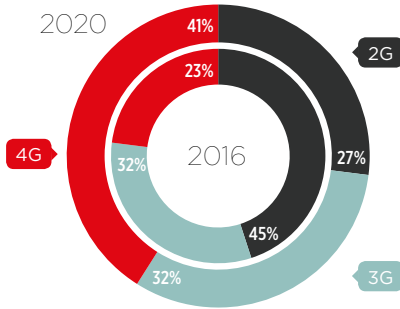
Asia Pacific

TECHNOLOGY MIX
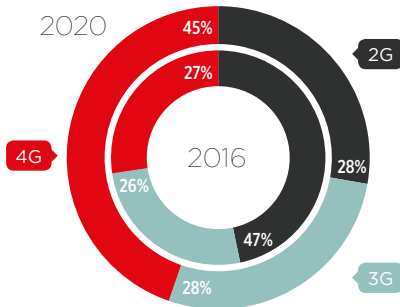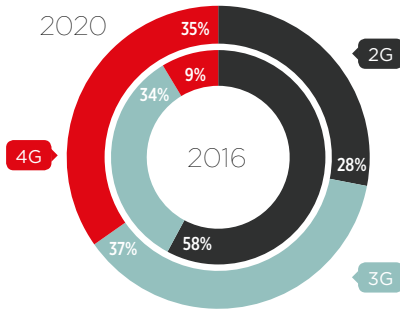
2020
2016

45%
27%
2G
28%
4G
26%
47%
28%
3G

SUBSCRIBER PENETRATION

2016 — 2020
65% 76%

SMARTPHONE ADOPTION

2016 — 2020
51% 63%

CIS

TECHNOLOGY MIX

2020
2016

35%
9%
2G
28%
4G
34%
58%
37%
3G

SUBSCRIBER PENETRATION

2016 — 2020
78% 83%

SMARTPHONE ADOPTION

2016 — 2020
48% 66%

Europe

TECHNOLOGY MIX

2020
2016

61%
33%
2G
14%
4G
25%
42%
25%
3G

SUBSCRIBER PENETRATION

2016 — 2020
84% 87%

SMARTPHONE ADOPTION

2016 — 2020
65% 75%

Latin America

TECHNOLOGY MIX

2020

38%
16%
45%
41%

2G
22%
39%

2016

3G

4G

SUBSCRIBER PENETRATION

2016 ● 2020
70% 78%

SMARTPHONE ADOPTION

2016 2020
55% 70%

MENA

TECHNOLOGY MIX

2020

19%
6%
41%
49%
53%

2G
33%

2016

3G

4G

SUBSCRIBER PENETRATION

2016 ● 2020
59% 62%

SMARTPHONE ADOPTION

2016 2020
46% 64%

North America

TECHNOLOGY MIX

2020

82% 5%
62% 10%
12%
29%

2G

2016

3G

4G

SUBSCRIBER PENETRATION

2016 ● 2020
81% 85%

SMARTPHONE ADOPTION

2016 2020
77% 79%
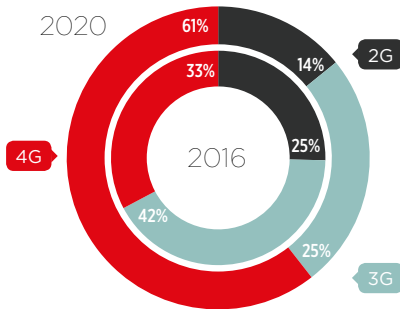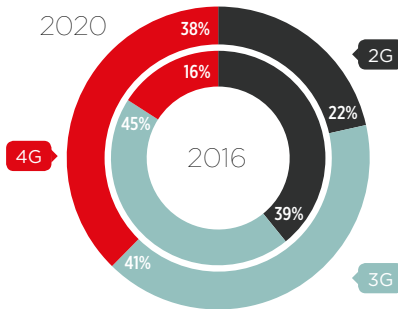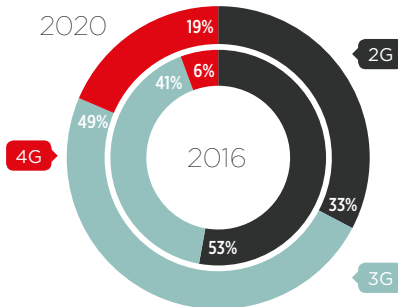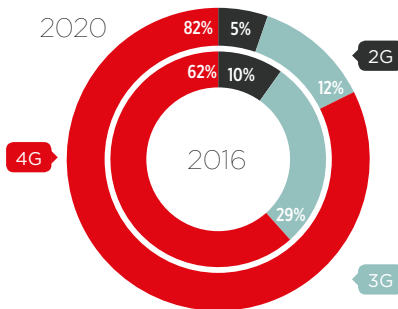
Sub-Saharan Africa

TECHNOLOGY MIX

2020

12%
2%
47%
30%
67%

2G

2016

3G
41%

4G

SUBSCRIBER PENETRATION

2016 ● 2020
44% 50%

SMARTPHONE ADOPTION

2016 2020
28% 55%
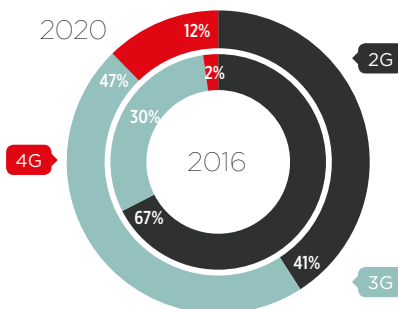
1.1
Mobile adoption still rising, but growth continues to slow

At the end of 2016, 65% of the world's population had a mobile subscription – a total of 4.8 billion unique mobile subscribers. The total is set to reach 5 billion in mid-2017. By 2020, almost 860 million new subscribers will be added, taking the global penetration rate to 73%. However, mobile subscriber growth is slowing; we expect a compound annual growth rate (CAGR) of 4.2% between 2016 and 2020, compared to 5.6% over the preceding four years.

With developed markets approaching saturation, developing markets will account for nine out of ten new subscribers in the four years to 2020. Asia Pacific will add approximately 571 million unique subscribers, representing two thirds of new subscriber growth globally over the same period. Annual subscriber growth in Sub-Saharan Africa – the world's most under-penetrated region – is expected to be 6.2%.

Figure 1   Source: GSMA Intelligence

Unique subscribers by region

(Millions)

Legend: Asia Pacific | CIS | Europe | Latin America | MENA | Northern America | Sub-Saharan Africa
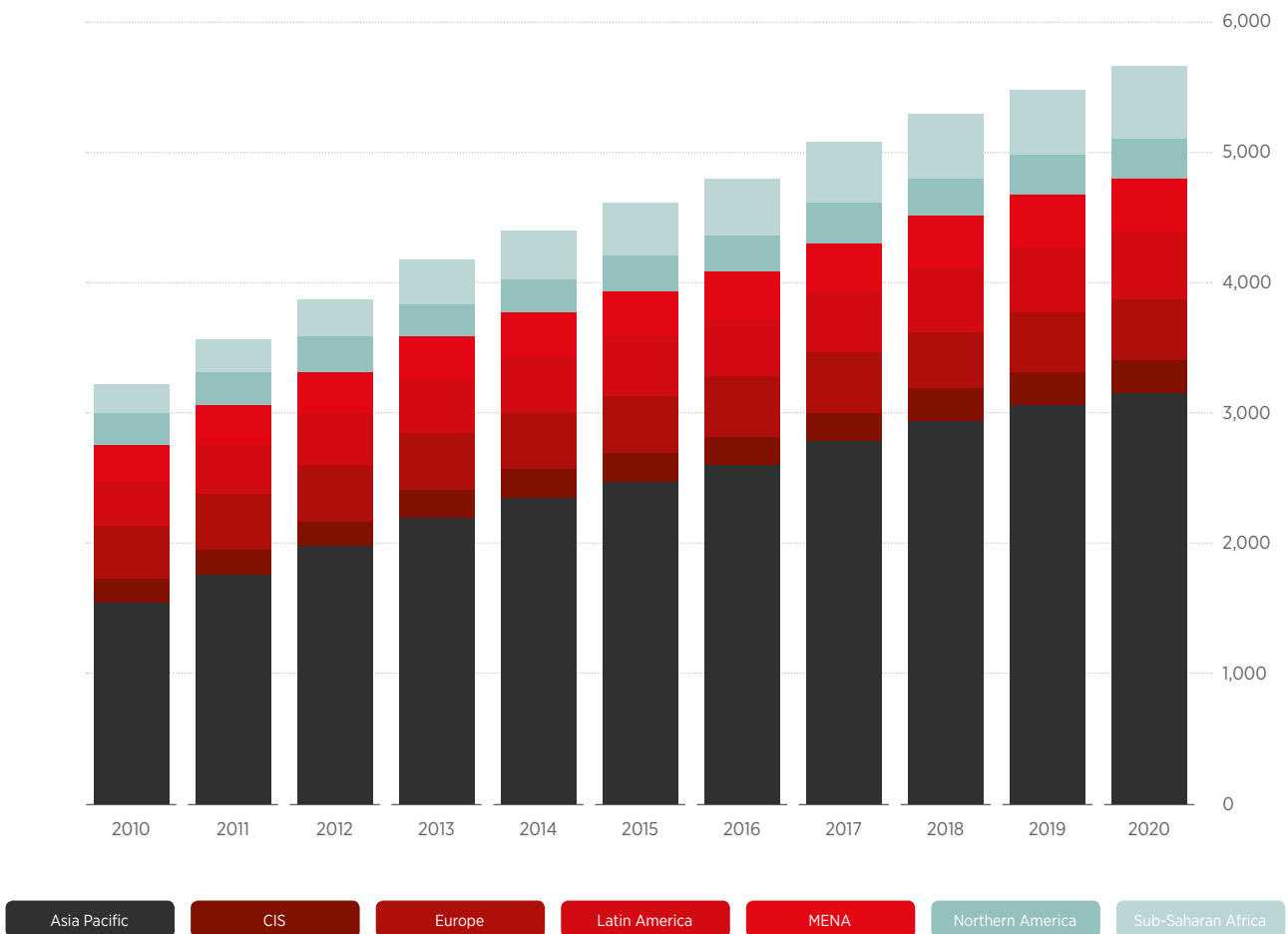
Ten countries will account for 72% of growth in new mobile subscribers worldwide. There is a clear geographic shift underway, with Asia set to account for two thirds of the incremental subscriber growth over the forecast period. India, already the world's second largest mobile market, will be the primary driver of this growth, with 310 million new unique subscribers expected in the period to 2020, helped by improving affordability, falling device prices and better network coverage. This is followed by China and fast-growth Asian markets including Indonesia, Pakistan and Bangladesh.

Figure 2   Source: GSMA Intelligence

Top 10 countries by projected new subscribers

(Millions), 2016-2020

Mobile subscribers 2016   Additional mobile subscribers (2016-2020)
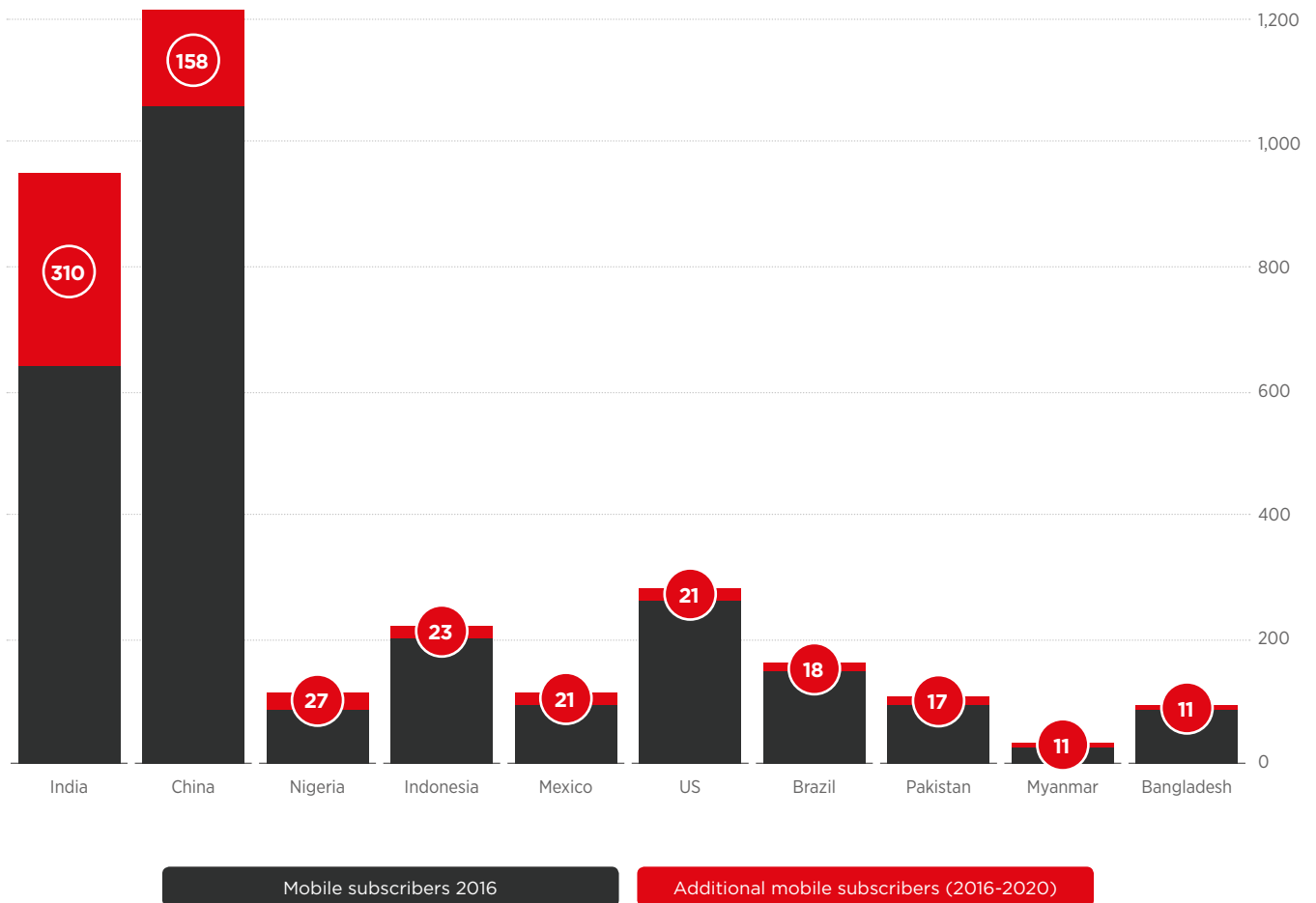
Unique subscriber penetration rates vary significantly across regions. The average rate for developed markets of 84% is approaching saturation. In contrast, there remains upside for subscriber growth in developing markets. Asia Pacific, Latin America and Sub-Saharan Africa are expected to see the largest improvements in penetration levels over the next four years.

As well as the challenging network economics of connecting remote and rural areas, other barriers will limit subscriber growth in developing markets. These include volatile economic conditions, the lower income and purchasing power of the still unconnected populations, uneven distribution and quality of infrastructure, and social and political instability of different markets.
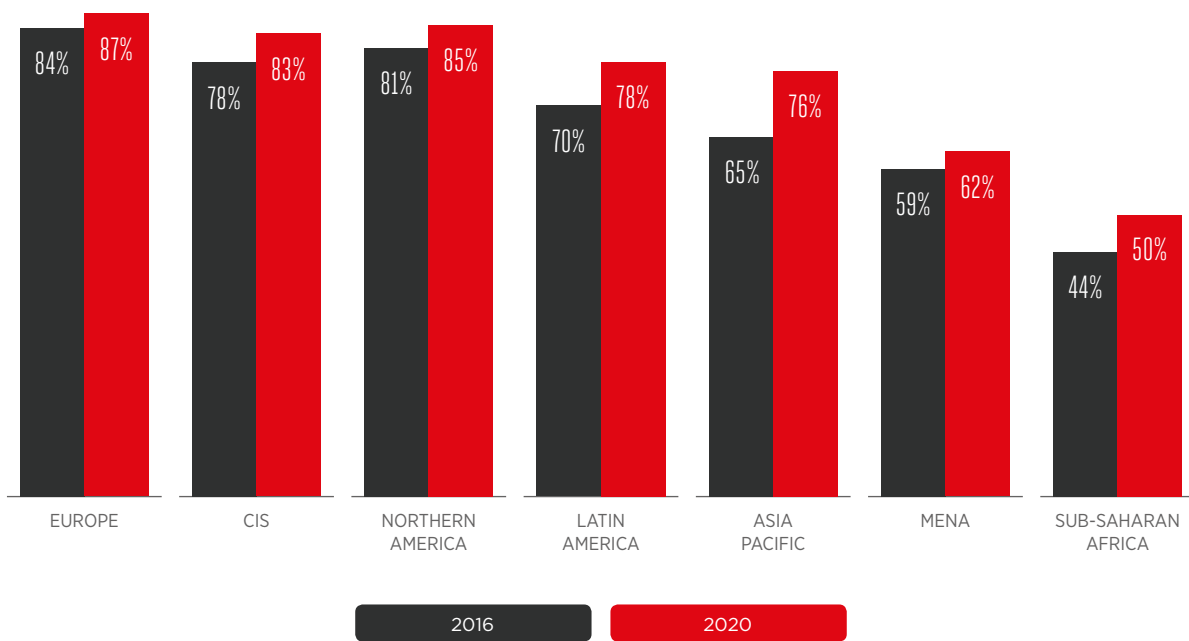
Figure 3   Source: GSMA Intelligence

Unique subscriber penetration by region

	EUROPE	CIS	NORTHERN AMERICA	LATIN AMERICA	ASIA PACIFIC	MENA	SUB-SAHARAN AFRICA
2016	84%	78%	81%	70%	65%	59%	44%
2020	87%	83%	85%	78%	76%	62%	50%

Multiple SIM ownership means that at the end of 2016 there were 7.5 billion SIM connections (excluding cellular M2M, which accounted for a further 0.4 billion) worldwide. However, the ratio of SIM cards per person varies significantly by region, with an average of nearly two in many developing regions, where prepaid plans are the norm and subscribers are most price-sensitive.

Globally, the average number of active SIM cards owned per mobile subscriber declined to 1.44 in 2016, from a high of 1.50 in 2012. The GSMA Intelligence 2016 Consumer Survey suggests that, after having separate SIM cards for personal and business use, variable network quality is the second biggest driver of multi-SIM ownership. The higher the perceived network quality in a country, the less

likely consumers are to own dual-SIM handsets and switch between different operators to seek better network coverage.

Global SIM connections are forecast to grow at a CAGR of 4% between 2016 and 2020, in line with unique subscriber growth and thus lifting connections penetration to 112%. In Europe, connections grew modestly in 2016 – by 0.3% to 678 million – following three consecutive years of decline. They are forecast to reach 723 million by the end of 2020. As with unique subscriber trends, connections growth will be driven by Asia Pacific and Sub-Saharan Africa with forecast CAGRs of 5% and 6% to 4.7 billion and 0.9 billion respectively out to 2020.

Smartphone growth led by Asian markets as affordability improves

There were 3.8 billion smartphone connections at the end of 2016, accounting for half of total connections (excluding M2M) worldwide. Adoption rates have reached 65% of the connected base in developed markets. As with subscriber growth, developing markets and particularly Asia are driving the current phase of smartphone growth. In developing markets smartphone connections reached 47% of the total base at the end of 2016 and are forecast to reach 62% by 2020.

Overall, Asia Pacific will account for half of the 1.9 billion new smartphone connections forecast globally by 2020. India overtook the US to become the second largest smartphone market in 2016,

with 347 million smartphone connections. India will account for just under one fifth of new smartphone connections globally in the four years to 2020; its smartphone base will double to 686 million over the period.

Affordability is becoming less of a barrier to smartphone adoption as incomes rise and there is continued growth in sub-$100 devices, led by Chinese manufacturers such as Huawei, Oppo, OnePlus and Xiaomi. While China, South Korea and Japan have been the traditional smartphone manufacturing hubs in Asia Pacific, local manufacturers are also gaining prominence in India, Indonesia and the Philippines.

Figure 4

Source: GSMA Intelligence

Global smartphone connections as a share of total connections

Developed: 17% (2010) → 75% (2020)

Developing: 5% (2010) → 62% (2020)

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
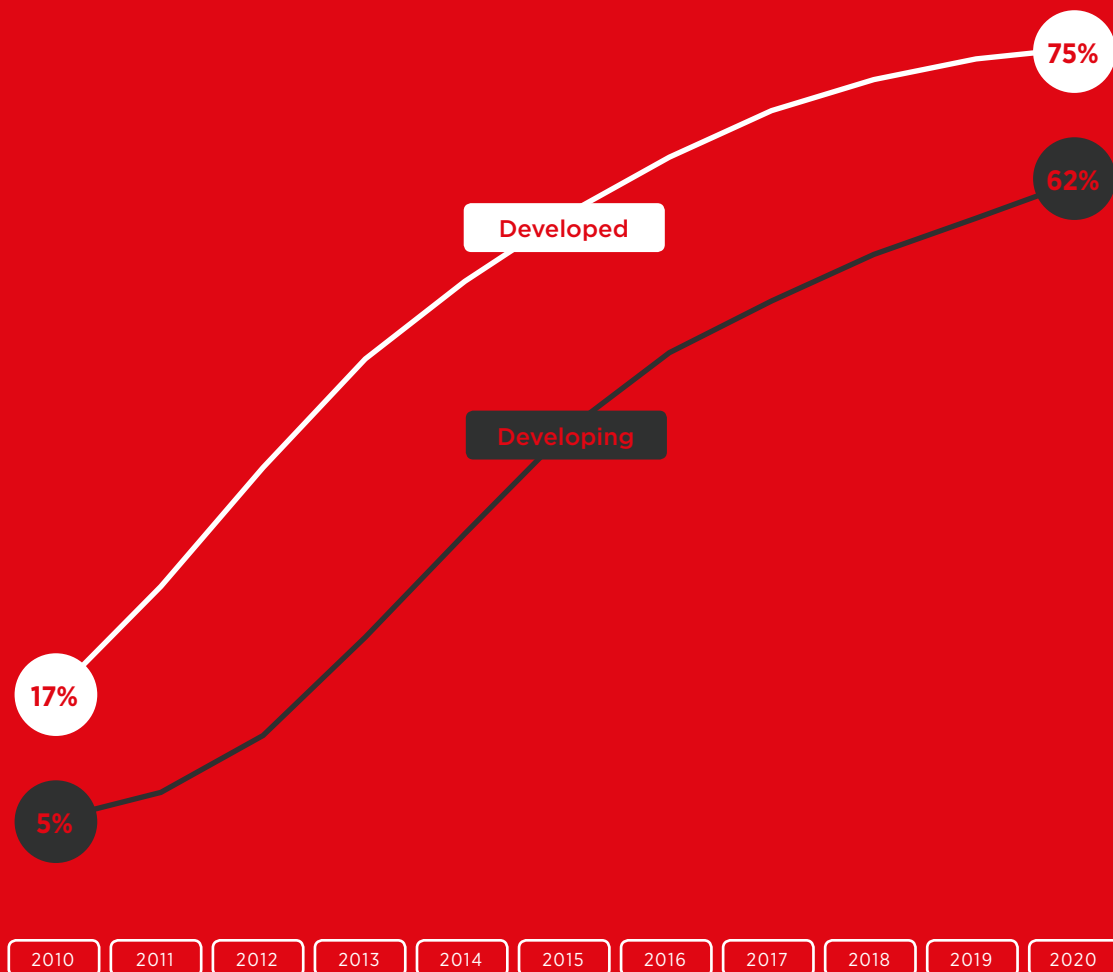
1.2
Technology shift ongoing

1.2.1
4G uptake driving surge in mobile broadband adoption

The generational shift to mobile broadband networks across the world continues to gain momentum, driven by improved coverage of higher speed networks, more attractively priced data tariffs and greater availability and affordability of smartphones. At the end of 2012, mobile broadband connections (3G and 4G technologies) accounted for a quarter of total connections (excluding M2M). This increased to 55% by the end of 2016, with 4 billion mobile broadband connections.

Figure 5   Source: GSMA Intelligence

Global connections by technology

(Excluding M2M)
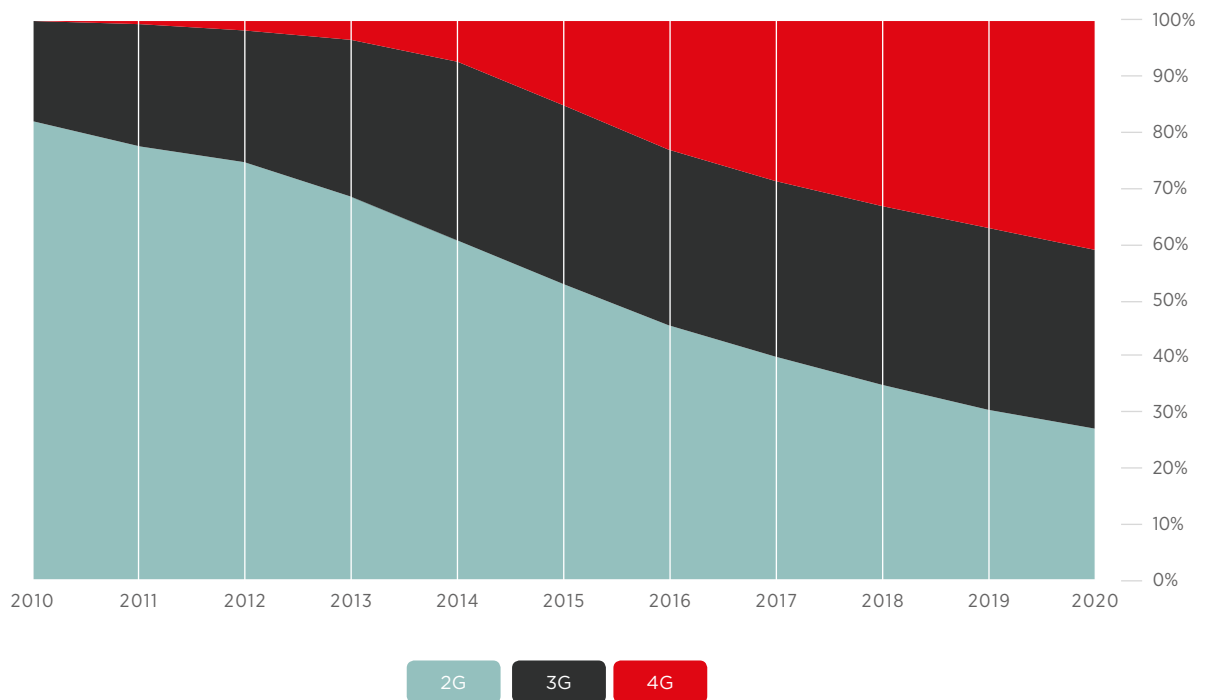
An additional 2.3 billion mobile broadband connections are forecast between 2016 and 2020, with the proportion of the total rising to 73%. The rapid migration to 4G remained a key feature in 2016, with 4G connections increasing 55% in the year to 1.7 billion. Indeed, the proportion of 4G connections worldwide is forecast to almost double between 2016 and 2020 from 23% to 41%. As a result, by 2020, 2G will no longer be the dominant technology in terms of connections.

LTE now reaches 60% of the population as operators continue to invest in network rollouts

Operators have invested heavily in LTE network rollouts, which have been instrumental in driving the surge in 4G adoption. As of 2016, 580 LTE networks had been deployed in 188 countries. The developing world accounted for three quarters of the new network launches in 2016 and now represents just under half of total LTE networks, up from one quarter in 2012. 4G networks reached almost 60%

of the world's population in 2016, up from 50% in 2015 and 11% in 2012. In the developing world, half of the population is covered by 4G; this is expected to increase to almost 70% by 2020. In contrast, 4G coverage levels in the developed world, at 93% of the population, are only expected to improve by two percentage points to 95% by 2020.

Figure 6   Source: GSMA Intelligence

Global live 4G networks

(cumulative)
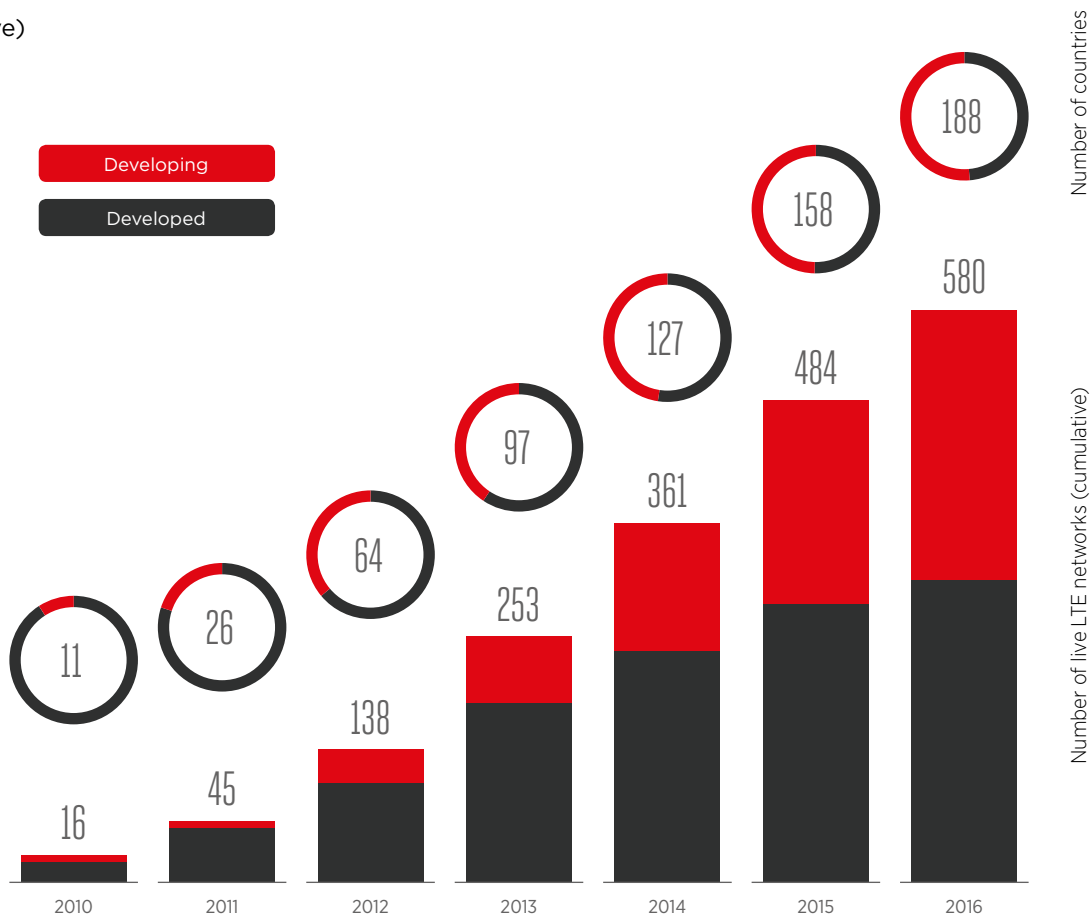
The proliferation of smartphones and other advanced devices (such as tablets) connected to increasingly higher speed networks (both 3G and 4G) continues to drive the use of data-intensive applications, including video and music streaming,

browsing and file downloads. This surge in mobile data traffic means that volumes are expected to grow at a CAGR of 47% between 2016 and 2020 to reach almost 40 EB per month by 2020, according to Ericsson.

1.2.2
5G will be delivered in a phased approach; capabilities will evolve over time

5G from a technology perspective is beginning to crystalise. Over time 5G will see a major shift in how cellular networks are designed and what they are used for. Mobile operators will use new network architectures, as well as new radio technologies, to achieve the flexibility required to serve an extremely diverse set of applications from mission-critical communications between machines to highly immersive entertainment and fingertip control over remote devices and appliances.

5G will be delivered in a number of phases; the pre-emptive phase will comprise fixed-wireless access networks using millimetre wave (mmW) spectrum, currently championed by Verizon in the US. While there will likely be a handful of pre-5G wireless networks, including those linked to sporting events taking place ahead of the standardisation date, the first commercial 5G cellular networks will launch in late 2019 and early 2020. These networks will be built on evolved LTE (Release 15) and will offer increased performance. 5G's second phase, based on LTE Release 16, will deliver mobile data over mmW frequencies, facilitating a massive increase in bandwidth potential.

Demand for a new network technology cycle is accelerating the development of 5G

The desire to frame the development of the 5G standard and gain first-mover advantage is seeing operators set ambitious targets for 5G commercial launches. 5G is the first technology cycle that the mobile industry is approaching in a state of maturity, with subscriber penetration close to demographic ceilings in most developed markets, and revenue growth averaging low single digits globally. As a result, the imperative to deliver a new network technology is stronger than ever.

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

- **South Korea** – KT has announced that it will launch commercial 5G services in 2019

- **Japan** – NTT DoCoMo has announced that it will launch commercial 5G services in 2020

- **China** – China Mobile plans to deploy 10,000 5G base stations by 2020

- **US** – operators have been testing and developing fixed-wireless access solutions using mmW technologies, and are expected to be among the first to launch commercial 5G wireless networks

- **Europe** – in July 2016, the major European operators published a 5G manifesto, which indicated a target of launching 5G in at least one city in each of the European member states by 2020

- **Middle East** – Etisalat has indicated that it will launch a nationwide 5G network in time for Expo 2020 in the UAE.

5G networks will cover a third of the world's population by 2025

Early 5G networks based on LTE Release 15 will be deployed in dense urban areas, as operators look to supplement existing mobile broadband capacity, while also providing a test-bed for 5G use cases to emerge. Operators are expected to roll out 5G at a similar rate to the deployment of 4G, attaining coverage of 34% of the global population, 2.6 billion people, 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 cellular M2M) are anticipated to reach 1.1 billion by 2025.

Figure 7

Source: GSMA Intelligence

5G adoption forecast
2020–2025

- 5G connections (billions)
- 5G coverage (percentage of population)
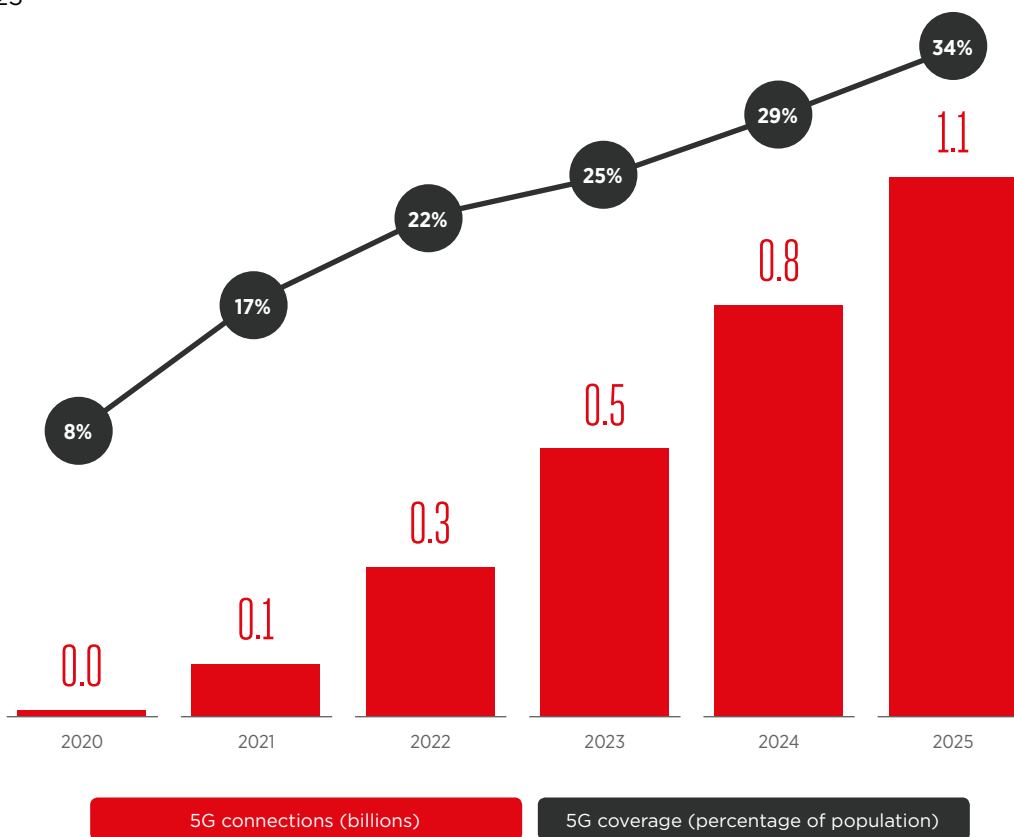
The rollout profile for 5G Phase 2 (LTE Release 16, based on small cell deployments) will be much more varied between operators and countries. Cost is the principal concern; rolling out a dense small cell network in urban areas will require considerable amounts of capex, while also adding to current network opex burdens. Access to, and ideally ownership of, dense urban fibre networks will be a pre-requisite.

Mobile operators' need for a new business model is most stark here. If new use cases do not emerge

that support investment, then under the current operator business model rollout is likely to be patchy and slow. In order to bring down the cost of ownership, the industry must determine how best to promote rollout while maintaining network competition. The onus is also on regulators and public bodies not only to promote a healthy investment climate but also remove bottlenecks to network rollout, particularly those linked to planning regulations.

1.3
Revenue and investment trends

1.3.1

Revenue: short-term spike in growth, but challenges remain

Total mobile revenues reached $1.05 trillion in 2016, an increase of 2.2% on 2015. While down considerably on growth rates mobile operators witnessed over the last ten years, 2016 marked the second consecutive year of rising revenue growth. 2016 saw improved growth rates in developing markets in particular, as the macroeconomic headwinds eased and key markets such as China and India posted encouraging growth rates. The future outlook is more mixed – competition, regulatory intervention and slowing subscriber growth will continue to weigh on revenues, while rising demand for data and more sustainable pricing will act as a positive lever in ensuring mobile revenues continue to grow over the next four years.

Revenue growth in developed markets has remained relatively level over the last few years, as falling revenues in Europe were offset by growth in other key developed markets such as the US, Japan and South Korea. In 2016 key European markets such as Germany, Italy and Spain returned to growth. The principal driver of this turnaround is tariff readjustments, which specifically offer greater data allowances at higher cost, and have been implemented in a number of European markets. Alongside increasing demand for data, and the positive impact of earlier consolidation, these price adjustments will help to drive higher revenue growth in 2017.

By contrast, the US market has grown consistently over the last few years but is now entering a more stagnant growth phase, as strong competition weighs on revenues. From 5% growth witnessed in

2014 (year-on-year), the US market grew by 1.7% in 2015, and by a mere 0.1% in 2016. T-Mobile USA and Sprint continue to act as challengers in the market, with the former in particular proving successful in attracting customers from AT&T and Verizon.

Following two years of low growth, which marked a convergence with developed markets, the developing world rebounded in 2016, with revenues increasing 5.3% year-on-year. Macroeconomic headwinds eased, with China and India the key drivers of growth; rising demand for data and subscriber penetration helped accelerate growth rates in both countries. Revenue growth in developing markets is forecast to slow over the next four years as heightened competition in key markets (India and Malaysia) and regulatory cuts to mobile termination rates in Brazil weigh on growth.

Mobile revenues, 2014–2020

($ billion)
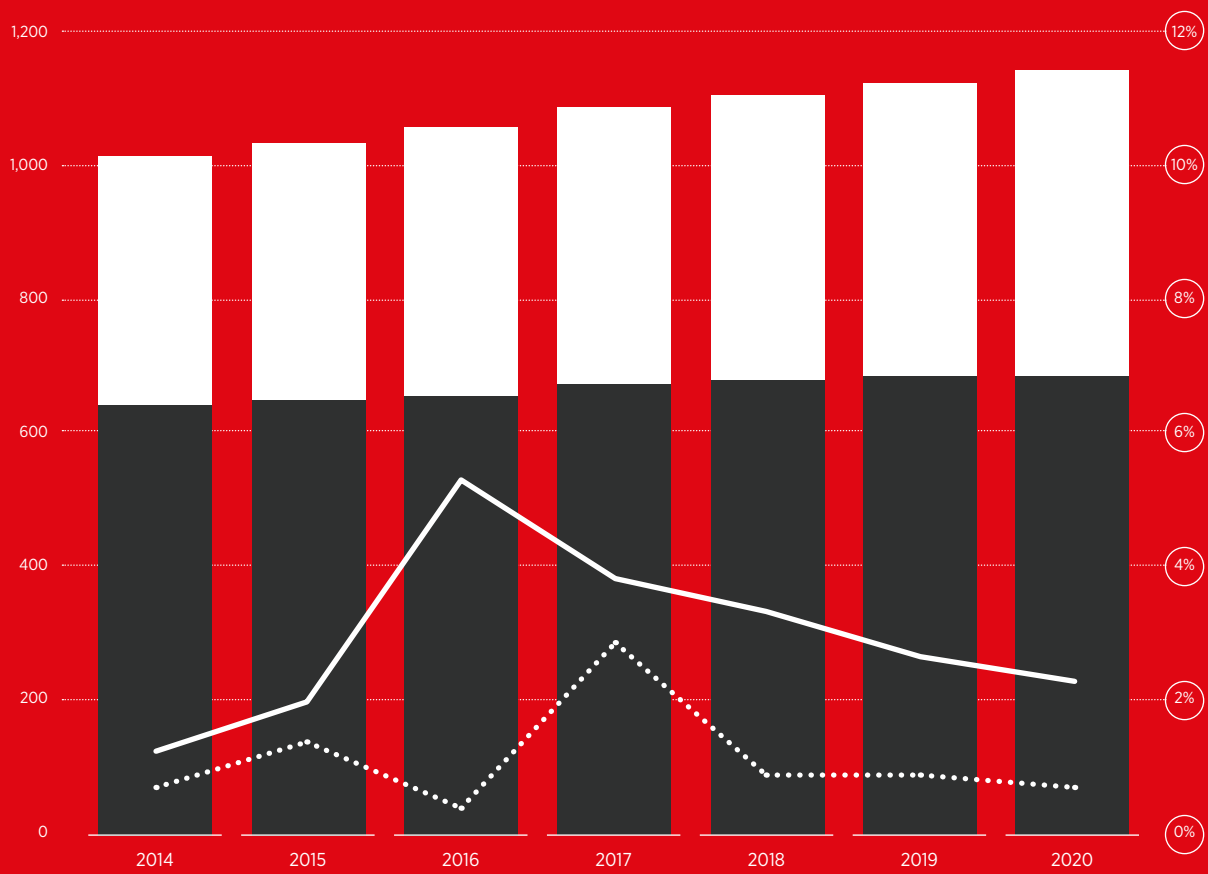
Developed | Developing

Developed growth | Developing growth

1.3.2

Capex: spend continues to fall from earlier peaks but will begin to stabilise

Since 2010 mobile operators have invested $1.2 trillion in capex as they look to increase capacity and deploy mobile broadband networks. Global annual capex increased consistently from 2010, to reach $197 billion in 2015. However, 2015 marked a peak in global mobile capex levels, which subsequently fell by 6% in 2016. The knock-on impact of falling mobile capex on network infrastructure vendors is already apparent and is set to continue. Over the medium term, capex levels will continue to decline but at a slower rate, before returning to growth in 2020.

Over the course of this timeframe, operators will invest an additional $700 billion in mobile networks and infrastructure worldwide. Operators in advanced telecoms markets will begin to invest in the mobile infrastructure necessary to support 5G towards the end of this decade. We expect capex to rise as a result, as operators seek to gain a competitive advantage in this new technology. However, given the likely incremental nature of early 5G networks, any uplift is likely to occur after 2020 as operators roll out 5G in mmW.

Figure 9   Source: GSMA Intelligence

Mobile capex forecasts, 2014–2020

($ billion)
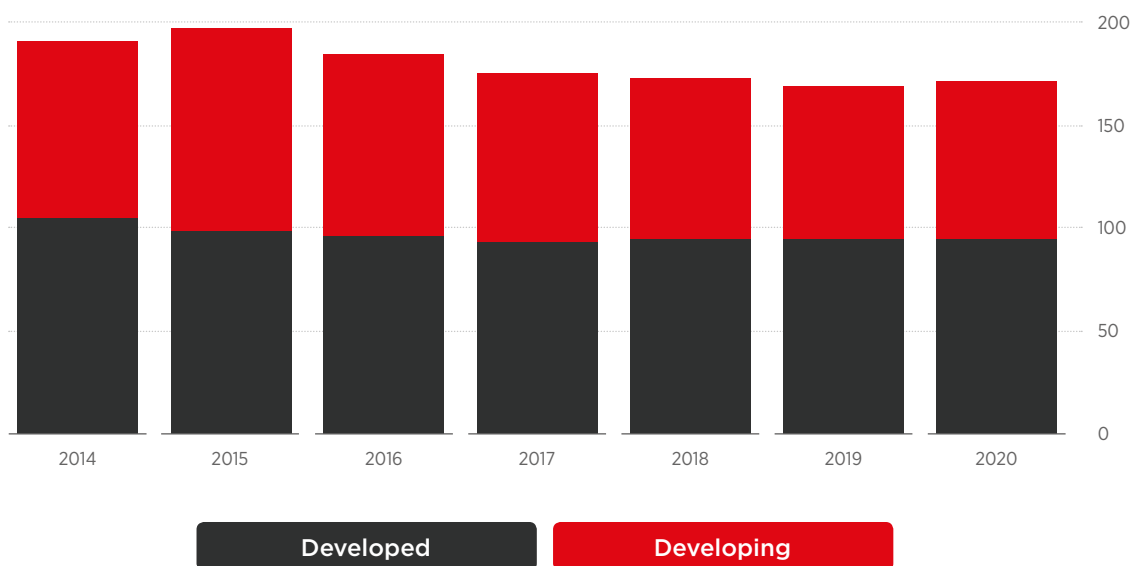
Capex in developed markets is forecast to continue to decline in 2017 but to rise towards the end of the forecast period. Operators will continue to seek to drive competitive advantage from their networks, and begin to invest in the infrastructure necessary to support 5G.

Having risen rapidly over a number of years, the share of global mobile capex attributable to developing markets equalled that of developed markets in 2015. China was the key driver of this growth, with its aggressive 4G network rollout cementing its position as the largest market worldwide in terms of capex. However, 2016 marked a strong decline in developing market capex of almost 10% year-on-year, as Chinese network rollout slowed comparatively. Developing market capex will continue to fall in the medium term, as further declines in China and macro-economic pressures in other developing economies weigh on the growth seen in markets such as India.

2
Mobile driving innovation and growth

2.1
Platforms, scale and the shift to open

The shift of consumer engagement to mobile is now manifesting itself in the rapid growth of messaging platforms. The leading messaging platforms across the world continue to scale rapidly, with a total user base of around 3.6 billion at the end of 2016. The vast majority of the users on these messaging platforms are on mobile, suggesting that the majority of the just under 5 billion mobile subscribers across the world are using messaging apps.

WhatsApp was the first messaging platform to reach 1 billion users, subsequently followed by Facebook Messenger. Newer messaging platforms are also emerging and growing rapidly, including the likes of Snapchat. Messaging platforms have now overtaken the larger social media sites in terms of their user bases, while also typically showing higher user retention and engagement than other apps.

Figure 10   Source: Company data

Major messaging platforms: active user base
(Billions)
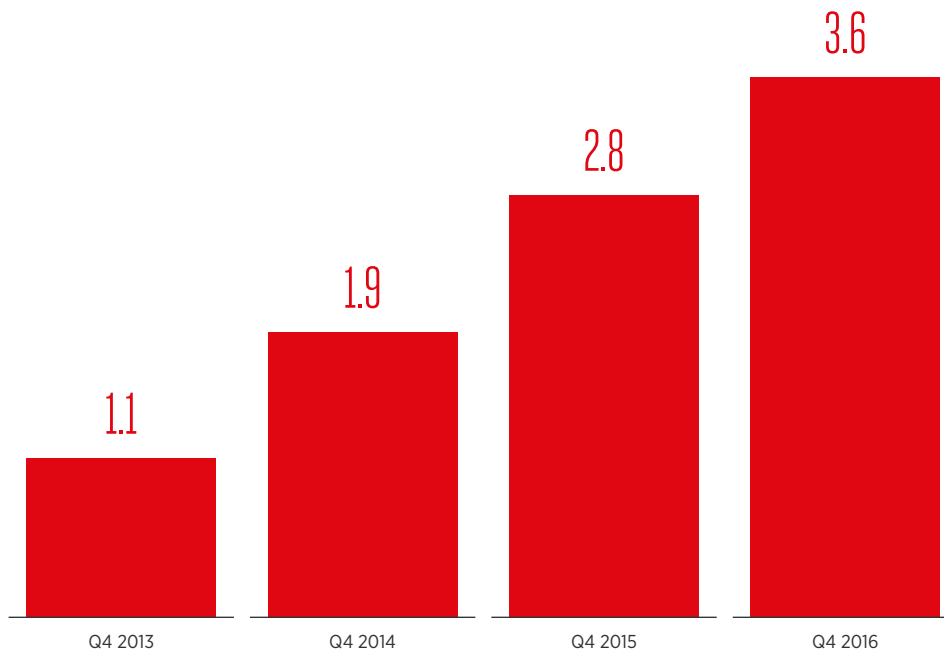
The leading messaging platforms are using their scale and platform business models to monetise a growing range of services. The most successful examples to date include several of the Asian messaging platforms. In China, WeChat has amassed a merchant base of 30 million connected with its payment systems – mostly SMEs but also large enterprises – through concerted marketing and opening up its APIs[1]. When combined with its consumer user base of almost 700 million as of the third quarter 2016, it is not hard to see the prodigal network effects that become available.

However, the use of digital platforms now extends well beyond the mobile messaging ecosystem and internet players to embrace a broad range of consumer sectors where companies are reinventing their business models to offer new and innovative services. The growth of the sharing economy is now seeing a global impact, with prominent successes including Uber and Airbnb, but many regions are now seeing a range of new players emerge. All of these companies gain enormous power and revenues through network effects – the more users the platform attracts, the more customers, which in turn attract a greater number of merchants and partners. High levels of smartphone ownership, especially in developed markets, have enabled the emergence of scalable, on-demand services that are affordable and accessible anywhere.

Platforms are now spreading further with the growing adoption of cloud computing; a range of industrial companies are putting analytics and automation into cloud-based services. These services and real-time analytics, combined with new scalable connectivity services (such as LPWA), will be key in realising the potential of the industrial Internet of Things.

1. Application programming interfaces (APIs) allow software programs to "talk" to one another.

2.1.1
The platform economy: messaging was just the start

Open innovation and the development of open standards has a long history in computing and software development, starting with the Linux operating system and spreading to a broad range of software products. Today, openness is de rigueur in all aspects of the internet, and the widespread adoption of large-scale collaboration has helped drive the rapid pace of innovation in the digital age.

Recent examples of open source initiatives include the following:

- **Open Compute Project:** its mission is to design and enable the delivery of the most efficient server, storage and data centre hardware designs for scalable computing. Members of the initiative include Facebook, Intel, Nokia, Google, Apple and Microsoft.

- **OpenAI:** a non-profit artificial intelligence research company, associated with business magnate Elon Musk, that aims to carefully promote and develop friendly AI in such a way as to benefit, rather than harm, humanity as a whole.

- **The Telecom Infrastructure Project:** founded by Facebook, this initiative includes telecoms operators, infrastructure providers and other technology companies. This is an engineering-focused initiative that aims to reimagine ways of building and deploying telecoms network infrastructure and drive the development of next-generation open components.

Figure 11

The platform economy: messaging was just the start

From OTT messaging apps

To a broad range of consumer-focused sectors reinventing how business is done through digital platforms

TRANSPORTATION

AVIATION

POWER DISTRIBUTION

INTELLIGENT ENVIRONMENTS

HEALTHCARE

1 SCHEDULING AND LOGISTICS

7 OPERATIONS OPTIMISATION

2 CONNECTED PRODUCTS

OIL & GAS

POWER GENERATION

To major industrial sectors putting analytics and automation in the cloud

6 ASSET PERFORMANCE MANAGEMENT

3 INTELLIGENT ENVIRONMENTS

WATER

WIND

5 INDUSTRIAL ANALYTICS

4 FIELD FORCE MANAGEMENT

AUTOMOTIVE

MINING

MANUFACTURING

Source: Adapted from General Electric

2.1.2

Driving new areas of innovation: AI and new user interfaces

The near ubiquity of smartphones, high-speed connectivity and the on-demand accessibility of cloud computing are driving new areas of innovation, particularly in the field of artificial intelligence. Some of these developments and new services represent a further evolution in the smartphone ecosystem, while others move well beyond smartphones.

The development of AI is being led by a combination of new start-ups, established players from the internet ecosystem (Twitter, Apple, Google, Amazon and Facebook) and more established IT players such as Microsoft and IBM. Google has been particularly active, with nine major acquisitions over the last three years, but other companies are also investing heavily in this area. AI promises a new category of products and services, many of which will not be tied to existing devices.

The growing utility of AI and in particular natural language processing, allowing technology to understand humans, is opening the door to a paradigm shift in the user interface. One use case for AI has been with virtual agents and chatbots (computer programs designed to simulate conversation with human users). Chatbots can respond to people in their native language, either verbally or in text, and can interact with both humans and other machines. The AI component allows chatbots to respond to more complex situations and continuously 'learn' so as to improve their effectiveness over time.

Chatbots have seen the most extensive deployment to date on the large messaging platforms, where the user interface is text messaging. However, advances in natural language processing mean that voice interfaces are increasingly a reality. A number of virtual assistants have now been launched, and while some are still tied to smartphones (such as Apple's Siri), others can be accessed by a new category of device, such as the Amazon Echo. These relatively 'dumb' terminals have little processing power but rely on connectivity and intelligence in the cloud to provide information and control other devices.

"The last 10 years have been about building a world that is mobile-first, turning our phones into remote controls for our lives. But in the next 10 years, we will shift to a world that is AI-first, a world where computing becomes universally available."

Sundar Pichai, CEO of Google

2.2
The operator response

It is the newer and more innovative digital players that have generally been most successful in driving innovation and capturing the opportunities from the digital revolution, often in the process cannibalising some of the mobile operators' core services. This has led mobile operators to collaborate more closely with tech start-ups and to develop more open models of innovation.

Reflecting these developments, mobile (and other telecoms) operators continue to invest significantly

in venture capital and start-up companies. Total investments by telecoms sector operators tripled between 2014 and 2015. Reflecting the ongoing shift in growth and innovation in the mobile ecosystem to emerging markets, operators have invested an increasing amount in developing regions. In 2015 alone, the total was $3.2 billion, well over twice the amount in the previous year.

Figure 12

Source: Operator data, Capital IQ, Delta Partners

Telecoms operators' investments in tech companies

($ billion)

Developed markets   Developing markets
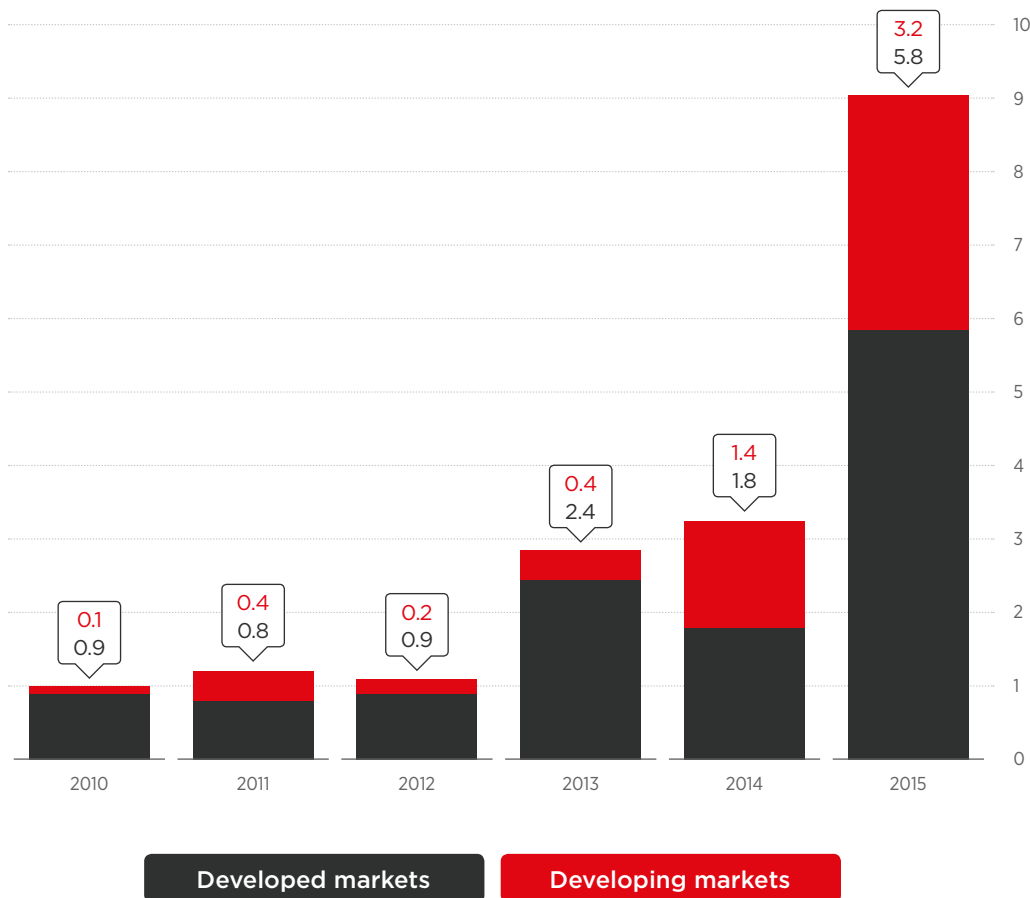
2.2.1

New networks: LPWA and 5G

LPWA networks are being developed to support IoT services and offer a range of advantages over other wireless and cellular technologies. LPWA networks are designed for M2M applications with low data transmission levels that require long battery lives and that operate unattended for long periods of time. Some of the early LPWA network deployments used unlicensed spectrum, including Ingenu, Sigfox and LoRa. Sigfox has deployed networks in most of the major markets around the world, having recently announced a deployment in Japan.

New opportunities for operators are emerging from 3GPP-approved LPWA standards in 3GPP Release 13 (Q2 2016) in licensed spectrum using their existing LTE or GPRS networks. These standards cover LTE Machine-Type Communication (LTE-M), Extended Coverage GSM IoT (EC-GSM-IoT) and Narrowband IoT (NB-IoT). Both LTE-M and NB-IoT run on LTE networks, while EC-GSM-IoT runs on 2G. The global addressable market for LPWA applications is large, totalling around 1.4 billion connections by 2020, with some industry watchers forecasting 5 billion by 2022.

Operators across the world are now beginning to deploy networks and services using these new LPWA standards, with a focus on using their existing LTE network infrastructure. For example, Verizon is launching an LTE-M network, with the goal of nationwide coverage by mid-2017. The company believes it will make its LTE network roughly as affordable as other networks such as Zigbee and Z-Wave for IoT connections. Industry data suggests that in 2017 alone over 35 NB-IoT networks will be deployed in more than 20 countries across the world.

Operators and equipment vendors are collaborating to help drive the development of 5G standards and are already planning early-stage deployments. GSMA Intelligence forecasts that 5G networks will cover around a third of the world's population by 2025. However, 5G will be one of a range of cellular and wireless technologies set to co-exist in a multi-device, multi-network future. Rather than operating as separate networks, 4G, 4.5G and 5G are likely to be integrated into a single network architecture. This architecture may also integrate radio technologies in unlicensed spectrum, such as Wi-Fi.

Small cells and network densification will be key elements of these future network deployments. These fully integrated multi-vendor, multi-technology HetNets (heterogeneous networks), connecting a broad range of devices, will mean high levels of complexity in terms of network management and will pose new challenges for operators and other ecosystem players. 5G will require a new, software-centric, network architecture and for operators to build a broader open ecosystem to develop new business models and use cases.

2.2.2

Embracing the move to open

Many players in the broader mobile ecosystem have already adopted open innovation strategies and embraced the power of collaborative partnerships, particularly those in the app economy and the mobile internet. Open strategies are now being embraced by a number of equipment vendors, for example Huawei's Open ROADS initiative. A number of equipment manufacturers have joined the

Telecom Infrastructure Project (TIP), including Nokia and Cisco.

These trends reflect a more fundamental shift in innovation and the spread of the 'open' concept down to the network layer itself. Operators are also now embracing the move to open innovation, with several joining collaborative initiatives such as TIP and the Open ROADS community.

Figure 13   Source: GSMA Intelligence

The network layer and the shift to open
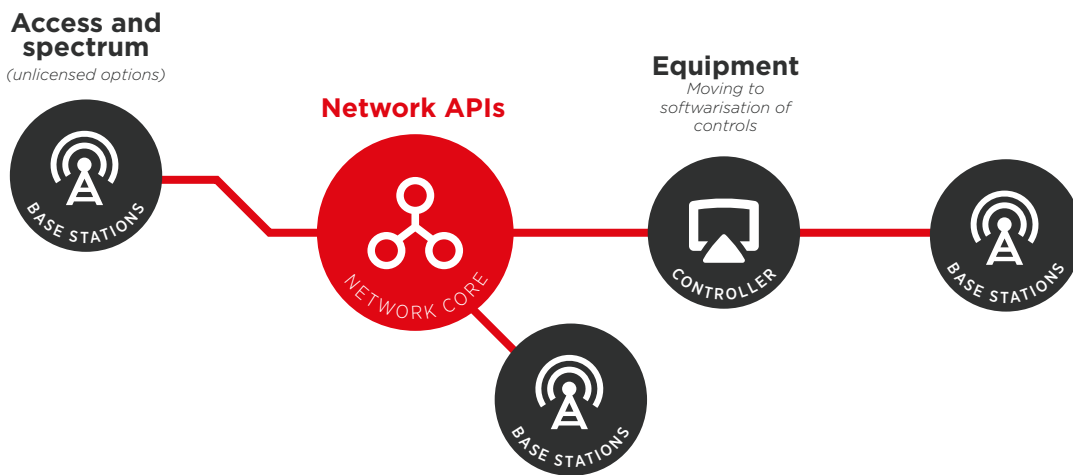
The rapid pace of technological development and open innovation promises a paradigm shift in future networks, leading to a world of heterogeneous networks where multiple network technologies co-exist. This creates the opportunity for mobile operators to further support start-ups and new business models, whether through direct partnerships or the use of open APIs, access channels, incubator programmes or direct funding. Operators can play a crucial role as enablers of open innovation, which would allow them to capture a greater share of value from these future innovations.

Operators are already developing new business models that leverage these trends in open networks, to offer new platforms and innovative new services. As well as opening the door to new services for

customers, these trends will allow a faster pace of innovation and raise the prospect of lower cost operating models for operators at a time when margins and cashflows remain under pressure.

IoT and the prospects of 5G deployments have changed the outlook for network API utility. Both require partnerships for success, and a number of new use cases come into play with the shift of networks to a platform model. As an example, there is an increase in value to be gained in moving from traditional M2M to a full service model by allowing enterprise customers to plug into the host network through custom APIs. The extension of this is to adopt a more decentralised model of network service, in effect bringing cloud principles to mobile networks through edge computing.

2.2.3
Identity and messaging as a platform

Platforms have been at the heart of most of the successful ecosystems created in the digital economy, but the mobile operator community has had limited success in deploying successful platforms that have scaled and found a route to monetisation. One challenge has been a reluctance to embrace the opportunities of open standards and collaboration, as well accepting the fact that competition on digital platforms is often asymmetric.

Collaboration and open standards allow platforms to scale rapidly – a key success factor when competing digital platforms have already achieved significant scale. Collaboration and the nature of asymmetric competition mean that on an open platform, the collaborators and other platform users are able to target each other's customers. While this may result in less control and lower margins for each individual player, the reduced overall costs, ability to scale rapidly and increased rate of innovation afforded by open standards will usually outweigh any benefits of a proprietary platform.

The trade-off of scale versus value leakage by opening up proprietary control points such as a network or database to third parties is not a new one. However, the developments in the broader digital ecosystem over the last 10 years clearly show the benefits of an open approach. Amazon, eBay, Netflix, Uber, Facebook, Google, Twilio and the emerging fintech cohort are all testament to this.

There are two opportunities for operators to build collaborative and scalable platforms:

Identity and access management

In a multi-network, multi-device world with increasing cyber-security threats, the need to accurately identify people and/or devices for secure access has become more urgent than ever. There are two key problems that the ecosystem requires to be solved: validating the 'true' identity of people (allowing access to certain actions) and the challenge of access management (making sure the right devices access the right networks for the right reasons).

Operators are well placed to solve both these challenges for the mobile ecosystem due to their unique range of credentials: network credentials (including the SIM, mobile number and mobile subscriber/device identity number), customer account credentials (including customer account data, point of presence locational data and billing) and personal credentials (such as individual biometrics and PIN codes).

To compete effectively with the internet giants already offering authentication for both their proprietary and third-party service providers, operators will need to collaborate as an industry to achieve the sufficient scale required to offer a compelling proposition to service providers. The industry has an opportunity to collaborate on an identity platform to provide a common interface between operator-led digital identity services and service providers to minimise technical and commercial fragmentation.

Mobile Connect is an example of how operators have come together as an industry to collaborate on identity. This is a global and federated solution for mobile phone-based authentication, authorisation, identity and attribute services. With a potential user base in excess of 2.8 billion, Mobile Connect offers the potential of a scale solution for digital identity. It is built on OpenID Connect – a widely used open standard that can be delivered either by open source platforms, making it simple and cost effective, or bespoke platforms. Mobile Connect is a good starting point to provide a holistic proposition throughout the identity lifecycle, with future evolution likely to see it evolve into a platform-orientated product.

Messaging as a platform

The leading IP messaging platforms have achieved significant scale, with the total global user base approaching 4 billion. Some of the most successful platforms such as WeChat have proved the potential commercial success and value of 'messaging as a platform' to consumers and businesses/brands. In fact, such ecosystems are transforming the way consumers and businesses interact – from the current model of apps and web search to a unified experience for search, interaction and payment of services in one spot: messaging

Rich Communication Services (RCS) is a GSMA-backed technology for advanced messaging services built on an IP multimedia subsystem (IMS) backbone, including video calling, presence, photo sharing and enhanced messaging. In 2016, announcements supporting RCS and the universal profile[2] from leading handset operating system providers, handset suppliers, and operators representing more than 1.5 billion users demonstrated the potential to build an ecosystem around the platform.

Mobile operators have a unique authority to position themselves at an important junction between subscriber and bot technology interactions, with messaging gateways that provide chatbot functionality via SMS or RCS. Operators also have several key advantages that only they can claim, such as network reliability, global interoperability, service ubiquity and, perhaps most importantly, subscriber trust enabled by security and privacy management. Ensuring a secure network will be especially important as chatbots move into the enterprise applications space. In organisations operating in the financial or healthcare sectors, there are also complex legal requirements for protecting information stored on and exchanged via applications.

2. RCS Universal Profile Service Definition Document, GSMA, 2016

2.3
Mobile contributing to jobs and economic growth

For the purposes of this analysis the mobile ecosystem consists of mobile network operators, infrastructure service providers, retailers and distributors of mobile products and services, mobile handset manufacturers and mobile content, application and service providers. The direct 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 $1 trillion (or 1.4% of GDP), with network operators accounting for two thirds of this.

Figure 14   Source: GSMA Intelligence

Direct GDP contribution of the mobile ecosystem

(2016 $ billion, % 2016 GDP)

60	665	110	90	100
0.08%	0.88%	0.14%	0.12%	0.13%
Infrastructure providers	Mobile operators	Device manufacturing	Distributors and retailers	Content, applications and other services
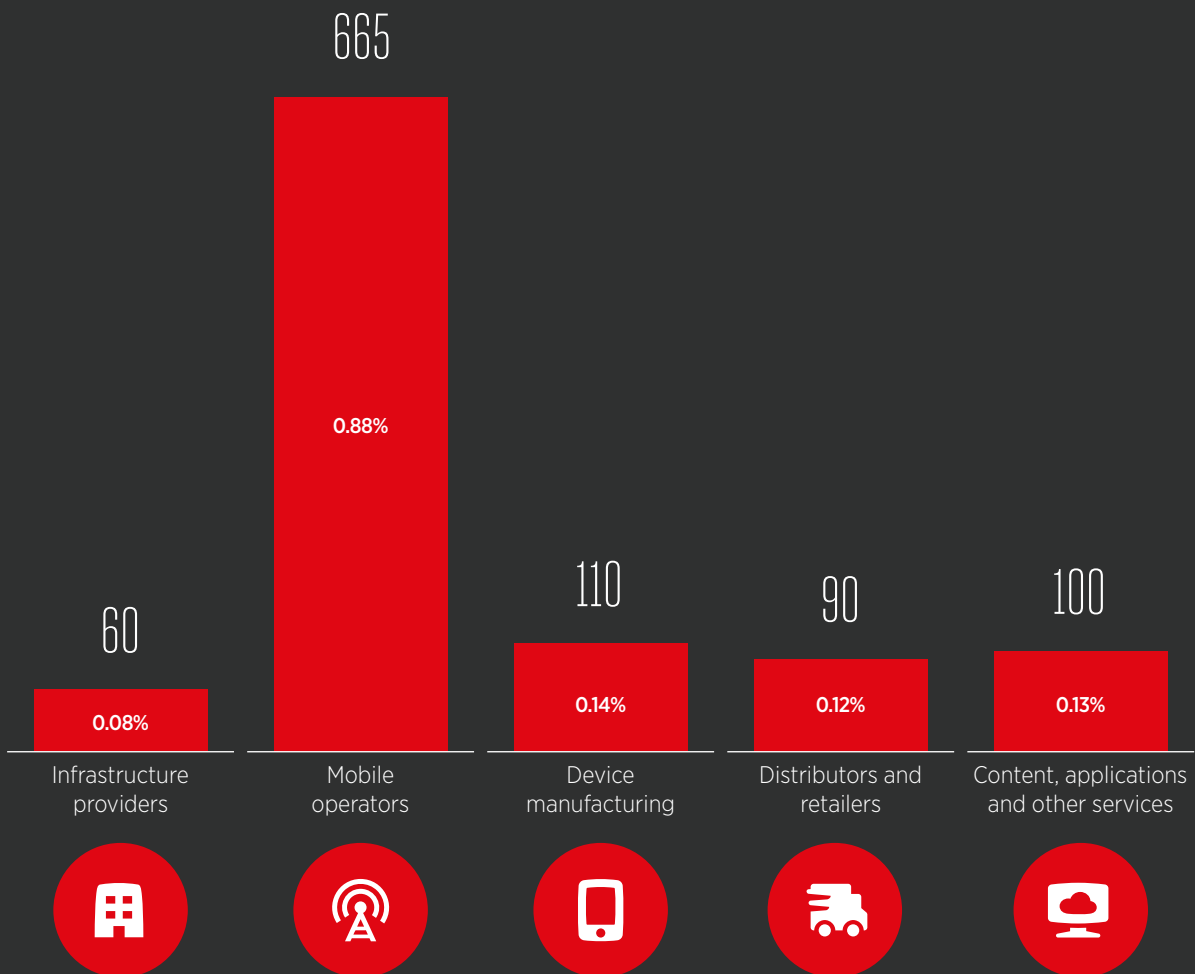
This value added footprint changes across regions. High income countries have advanced digital economies, skilled labour and capital so tend to specialise more on value creation in areas such as content and services. Medium income markets have competitive advantages in device manufacturing (labour costs in particular). Low income countries have on average a less skilled workforce, so their ecosystem configuration typically relies more on the parts of the value chain that are more labour intensive, particularly distribution and retail.

Figure 15   Source: GSMA Intelligence

Value added footprint by income

Percentage of total ecosystem value added

HIGH INCOME COUNTRIES — 6%, 67%, 6%, 8%, 12%

MEDIUM INCOME COUNTRIES — 5%, 59%, 21%, 9%, 6%

LOW INCOME COUNTRIES — 8%, 67%, 8%, 13%, 4%

Legend: Infrastructure | Operators | Device manufacturing | Distributors and retailers | Content and services
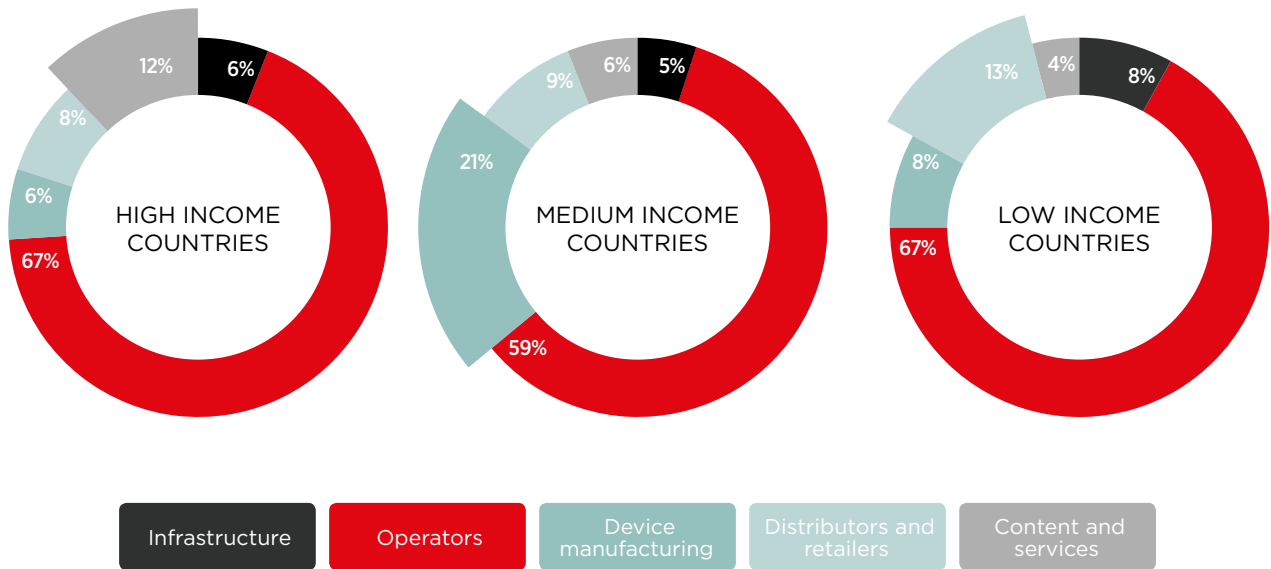
In addition to their direct economic contribution, firms in the mobile ecosystem purchase inputs from their providers in the supply chain. For example, handset manufacturers purchase inputs from microchip providers and mobile content providers require services from the broader IT sector. Furthermore, some of the profits and earnings generated by the ecosystem are spent on other goods and services, stimulating economic activity in those sectors.

In 2016, this additional economic activity generated a further $430 billion in value add (or 0.6% of GDP). The use of mobile technology also drives improvements in productivity and efficiency for workers and firms. These productivity impacts generated around $1.85 trillion in 2016 (or 2.5% of GDP). Overall, taking into account the direct, indirect and productivity impacts, in 2016 the mobile industry made a total contribution of approximately $3.3 trillion in value added terms, equivalent to 4.4% of global GDP.

Figure 16   Source: GSMA Intelligence

Total contribution to GDP

2016 $ billion, % 2016 GDP
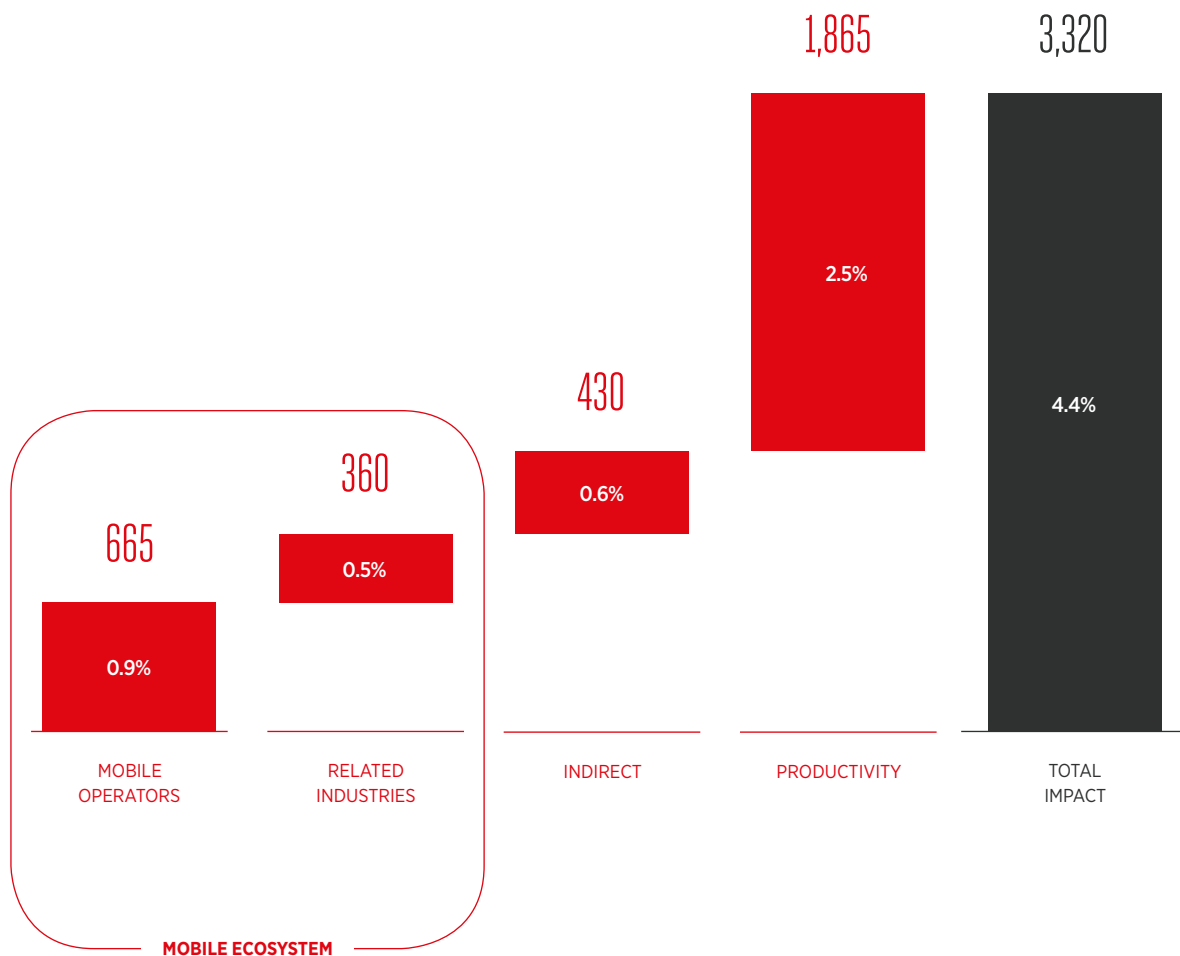
Employment and public funding

In 2016 mobile operators and the ecosystem provided direct employment to more than 11 million people globally. Economic activity in the ecosystem also generates jobs in other sectors. Firms that provide goods and services as production inputs for the mobile ecosystem (for example, microchips) will employ more individuals 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. In 2016, around 17 million additional jobs were indirectly supported in this way, bringing the total impact (both direct and indirect) of the mobile industry to more than 28 million jobs.

Figure 17

Employment impacts

Jobs (millions)

INFRASTRUCTURE PROVIDERS	OPERATORS	DEVICE MANUFACTURING	DISTRIBUTION	CONTENT, APPS AND SERVICES	DIRECT	INDIRECT	TOTAL
0.7	3.1	1.5	4.7	1.3	11.2	17.3	28.5
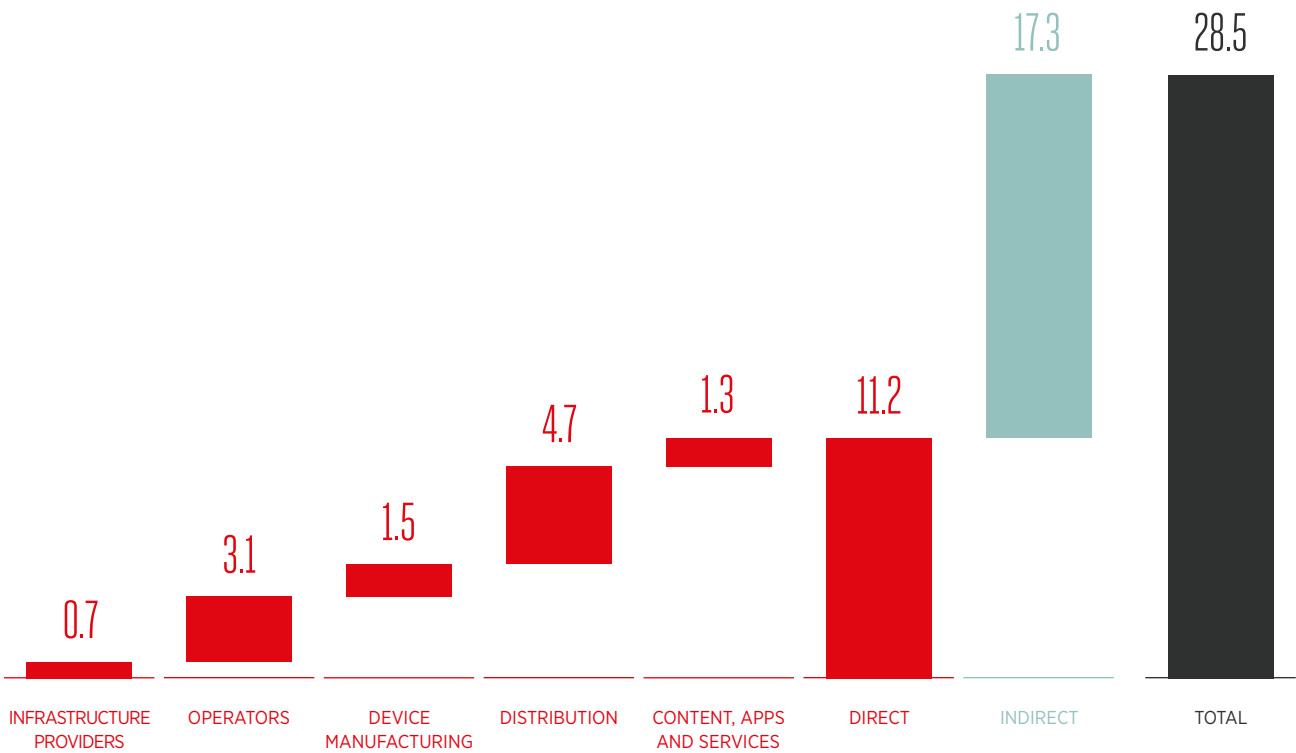
Note totals may not add up due to rounding.

The mobile ecosystem also makes a significant contribution to the funding of the public sector through general taxation. In most countries, this includes value added tax, corporation tax, income tax and social security from the contributions of firms and employees. The ecosystem made a tax contribution to the public finances of governments of around $450 billion in 2016.

Figure 18   Source: GSMA Intelligence analysis

Contribution to public funding

2016 $ billion

Besides the public funding contributions through general taxation, mobile operators made further contributions via two additional channels. In 2016, spectrum auctions generated revenues of almost $19 billion – half of which was from the auction in India. In some countries mobile operators are also subject to sector-specific taxes such as revenue share taxes, social obligation fund contributions, SIM and airtime voucher taxes or annual spectrum fees.[3]

Outlook and trends for 2016–2020

We expect the global economic contribution of the mobile industry to continue to increase in both relative and absolute terms. In value-added terms, we estimate that the ecosystem will generate more than $4.2 trillion by 2020 (4.9% of GDP) up from $3.3 trillion (4.4% of GDP) in 2016. Most of this increase will be due to productivity gains. In the developed world, the adoption of M2M solutions will drive increased productivity growth. In developing countries productivity growth will be driven mostly by the adoption of mobile internet services.

3. See Digital inclusion and mobile sector taxation 2016, GSMA/Deloitte, 2016

3

Mobile addressing social challenges

3.1
Mobile impact on the Sustainable Development Goals

In September 2015, the United Nations Member States adopted the Sustainable Development Goals (SDGs) — a 17-point plan to end poverty, combat climate change and fight injustice and inequality by 2030 – building on the work undertaken through the Millennium Development Goals. The UN SDGs and their associated targets outline a broad and ambitious agenda that integrates economic, social and environmental issues across all geographies and applies to both developed and developing economies.

Mobile is essential to achieving the SDGs. The ubiquity and affordability of mobile technology provides a unique platform for improving and enhancing social and economic development. The industry has already connected 4.8 billion people globally, including 3.6 billion people in developing countries, providing access to tools and applications that address a wide range of socioeconomic challenges in vulnerable communities, as well as enabling new technologies and innovations for building more efficient and environmentally sustainable societies.

The GSMA 2016 Mobile Industry Impact Report[4], which assesses the performance and impact of the mobile industry on the SDGs, finds that mobile is already contributing to all 17 SDGs to varying degrees.

Geographically, the mobile industry has a higher level of impact across developed economies, as investments in networks and connectivity over a long period of time have led to higher penetration of voice, data and IoT services. In developing countries, the mobile industry has made progress against the SDGs predominantly through increased connectivity and access to information, with specific services such as mobile money and agricultural platforms contributing to increased productivity and poverty eradication.

The GSMA and mobile operators are united in support for helping achieve the SDGs across the world, leveraging the power of mobile networks to accelerate this journey in a way that no other technology can. Table 1 highlights some GSMA-backed initiatives addressing specific SDGs.

4. 2016 Mobile Industry Impact Report: Sustainable Development Goals, GSMA, 2016

"The spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies."

Transforming our world: the 2030 Agenda for Sustainable Development, United Nations

Selected GSMA-backed initiatives supporting specific SDGs

1 NO POVERTY

Financial Inclusion
End poverty in all its forms everywhere

With over 400 million registered users, mobile money facilitates access to financial services, many of which contribute to building the resilience of the poor by reducing their vulnerability to economic, social and environmental shocks and disasters.

Research[5] on the impact of mobile money in Kenya shows that the service, since 2007, has helped bring 194,000 Kenyans out of poverty, by allowing users to send and receive payments at low cost, to move from farming to business occupations, and to save more of their income.

2 ZERO HUNGER

Agriculture
End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

Agriculture is the main contributor to GDP in emerging markets and the largest employer. Mobile is uniquely positioned to deliver the critical information quickly that rural smallholder farmers need, enabling them to make better decisions and investments that boost their productivity and profit.

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 outbound alerts that notify users twice per day.

3 GOOD HEALTH AND WELL-BEING

Health
Ensure healthy lives and promote well-being for all

Mobile can increase the quality, reduce the cost and extend the reach of healthcare to benefit millions. There are currently more than 1,000 mobile health services in developing countries targeting families through the provision of health content and diagnostics services.

Wazazi Nipendeni is a mobile health service in Tanzania offering clinic appointment reminders to pregnant women, mothers with new-born babies and caregivers, with the objective to promote healthy behaviours in pregnancy and early childhood care. Led by the Ministry of Health and supported by operators (Airtel, Tigo, Vodacom and Zantel) the service has reached over 1.2 million people since it launched in 2011.

5. The Long-Term Effects of Access to Mobile Money in Kenya, Innovations for Poverty Action

5 GENDER EQUALITY

Women Empowerment
Achieve gender equality and empower all women and girls

Mobile can help empower women, helping them feel more connected, safer, and with access to information and life-enhancing opportunities, such as health information, education opportunities and financial services.

The GSMA Connected Women Commitment Initiative focuses on reducing the gender gap in mobile internet and mobile money services. Mobile operators are making formal commitments in low- and middle-income countries to increase the proportion of women in their mobile internet and/or mobile money customer base by 2020, connecting millions more women. As of January 2017, there were 32 formal commitments to these goals by 24 mobile operators.

6 CLEAN WATER AND SANITATION

Water and Sanitation
Ensure access to water and sanitation for all

Mobile-enabled solutions can improve the efficiency of water and sanitation services and extend their reach, bridging the gap in universal access to water and safe sanitation.

In Kenya, Sanergy has been piloting the use of cellular sensors in Fresh Life Toilets. This improves toilet efficiency by more accurately predicting when waste collection is needed; recording when waste collectors visit latrines and when service is requested, ensuring affordability and hygiene.

7 AFFORDABLE AND CLEAN ENERGY

Energy
Revitalise the global partnership for sustainable development

In the off-grid energy sector, the mobile-enabled solar pay-as-you-go model has been enabling access to clean energy solutions since the early 2010s. Over 800,000 solar home systems use mobile payments and M2M technology to provide reliable, clean energy.

In Uganda the majority of people have no access to grid electricity. Fenix International partnered with MTN to offer pay-as-you-go solar energy, providing a cleaner, affordable alternative to existing kerosene lamps. Only 31% of customers reported using alternative sources of lighting, significantly decreasing the proportion of those subject to unreliable, dangerous energy sources.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Infrastructure
Build resilient infrastructure, promote sustainable industrialisation and foster innovation

A key challenge for this SDG is to address the rural-urban divide. The mobile industry helps by extending and upgrading its infrastructure, connecting remote and underserved communities, stimulating economic participation, and supporting IoT-related innovation.

/n January 2017, the GSMA announced the launch of the first roaming agreement in Tanzania and the first in East Africa. Airtel, Millicom and Vodacom launched six 3G roaming pilot sites to test the sustainable provision of mobile broadband services. The pilots will help cover 70,000 new users across rural areas of Tanzania. They are structured around a replicable methodology to provide critical mobile network access to the unconnected. The GSMA expects to launch similar projects in other markets over the next three years.

10 REDUCED INEQUALITIES

Enhance inclusion
Reduce inequality within and among countries

For many marginalised groups around the world, mobile is the first step to inclusive participation in a connected society. Mobile has a key transformational role in providing formal identity and access to various essential services, including banking.

Addressing the over 60 million people who are forcibly displaced worldwide, approximately 21.3 million of whom are refugees, would go a long way to reducing inequalities. The GSMA Disaster Response programme has launched the Refugees and Connectivity portal to demonstrate how mobile technology is making a difference to the lives of refugees

13 CLIMATE ACTION

Disaster response
Take urgent action to combat climate change and its impacts

Asia Pacific is the world's most disaster-stricken region, with natural disasters alone accounting for over 340,000 deaths in the last 12 years. Given the frequency and intensity of disasters in Asia Pacific, mobile operators have launched services to both prepare for and respond to disasters.

Sri Lankan mobile operator Dialog developed a Disaster and Emergency Warning Network in the aftermath of the 2004 Indian Ocean tsunami. This utilises mobile communications to form an early warning network. The network connects mobile subscribers, emergency responders, community leaders and the general public to a national emergency monitoring centre.

3.2
Call to international development community: mobile can help deliver greater socioeconomic impact

The global community provides around $135 billion per year in official development assistance, according to the Organisation for Economic Co-operation and Development (OECD). A large proportion of this funding is aimed at tackling the challenges highlighted in the UN SDGs. Mobile technology presents a vital opportunity to increase the scale and sustainability of the impact of the development community across sectors and geographies. Inclusive models, emerging from the convergence of various services, such as mobile financial services, M2M and IoT, are increasingly providing affordable access to quality goods and services at the base of the pyramid, and creating livelihood opportunities.

GSMA Mobile for Development (M4D), together with its mobile operator members, is stepping up its commitment to ongoing engagement and support to public and private organisations in the development community through coordinated actions and partnerships that build on the strengths of mobile communication. This creates an opportunity for governments, donors, social enterprises and investors to partner with the mobile industry to address current access and utilisation challenges, and other inequality gaps in critical sectors. The role of governments and other organisations in such partnerships can take various forms – from financial and operational support, to co-creation of services and development policy support.

These partnerships are already occurring; for example, the GSMA M4D Utilities programme partnered with the UK Department for International Development to identify and support innovative mobile-enabled solutions that will improve the lives of many by providing access to affordable and sustainable utility services. To date, the initiatives supported by the fund have directly affected 2.3 million people across Africa and Asia.

3.2.1
Leveraging mobile to improve access to energy, water and sanitation

THE SOCIAL CHALLENGE

In 2015, there were 1.2 billion people without basic energy access[6], 663 million without access to improved drinking water and 2.4 billion lacking access to improved sanitation facilities.[7] Bridging this utilities access gap is essential to eradicate extreme poverty and reach SDG 1. Key obstacles include last mile distribution, affordability, operation and maintenance costs, financing and payment collection. Further, as urban growth stretches the limits of existing and antiquated infrastructure, millions more people across emerging markets are increasingly living with intermittent and unpredictable supply of basic utility services.

THE OPPORTUNITY IN MOBILE

While access to energy, water and sanitation experiences slow growth rates (between 1% and 2% per year for energy), mobile networks have rapidly expanded at a rate of approximately 11% per year in rural locations between 2001 and 2011.[8] This has caused a widening of the gap between access to mobile and access to basic utilities. The size and the reach of the mobile industry's infrastructure offer new pathways to achieve improved access to utilities to underserved communities.

INDUSTRY ACTION

The mobile industry is already helping to bridge the utilities gap with solutions that leverage mobile technology to increase access to energy, water and sanitation in underserved markets. For example, in the first phase of the M4D Utilities Innovation Fund (2013–2015), two organisations operating in Rwanda received funding to pilot their models:

- A consortium including Living Water International, Portland State University and Sweetsense Inc. tested water pump sensors and mobile connectivity to improve rural water pump maintenance

- Mobisol, in partnership with MTN Rwanda, deployed solar pay-as-you-go (PAYG) systems to help entrepreneurial customers power their businesses and generate more income.

The GSMA's M4D Utilities programme has identified five channels through which mobile can impact SDG 6 and 7. See Figure 20.

6. Mobile for Smart Solutions: How Mobile can Improve Energy Access in Sub-Saharan Africa, GSMA, 2014
7. Progress on sanitation and drinking water – 2015 update and MDG assessment, UNICEF, WHO, 2015
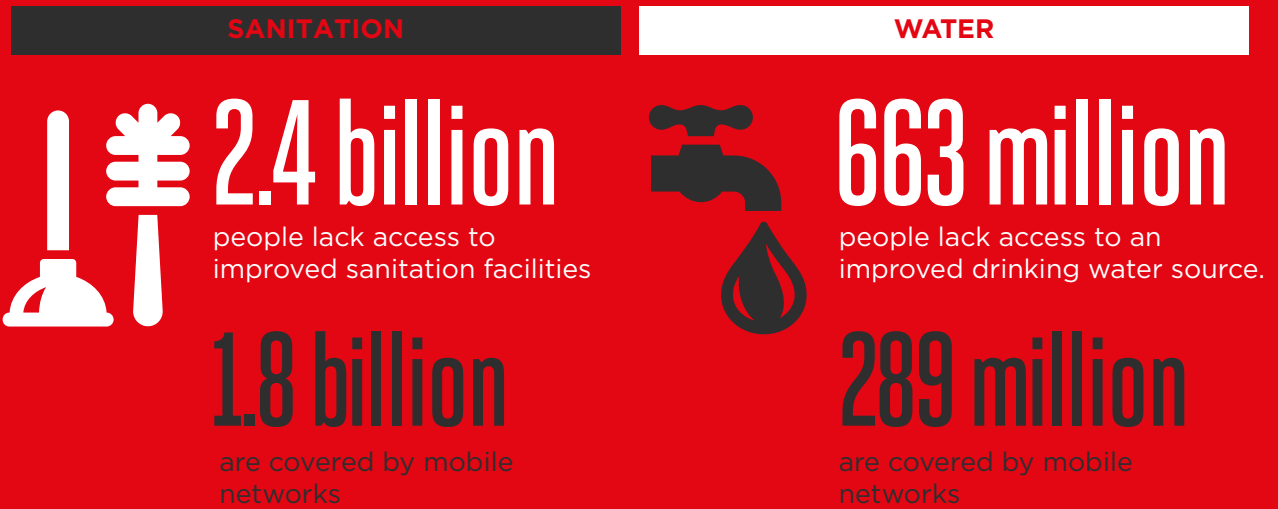8. Predicting the future of Mobile-Enabled Community Services, GSMA, 2014

Improving access to energy, water and sanitation

SDG 6

Ensure availability and sustainable management of water and sanitation for all by 2030

SANITATION	WATER

2.4 billion
people lack access to improved sanitation facilities

1.8 billion
are covered by mobile networks

663 million
people lack access to an improved drinking water source.

289 million
are covered by mobile networks

SDG 7

Ensure access to affordable, reliable, sustainable and modern energy for all by 2030

1.2 billion
people lack access to energy

772 million
are covered by mobile networks
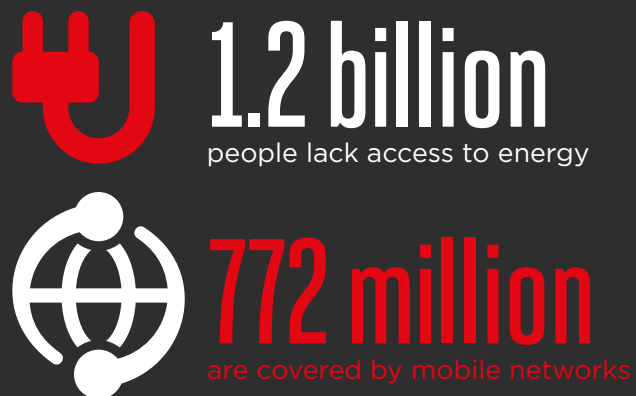
How mobile can impact SDGs 6 and 7

MOBILE INFRASTRUCTURE

The telecoms tower acts as the anchor load for the energy service company (ESCO) that also supplies energy to surrounding communities via a microgrid and/or energy hub model.

SALES, DISTRIBUTION AND BRANDING

The extensive footprint of mobile network operators' sales and distribution channels together with their recognisable and trusted brand can be leveraged to reach underserved customers with energy, water and sanitation solutions.

MACHINE-TO-MACHINE CONNECTIVITY

Smart metering and monitoring of utility systems over GSM networks improves their lifetime and efficiency, triggers more responsive maintenance and repair, and provides insights into customer behaviour. It also enables on/off control of services to customers on a PAYG arrangement.

MOBILE PAYMENTS

Mobile payments (mobile money services, SMS payments, airtime) enable the development of PAYG models and other innovative financing schemes. In addition to supporting remote and secure collections, mobile payments also create a digital record of payments, for those without a prior credit history.

MOBILE SERVICES

Mobile services (voice, SMS, USSD, apps) are used by communities, village agents and service providers to report service delivery status, improve field operations, optimise supply chains or provide customer support.

3.3
Mobile delivering greater inclusion

3.3.1
Digital inclusion – closing the access and usage gap

Mobile technology plays a critical role in delivering the ambition of universal internet access; the number of individuals accessing the internet over mobile devices doubled over the past five years to 3.6 billion. Over the period to 2020, an additional 1.1 billion people are expected to subscribe to a mobile internet service, the majority of them from the developing world, bringing the total to 4.7 billion.

Mobile internet subscriber penetration

| 2016 | 2020 |
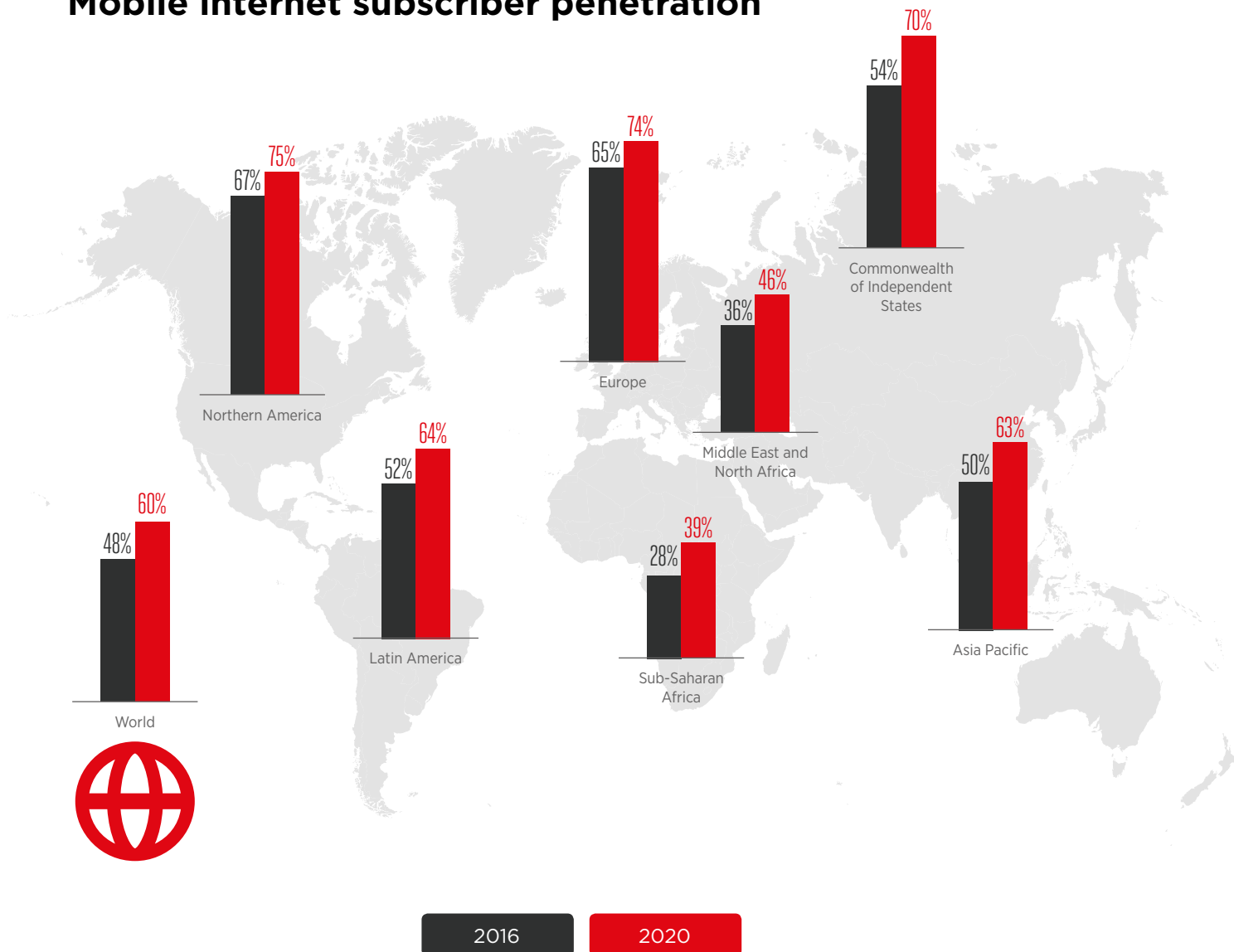
Despite this strong growth there remains a significant digital divide; around 40% of the global population will still lack mobile internet access by 2020, a figure that rises to more than half in some developing regions. A disproportionate share of unconnected individuals will be among underserved population groups, including women and low-income earners, who still face significant barriers to mobile internet adoption.

The growth in internet access continues to leave women behind in particular. The ITU found that the gender gap in internet access is worsening: between 2013 and 2016 the gender gap increased from 15.8% to 16.8% in developing countries.[9] As internet access expands in rural areas, it is men who tend to be connected first. This issue is compounded by lower rates of female literacy and financial autonomy, and by the prevalence in many developing countries of attitudes and cultural norms that prohibit access to technology and the internet for women.

9. ICT Facts and Figure 2016, ITU, 2016

Underpinning the gap in internet access is the gender gap in mobile phone ownership. In its 2015 Gender Gap study[10], the GSMA found that women in low and middle income countries were 14% less likely than men to own a mobile phone – and 38% less likely in South Asia – equating to 200 million fewer women than men owning mobile phones in these markets.

The GSMA Connected Society programme works with and on behalf of the mobile ecosystem to facilitate four key enablers that support greater adoption of the mobile internet:

INFRASTRUCTURE – availability of high-performance mobile internet network coverage

AFFORDABILITY – 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 use and benefit from the internet with a cultural environment that promotes gender equality

CONTENT – the availability of online content and services that are accessible and relevant to the local population.

Infrastructure
Driving coverage expansion through active infrastructure sharing

Around 1.3 billion people are not yet covered by a mobile broadband network. The coverage gap is particularly wide in Sub-Saharan Africa; two thirds of the population in the region live in rural areas where capital-intensive infrastructure deployment is commercially unviable.

In recent years, several unconventional mechanisms have emerged to address the high costs and complexities of rural deployment. These include operator-led initiatives, such as infrastructure sharing, and aerial connectivity solutions, such as satellites, drones and balloons. Passive infrastructure sharing has taken off in many markets across the world, but active infrastructure sharing is only starting to gain traction.

Sharing part, or all, of the radio access network (RAN) can address network densification requirements, boost spectral efficiency and give mobile operators the flexibility to redeploy infrastructure to underserved areas.

---

10. Bridging the gender gap: Mobile access and usage in low- and middle-income countries, GSMA, 2015

2.1 Affordability
Increasing connectivity through sector-specific tax reforms

Affordability remains a significant barrier to mobile broadband adoption. Although device costs are falling and price competition has brought down mobile broadband tariffs in many countries in recent years, other inhibiting factors such as income inequality and the level of taxation continue to weigh on the affordability of mobile broadband services.

Income inequality is a particular challenge to digital inclusion in developing countries. On average, the per-capita income of the top 20% of the population in Latin America is eight times the income of the bottom 40%. Consequently, the cost of mobile ownership for the poorest 40% of the population is on average 17% of income, compared to 2% for the top 20% of the population. This scenario is replicated across other developing regions.

Affordability challenges are often compounded by sector-specific taxes levied on mobile services, which have a disproportionate impact on unconnected populations. Mobile-specific taxes (such as airtime excise and SIM taxes) imposed on consumers and mobile operators reduce returns on investment for mobile operators and raise the final price of services for users. The result is lower incentives to invest in network rollout and upgrades in uneconomic rural areas, and lower affordability for consumers. A recent study[11] conducted for the GSMA by Deloitte on taxation and regulatory fees in Colombia found that sector-specific taxation represented 37% of mobile services total tax payments in 2014 – a larger share, with the exception of the Dominican Republic, than in any other Latin American country surveyed in the GSMA's 2016 mobile taxation survey.

Governments can encourage and speed up the transition to a connected society by providing incentives to mobile broadband uptake. This has been recognised by a number of countries[12]:

- Angola, China, Lesotho and Vietnam apply relatively lower VAT rates on mobile data and/or mobile services, compared to other standard goods and services, to stimulate uptake

- Turkey and Sri Lanka levy excise taxes on mobile services but the rate is lower for data usage

Conversely, there are illustrations of policy risks to providing affordable mobile broadband services. These include a directive, by the Nigeria Communications Commission (NCC) in November 2016, mandating that larger mobile operators increase mobile data tariffs in order to provide a level playing field for all operators in the market.

Consumer barriers
Improving consumer readiness and content

Digital skills and awareness are key factors of consumer readiness for mobile internet adoption. People need to understand the relevance and benefit to their lives from being online and have the necessary skills to take advantage of the opportunity. Lack of digital skills is a particular issue in Sub-Saharan Africa, where 38% of respondents

to a GSMA Consumer Survey in 2016 highlighted it as the biggest barrier to mobile internet adoption.[13] Enabling digital literacy is a key component to supporting understanding and use of the mobile phone interface, reading its display and using its keyboard.

11. Digital Inclusion and Mobile Sector Taxation in Colombia, GSMA, 2016
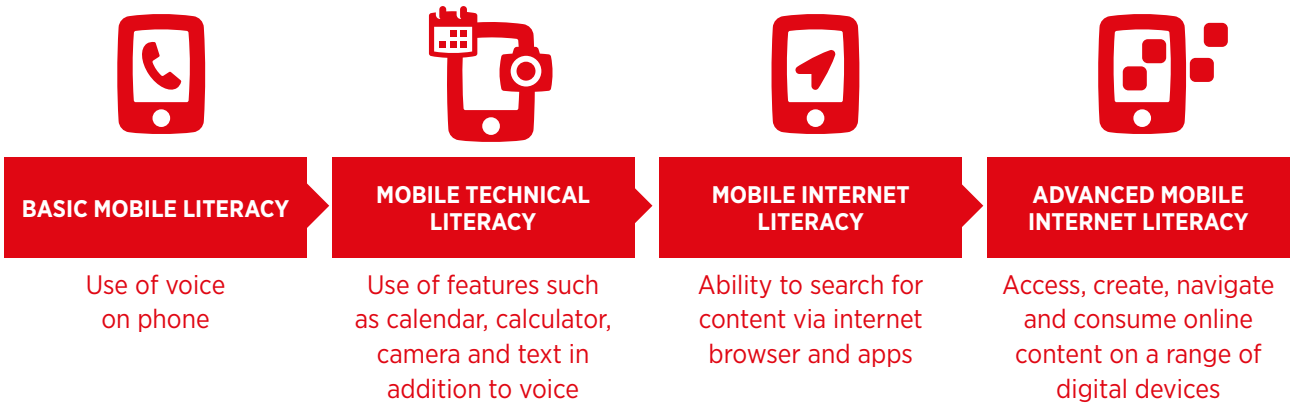12. Digital inclusion and mobile sector taxation 2016, GSMA, 2016
13. Consumer barriers to mobile internet adoption in Africa, GSMA, 2016

Figure 22   Source: GSMA

Explaining mobile internet literacy

BASIC MOBILE LITERACY	MOBILE TECHNICAL LITERACY	MOBILE INTERNET LITERACY	ADVANCED MOBILE INTERNET LITERACY
Use of voice on phone	Use of features such as calendar, calculator, camera and text in addition to voice	Ability to search for content via internet browser and apps	Access, create, navigate and consume online content on a range of digital devices

Complementing consumer readiness is the availability of locally relevant content, which ensures that consumers can access information online that addresses issues of interest in a language they can understand. Across several developing economies, respondents to the GSMA Intelligence Consumer Survey cited a lack of relevance as the largest barrier to mobile internet adoption. In Africa, just over 40% of the population in the surveyed countries speak the main languages of the internet, such as English, French and Portuguese, meaning there is a language barrier around available content.[14]

Mobile operators and other players in the mobile ecosystem have an important role to play in addressing these barriers. The opening up of key API assets, such as billing, location, messaging and mobile money, to local start-ups and third-party developers is enabling the development of content and services that appeal to local interests.

3.3.2
Financial inclusion – reaching the unbanked

Mobile money continues to help expand financial inclusion across the world, especially in countries with large unbanked populations. Services are now available in 85% of the countries where the vast majority of the population lacks access to formal financial institutions, and in six out of seven markets where less than 20% of people have an account at a financial institution.

There are now 277 live services across 92 markets, including two-thirds of low- and middle-income countries, according to GSMA's sixth State of the Industry Report on Mobile Money, marked by a special decade edition. Registered accounts have grown nearly six-fold in the last five years to more than half a billion in 2016, helped by a growing network of mobile money agents. In 2016, there were more than 4.3 million registered agent outlets, of which 2.3 million were active on a monthly basis. Thirty countries now have ten times more active agents than bank branches, bringing mobile money within reach of millions of unbanked households.

14. Consumer barriers to mobile internet adoption in Africa, GSMA, 2016

Driving financial inclusion in rural areas by digitising payments in agriculture

The digitisation of business-to-person (B2P) and government-to-person (G2P) payments in agriculture is emerging as a new opportunity to drive financial inclusion in rural areas. Payments through mobile money to smallholder farmers, the majority of which remain unbanked in developing countries, reduces the time, risk and cost associated with traditional cash disbursements by eliminating the need to travel long distances to receive and pay cash. It also offers the potential to create a financial identity via transactional records that can open the door to a broader range of financial services, such as savings and credit. For example, Telenor's partnership with Nestlé in Pakistan to digitise payments for dairy farmers through Easypaisa mobile accounts has the potential to drive financial inclusion for approximately 150,000 dairy farmers across the country.[15]

Success factors for mobile money

In 2015, the GSMA published a large-sample quantitative analysis[16] of the expansion of digital financial services globally. In this study the relative importance of key business and market characteristics on the growth of active mobile money accounts, as well as mobile money transaction volumes and values, were examined. The analysis found strong evidence of certain factors associated with the success of mobile money services, including:

- The outperformance of mobile operator-led[17] mobile money deployments in developing and delivering digital financial services with broad outreach compared to other deployments.

- The important role of enabling regulation to the success of mobile money services.

- Mobile operators with the largest market share were more likely to capture a greater proportion of a country's overall addressable market for mobile money.

- Countries with high levels of formal financial account ownership see relatively low mobile money prevalence, while countries with medium levels of account ownership see the greatest success.

Reducing the cost of international remittances

More than 250 million people live outside their country of birth and regularly send money home, providing a financial lifeline to their families and contributing to the economies of their home countries. In 2015, global remittances totalled $581.6 billion, of which nearly three quarters was sent to the developing world. The high cost of international transfers directly impacts the income of remittance recipients across the developing world. According to the World Bank, the global average cost of sending $200 stands at 7.6%.

A GSMA report[18] assessing the opportunities of mobile in international remittances found that using mobile money is, on average, more than 50% cheaper than using global money transfer operators. In 2010, Ooredoo Qatar launched Ooredoo Mobile Money, a mobile money service with remittance options, targeting low-income migrant workers who send money home on a regular basis. More than 50,000 international transfers are now sent every month using the service, primarily to Bangladesh, Indonesia, Kenya and the Philippines.

15. Market size and opportunity in digitising payments in agricultural value chains, GSMA, 2016
16. Success factors for mobile money services, GSMA, 2016
17. A mobile money service is operationally run by a mobile network operator (MNO) when the MNO is ultimately responsible for the design and implementation of the majority of the operational strategy, including distribution, marketing and customer care.
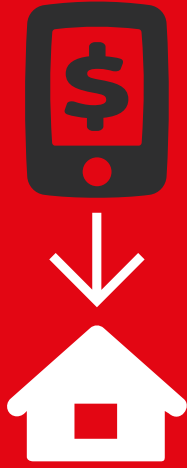18. Driving a price revolution: Mobile money in international remittances, GSMA, 2016

The promise of mobile money international remittances

In 2015,

250 million

international migrants remitted around $600 billion to their families in their home countries*

*Source: World Bank

Mobile money is a

SECURE, CONVENIENT & INSTANT

method for international remittances

International remittances via mobile money have

IMMENSE POTENTIAL

MOBILE MONEY IS AVAILABLE IN

85%

OF MARKETS

WHERE LESS THAN

20%

OF THE POPULATION HAS ACCESS TO A FORMAL FINANCIAL INSTITUTION

International remittances: The fastest growing mobile money product by volume

+52%
IN 2015

International remittances via mobile money are accelerating financial inclusion and supporting

UN SUSTAINABLE DEVELOPMENT GOALS

| 1 NO POVERTY | 5 GENDER EQUALITY | 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE | 10 REDUCED INEQUALITIES |

3.3.3

Identity – the potential for mobile to unlock digital identity for all

The United Nations Sustainable Development Goals aim for every person to have a legal identity by 2030. Without proof of identity, citizens cannot access a wide range of services, assert rights or fully participate in the digital and analogue worlds. Currently, more than 1.5 billion people lack any form of legally recognised identity, and this disproportionally impacts rural residents, poor people, women, children and other vulnerable groups. Robust digital identity systems can drive innovation, increase transparency and accountability, and generate savings for citizens, government and business.

The GSMA Digital Identity programme is working with mobile operators, governments and the development community to demonstrate the potential for mobile to enable and accelerate sustainable digital identity for all, leading to greater access to life-enhancing services that have social and commercial impact. By developing and testing new use cases that meet the needs of the underserved, generating research and insights, and addressing policy and regulatory issues, the GSMA aims to stimulate and drive the use of mobile in the digital identity ecosystem.

A recent report by the GSMA examines the role of policy and regulation in facilitating the introduction and take-up of digital identity solutions.[19] A number of country-specific factors present opportunities and risks that may impact the effectiveness, reputation and commercial viability of digital identity solutions. Key trends identified in the report include the following:

- An increased drive by governments to establish identity – something the SDGs seek to accelerate and mobile operators can help achieve.

- There is considerable diversity in approaches to digital identity, making harmonisation, standardisation, federated approaches and interoperability particularly important.

- Mobile operators in some markets are already subject to identity-related requirements, such as mandatory SIM registration and know-your-customer (KYC) obligations for mobile financial services. Taking an integrated policy approach to these requirements would boost momentum towards mobile-based digital identity.

- A robust trust framework is important for digital identity solutions to grow. Technical specifications, standards and procedures, data protection, privacy and other identity-related laws, regulations and consumer expectations must all be aligned to ensure operational effectiveness and a viable allocation of risk and opportunity.

- Increasing reports of government requests to access communications pose a risk to consumers' trust and perceptions of digital identity solutions. Regulators, policymakers and mobile operators need to promote transparency and proper lawful management of government access requests, ensuring that procedural checks and balances are in place, so that any interference with the right to privacy of mobile users is in accordance with the law.

Mobile birth registration in Tanzania

Tanzania has one of the lowest rates of birth registration in Africa – around 80% of Tanzanians do not have birth certificates, according to the 2012 census.

In October 2015, the government launched a pilot across multiple regions to help parents register births by mobile phone as part of a drive to better plan health, education and other public services. The system allows a health worker to send the baby's name, sex, date of birth and family details by phone to a central database, and a birth certificate is issued free of charge immediately. The initiative is run by the government registration agency RITA, in partnership with Tigo and UNICEF, and expects to register 90% of all new-borns in 10 new regions by the end of 2019.

---

19. Regulatory and policy trends impacting Digital Identity and the role of mobile, GSMA, 2016

4

Rethinking regulation for the digital age

With the growing digitisation of the economy, the telecoms industry is changing beyond recognition. These changes have major ramifications for policy, as many of today's rules and regulations date from an era when telecoms operators were the sole providers of communications and information services. Now they compete with a broad and diverse set of service providers.

Policymakers and regulators need to fully understand the changing role of the telecoms industry in an increasingly digital economy: longstanding market definitions have become obsolete. Through the convergence of digital technologies and services, telecoms markets have become increasingly integrated with adjacent markets: service providers from different sectors increasingly co-operate and compete with each other.

The fundamental changes taking place in telecoms markets and adjacent sectors have major implications for all aspects of policy, including regulatory frameworks, anti-trust reviews and the way spectrum is allocated. Prescriptive regulatory frameworks, which were designed for a less dynamic era, can be redesigned to encourage innovation and investment.

Figure 24   Source: GSMA

Features of digital market call for a different and more nuanced approach to competition policy

DYNAMIC WAVES OF INVESTMENT, INNOVATION & TECHNOLOGY

MULTI-SIDED MARKETS & PLATFORMS

NETWORK EFFECTS AND ECONOMIES OF SCALE FOR DIGITAL SERVICES

Quality more important to consumers than price

Big Data as a key competitive factor

Broader Markets and blurring of traditional boundaries

4.1
Redesigning regulation

In most markets, regulatory policies and institutions need to be reviewed and potentially overhauled to ensure they will be effective in the digital economy. In doing so, policymakers should apply three specific principles:

• Regulation should achieve its objective in the most efficient way regardless of the technologies, industry structures or legacy regulatory regimes.

• As markets in the digital ecosystem are dynamic and complex, regulation needs to be flexible.

• Regulatory reform should follow a bottom-up approach that takes entirely new approaches into consideration, and is willing – where appropriate – to jettison old ones.

Over the past 12 months, some policymakers have moved in this direction, initiating a fundamental overhaul of the way in which the telecoms industry is governed. For example, the European Commission has tabled legislative proposals to revamp Europe's telecoms regulatory framework – part of a broader new strategy to achieve ubiquitous, high-speed connectivity across the EU. Moreover, the proposals for spectrum policy reform, such as mandating longer licence durations, are designed to provide the consistency and certainty needed to give investors confidence.

The Commission is also taking steps to reduce some aspects of sector-specific service regulation that are no longer relevant or appropriate in today's dynamic and converging communications service market. If the EU can establish a consistent, fair and predictable regulatory environment, operators are more likely to make the investments needed to secure Europe's digital future and enable the region to benefit from 5G mobile technologies and services.

4.2
Resetting competition policy frameworks

Competition in digital markets is characterised by waves of investment and innovation, and rapid technological progress. Competitive dynamics are changing, with digital technologies reshaping existing markets and giving rise to new services. Consumers in digital markets often value quality and product features over low prices. The supply of digital services tends to be characterised by scale economies and strong network effects. Digital platforms can be two-sided or multi-sided, with distinct groups of users benefitting from the presence of the other. Collecting and analysing customer and supplier data may create a strategic advantage, especially when it helps to improve the quality of services.

These new features of the digital market call for a different and more nuanced approach to competition policy. Governments should ensure their competition and regulatory frameworks reflect how the market has evolved and provide a sound foundation for ongoing competition, investment and innovation that benefits everyone.

A recent report by the GSMA provides a number of recommendations as to how governments and regulatory authorities can update competition and regulatory frameworks to realise the full potential of the digital economy.[20]

20. Resetting competition policy frameworks for the digital ecosystem, GSMA, 2016

4.3
Spectrum and laying the foundations for 5G

To ensure their citizens and companies can harness the potential benefits of 5G mobile technologies, governments need to act now. In particular, policymakers need to take steps to make sufficient spectrum available once the first commercial 5G networks go live from 2020.

The World Radiocommunication Conference in 2019 (WRC-19) will be pivotal in this respect. Through the WRC-19 process, governments need to identify harmonised spectrum for 5G and incentivise the necessary network investment. Global harmonisation of the frequency bands used for mobile technologies and services enables the industry to develop low-cost devices, support international roaming and minimise cross-border interference. If governments fail to agree a common set of bands, then 5G spectrum could become fragmented, which could drive up device costs and undermine access to widespread, affordable 5G.

Mobile operators will need internationally harmonised spectrum in three different ranges:

- Sub-1 GHz will support widespread coverage across urban, suburban and rural areas and help support Internet of Things services.

- The 1–6 GHz range offers a good mixture of coverage and capacity benefits: spectrum within the 3.3–3.8 GHz range is likely to form the basis of many initial 5G services.

- Above 6 GHz is needed to meet the ultra-high broadband speeds envisioned for 5G; a focus will be on bands above 24 GHz.

Governments will also need to ensure that regulation, the cost of spectrum and the obligations placed on licence holders all encourage, rather than deter, investment. Given the large number of small cell sites required to deliver ultra-high speeds, 5G deployments will require significant network investment. An unfavourable regulatory environment and/or excessive fees could compromise the speed of 5G deployments, quality of service and coverage levels.

4.4
Securing data and safeguarding privacy

The collection of personal data by apps and devices has many benefits for individuals and society, such as tailored products and services, smarter cities, personalised recommendations and targeted healthcare and disaster response systems. However, realising these benefits depends on consumers fully trusting the online environment.

The mobile industry recognises the need to maintain consumer trust and has implemented various initiatives, such as the GSMA Privacy Principles, to help safeguard individuals' personal data and protect their privacy. Regulation should be principle-based and consistent across all sectors of the economy. It also needs to be flexible enough to enable service providers to develop innovative propositions by harnessing data from new sources, such as the Internet of Things, drones, smart appliances and other technological advances. New insights derived from the data will often give rise to new uses that had not been considered or identified when the data was initially being collected.

Any rules that restrict the legitimate use of data or metadata should be qualified and proportional to the risk of privacy harm that consumers might suffer if their data is misused and should not discriminate based on industry sector or technology.

The EU's General Data Protection Regulation (GDPR), passed in May 2016, is a good example of how regulation can be future-proof. Designed to modernise the EU Data Protection Directive of 1995, the GDPR set out to encourage data-driven innovation by maintaining a principle-based approach and introducing a more dynamic framework focused on addressing outcomes, rather than imposing prescriptive rules. It abolished the system of detailed national registrations and prior approvals in favour of a duty on organisations not only to comply with the rules but to implement comprehensive policies and safeguards and to be able to demonstrate how they comply. Organisations that hold themselves accountable in this way are able to take advantage of easier cross-border transfers of data.

As the digital economy is increasingly global, it is important that governments across the world seek to harmonise international privacy and data protection rules. Different regulations in different regions hamper international trade and curb economies of scale to the ultimate detriment of consumers.

Even so, there is a regulatory trend towards greater localisation, fuelled by a misconception that localised services are automatically safer than cross-border services.

The new EU–US Privacy Shield Framework, which has brought greater clarity to transatlantic data regulations, is a positive step. Designed by the US Department of Commerce and the European Commission, the Shield Framework provides companies with a mechanism to comply with EU data protection requirements when transferring personal data from the EU to the US in support of transatlantic commerce. In July 2016, the European Commission deemed the Privacy Shield Framework adequate to enable data transfers under EU law.

In Asia-Pacific, the APEC Cross Border Privacy Rules (CBPR) system is gaining traction. Designed to strengthen the protection of consumer data as it moves across borders and reduce regulatory compliance costs, the system requires participating businesses to develop and implement data privacy policies consistent with the APEC Privacy Framework. Participating firms develop their own internal business rules on cross-border data privacy procedures, but they must comply with the system's minimum requirements based on assessments by an independent body. There are currently four economies – the US, Mexico, Japan and Canada – participating in the APEC CBPR system and more are set to join soon.

gsma.com