

The Mobile Economy 2023



GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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Our team of analysts and experts produce regular thought-leading research reports across a range of industry topics.

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Executive summary

Mobile connectivity is a lifeline for society

Mobile connectivity continues to be a lifeline for society, helping the most vulnerable people in areas affected by conflict and natural disasters to stay connected. It is also enabling advanced connectivity capabilities needed by verticals to innovate amid diverse political, social and macroeconomic headwinds.

By the end of 2022, over 5.4 billion people globally subscribed to a mobile service, including 4.4 billion people who also used the mobile internet. The mobile internet usage gap has narrowed markedly in the last five years – from 50% in 2017 to 41% in 2022 on average – but still remains significant and demands urgent attention from all stakeholders.

In 2022, mobile technologies and services generated 5% of global GDP, a contribution that amounted to \$5.2 trillion of economic value added, and supported 28 million jobs across the wider mobile ecosystem. 5G will underpin future mobile innovation and services, building on ongoing deployments and adoption. 5G adoption will reach 17% this year, rising to 54% (equivalent to 5.3 billion connections) by 2030. The technology will add almost \$1 trillion to the global economy in 2030, with benefits spread across all industries.



By the end of 2022, over 5.4 billion people globally subscribed to a mobile service, including 4.4 billion people who also used the mobile internet

Key trends shaping the mobile ecosystem

5G consumer monetisation comes into focus

Throughout 2023, some 30 new markets will launch 5G services; importantly, many of these will be developing markets across Africa and Asia, making 5G a truly global trend. As 5G adoption continues to scale, the monetisation imperative will grow. Operators will increasingly focus their marketing efforts on highlighting the link between mobile devices, 5G and new digital services while also expanding their 5G fixed wireless access (FWA) offerings to new areas. Markets in which the mix of fixed broadband technology is skewed towards DSL are likely to lead in 5G FWA penetration growth. Markets with low fixed broadband penetration but rising incomes will also see faster-than-average growth.

Private 5G builds momentum

Private wireless solutions are back in vogue, as 5G's enhanced capabilities allow deployments to move beyond low-profile niche offerings. Industrial premises in the form of factories and warehouses are a natural setting for private wireless networks. Strong growth for private networks is also expected in transport and logistics, as 5G's improvements in terms of capacity, latency and reliability can facilitate new use cases within a private wireless setting. For private networks to scale, solutions need to become cheaper as well as easier and faster to install and operate. This is driving demand for pre-integrated solutions with supporting infrastructure.

Mobile industry shifts towards circularity

Across the telecoms ecosystem, sustainability has extended beyond corporate social responsibility to become a core strategic priority. Industry players are increasingly adopting a model of production, service offering and consumption that involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible. This circular approach is important for networks to operate in a more sustainable and energy-efficient way, and for the industry to make progress towards realising its climate goals.

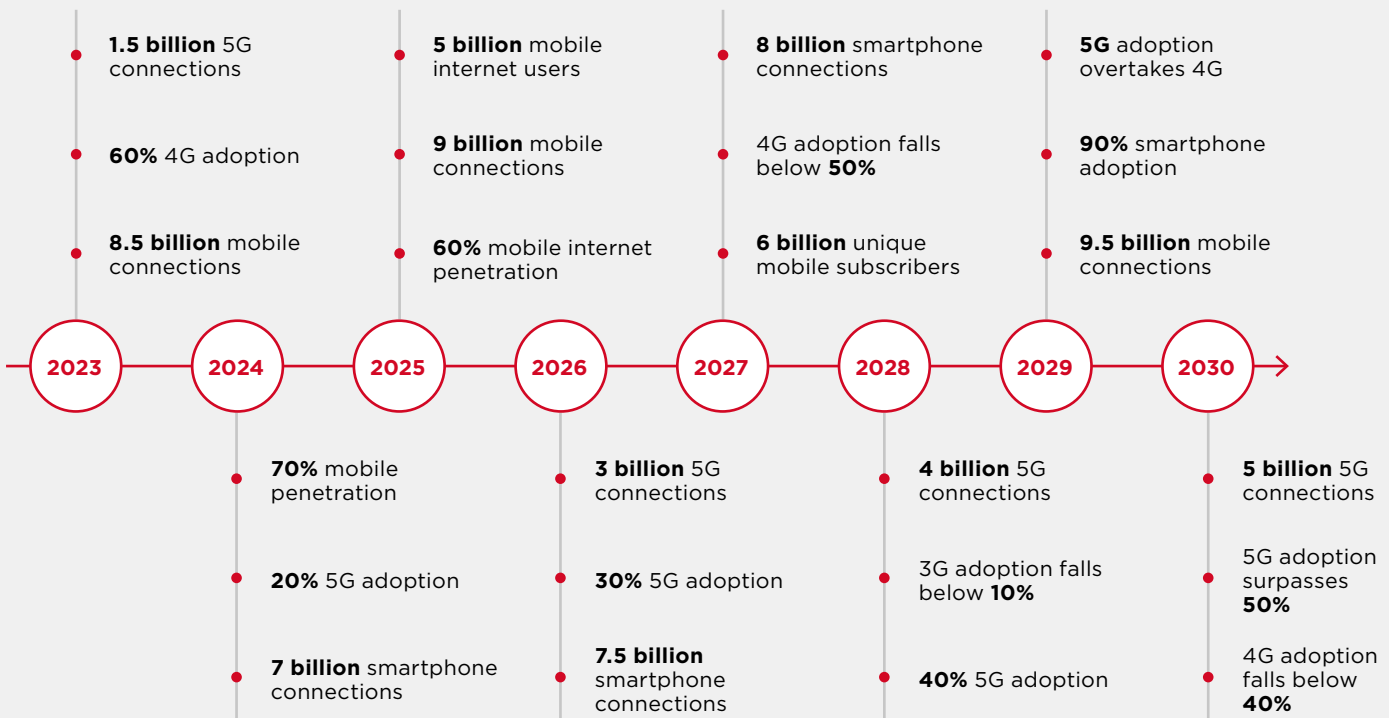
The metaverse continues to gain traction

Momentum for the metaverse continues to grow, alongside advancements in enabling technologies like 5G, AI and wearables. The growing interest from key stakeholders and ecosystem players has led to the emergence of important building blocks for the advancement of the metaverse, notably content and applications, standards and devices, which will be at the forefront of activities in 2023. Beyond connectivity, the metaverse holds the promise of new revenue streams for operators, highlighting the need for innovation and partnerships to identify use cases and network requirements.

Fintech presents opportunities for mobile industry players

Fintech has transformed the way financial services cater to consumers and businesses alike. Although investor sentiments fell sharply in 2022 after record funding the previous year, the fundamentals of growth – including high demand, digital-centric lifestyles and enabling regulations – remain strong. The fragmented nature of the fintech market and the positive long-term growth outlook raise the prospects for consolidation and interest from established financial institutions and companies in other sectors (including mobile ecosystem players) looking to capitalise on the fintech opportunity through strategic investments, collaborations and partnerships.

Key milestones for the mobile industry to 2030



Policies for growth and innovation

Telecoms infrastructure serves as the foundation of all modern digital economies. It plays a crucial role in helping governments, at both national and transnational levels, to achieve economic growth, digital inclusion, social mobility and environmental objectives. To this end, policymakers should take actions that can help to rebalance the digital ecosystem and create fairer business conditions, such as removing sector-specific regulatory and fiscal requirements, combined with removing market imbalances along the digital value chain. They should also rationalise tax structures based on internationally accepted principles and consider the balance effects (innovation, investment and price) of mergers on dynamic competition. Meanwhile, the ITU's World Radiocommunication Conference 2023 (WRC-23) will take place from 20 November to 15 December 2023 in Dubai. WRC-23 will offer an opportunity to build a spectrum roadmap going into

the 2030s, address the digital divide and ensure 5G can benefit billions of people around the world. The chance to expand the availability of affordable 5G services, along with regulatory policy support, would ensure future growth and innovation.

WRC-23 will offer the chance to expand the availability of affordable 5G services and this, along with regulatory policy support, would ensure future growth and innovation

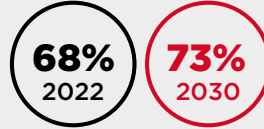
The Mobile Economy



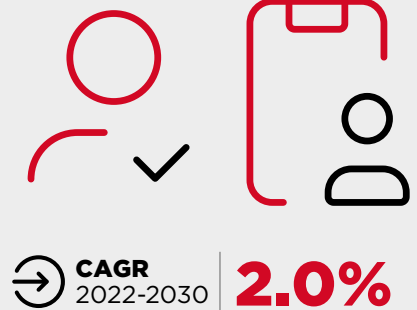
Unique mobile subscribers



5.4bn
6.3bn



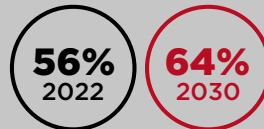
Penetration rate
Percentage of population



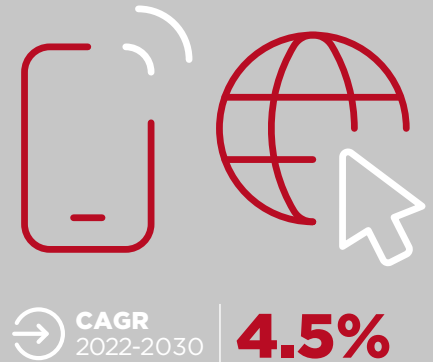
Mobile internet users



4.4bn
5.5bn



Penetration rate
Percentage of population



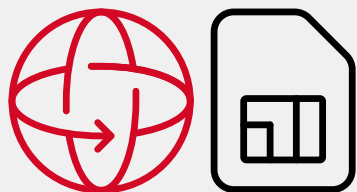
SIM connections (excluding licensed cellular IoT)



8.4bn
9.8bn



Penetration rate
Percentage of population



CAGR
2022-2030

1.7%



4G

Percentage of connections
(excluding licensed cellular IoT)



60%
36%



5G

Percentage of connections
(excluding licensed cellular IoT)



12%
54%

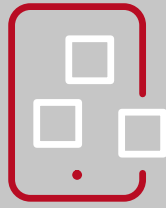




Smartphones (percentage of connections*)

2022

76%



2030

92%



Licensed cellular IoT connections



2022

2.5bn

2030

5.3bn



Operator revenues and investment

2022

\$1.07tn

Total
revenues

2030

\$1.20tn

Operator capex

\$1.5tn

2022 — 2030



92% on 5G



Mobile industry contribution to GDP

2022

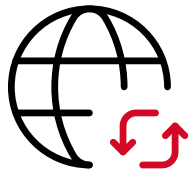
\$5.2tn (5% of GDP)

2030

\$6.0tn



Public funding



2022

\$530bn

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



Employment

16 million jobs



Directly supported by the mobile ecosystem in 2022



**12 million
jobs**

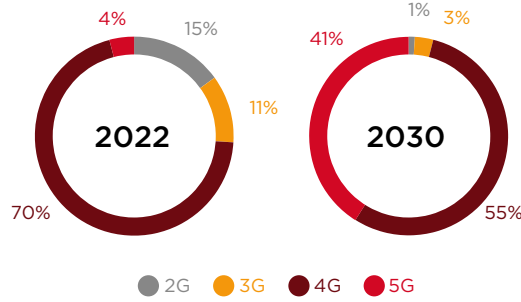


supported
indirectly

Asia Pacific



Technology mix



Subscriber penetration



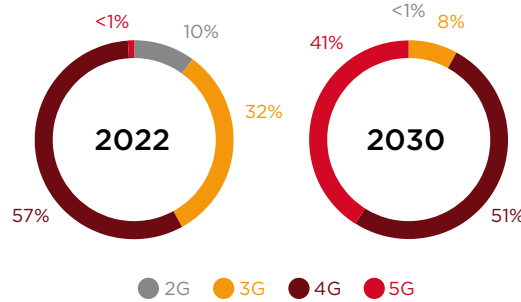
Smartphone adoption



CIS



Technology mix



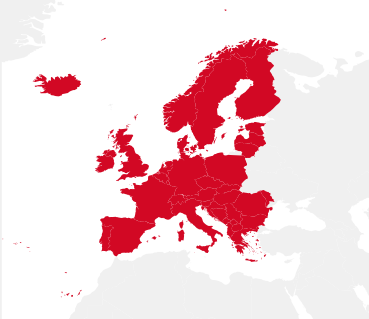
Subscriber penetration



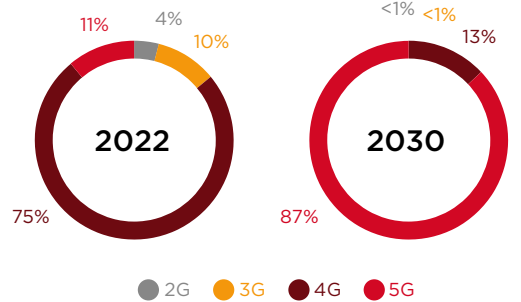
Smartphone adoption



Europe



Technology mix



Subscriber penetration



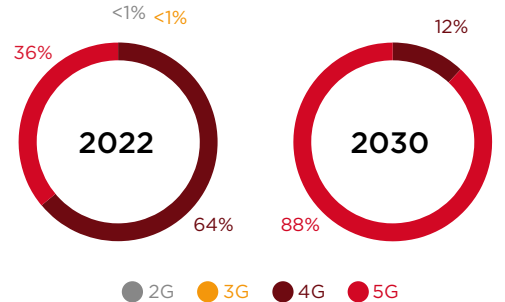
Smartphone adoption



Greater China



Technology mix



Subscriber penetration



Smartphone adoption

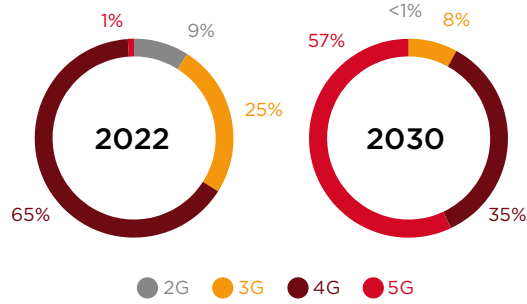


Note: Totals may not add up due to rounding

Latin America



Technology mix



Subscriber penetration



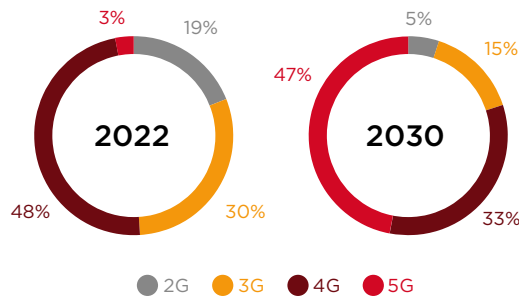
Smartphone adoption



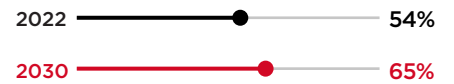
MENA



Technology mix



Subscriber penetration



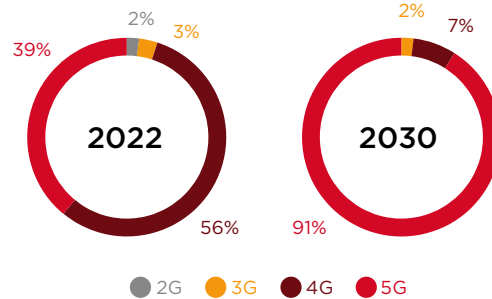
Smartphone adoption



North America



Technology mix



Subscriber penetration



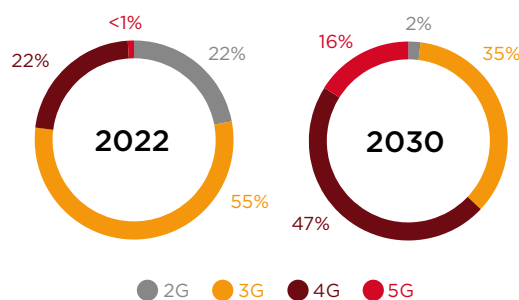
Smartphone adoption



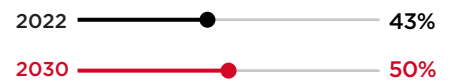
Sub-Saharan Africa



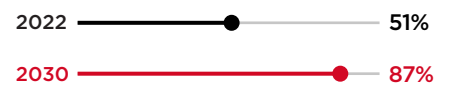
Technology mix



Subscriber penetration



Smartphone adoption



01

The mobile industry in numbers



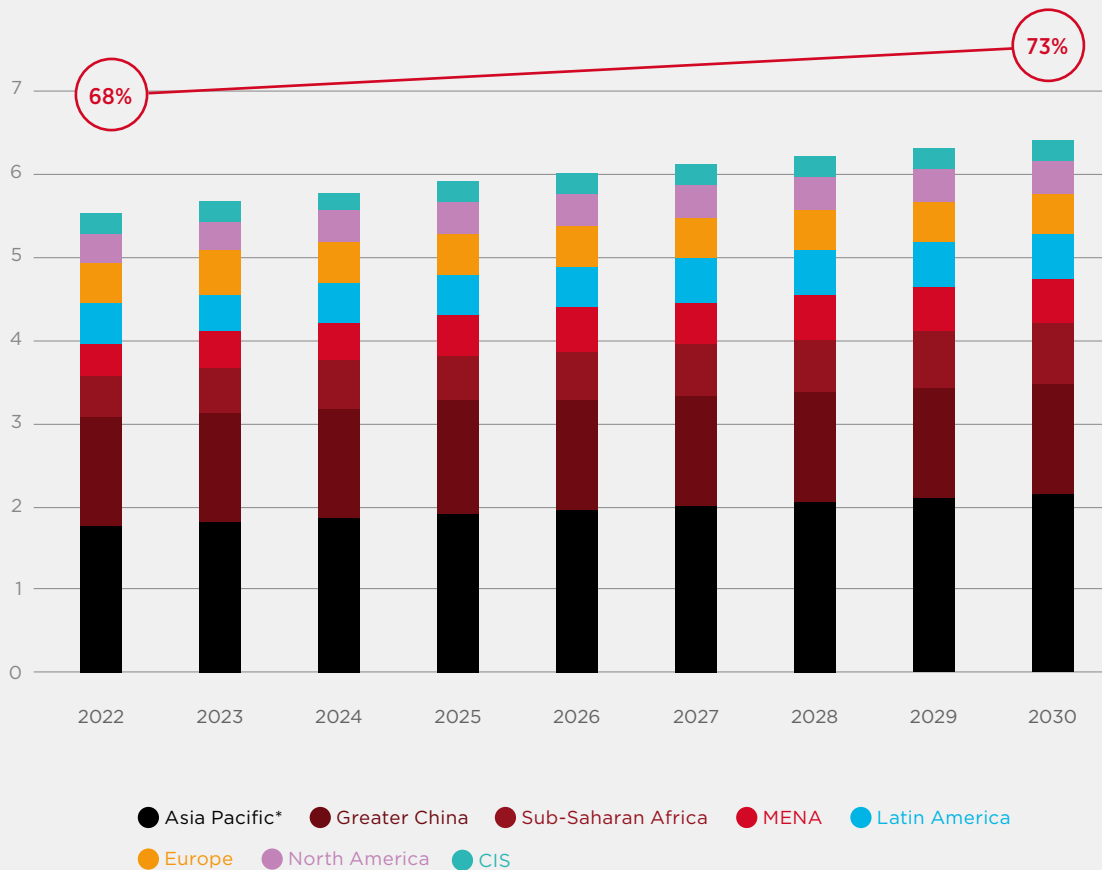
There were 5.4 billion unique mobile subscribers in 2022, rising to 6.3 billion by 2030

Mobile penetration is approaching saturation in most markets around the world, especially among adult and urban populations. In every region, the majority of new subscribers will be young consumers and rural dwellers.

Despite increasing saturation in developed regions, there is still room for growth in many large, underpenetrated markets in developing regions. For example, India and Sub-Saharan Africa will account for around half of new mobile subscribers globally over the 2022-2030 period.

Figure 1
Mobile subscriptions and penetration

Billion, percentage of population



*Excludes Greater China
Source: GSMA Intelligence



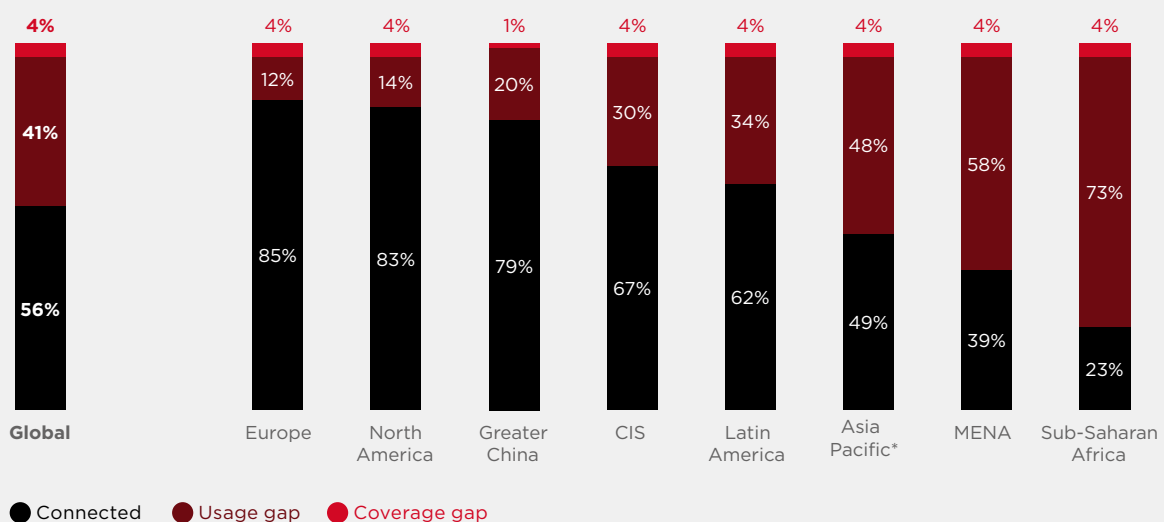
Globally, there were 4.4 billion mobile internet users in 2022, equivalent to 56% penetration

The mobile internet usage gap has narrowed markedly in the last five years – from 50% in 2017 to 41% in 2022 on average – as more people around the world rely on the internet for many daily activities, especially in the wake of the Covid-19 pandemic.

The usage gap is widest in Sub-Saharan Africa, highlighting the impact of the barriers to mobile internet adoption, including lack of affordability and low levels of digital skills. The usage gap is smallest in Europe and North America, at below 15% of the population.

Figure 2
Mobile internet penetration, 2022

Percentage of population



*Excludes Greater China
 Source: GSMA Intelligence

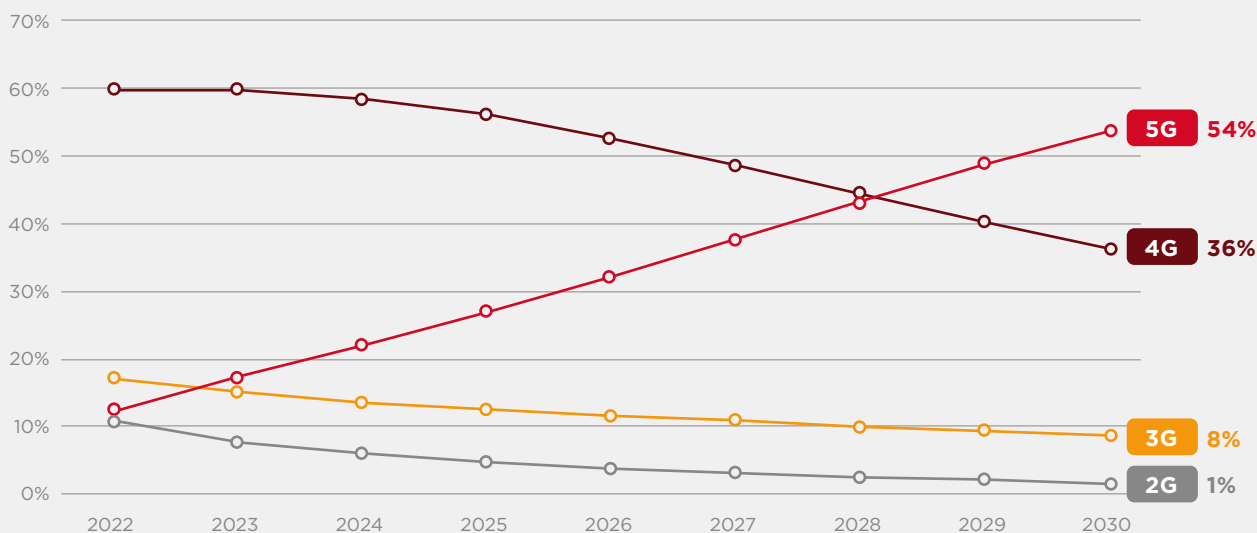
5G will overtake 4G in 2029 to become the dominant mobile technology by the end of this decade

5G adoption continues to rise due to new network deployments and cheaper devices. As of January 2023, there were 229 commercial 5G networks around the world and over 700 5G smartphone models had been launched, including more than 200 in 2022.

The number of connections on legacy networks (2G and 3G) will continue to decline in the coming years as users migrate to 4G and 5G, resulting in more network shutdowns. To date, operators have announced plans to shut down 96 2G networks and 107 3G networks around the world.

Figure 3
Mobile adoption by technology

Percentage of total connections



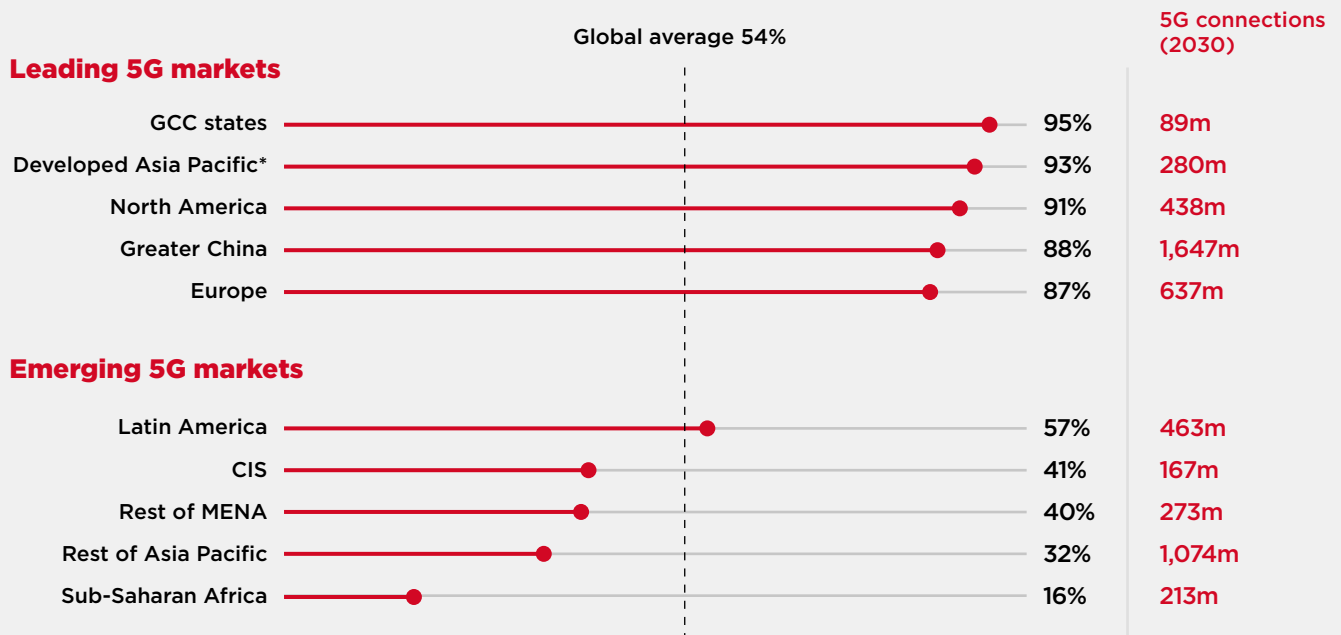
5G adoption will be over 85% in the top 5G markets by 2030, led by the GCC states, developed Asia Pacific and North America

In the coming years operators will shift their focus to driving 5G adoption, following significant capital outlays. The technology has already become mainstream in several markets, notably South Korea and the US, where 5G now accounts for more than 40% of total connections.

Elsewhere, 4G still has plenty of room to grow and will remain the dominant technology by the end of this decade. In Sub-Saharan Africa, 5G rollout will likely take a phased approach, as opposed to the fast population coverage approach that has been adopted in more advanced markets.¹

Figure 4
5G adoption in 2030

Percentage of total connections



1. [5G in Africa: realising the potential](#). GSMA, 2022



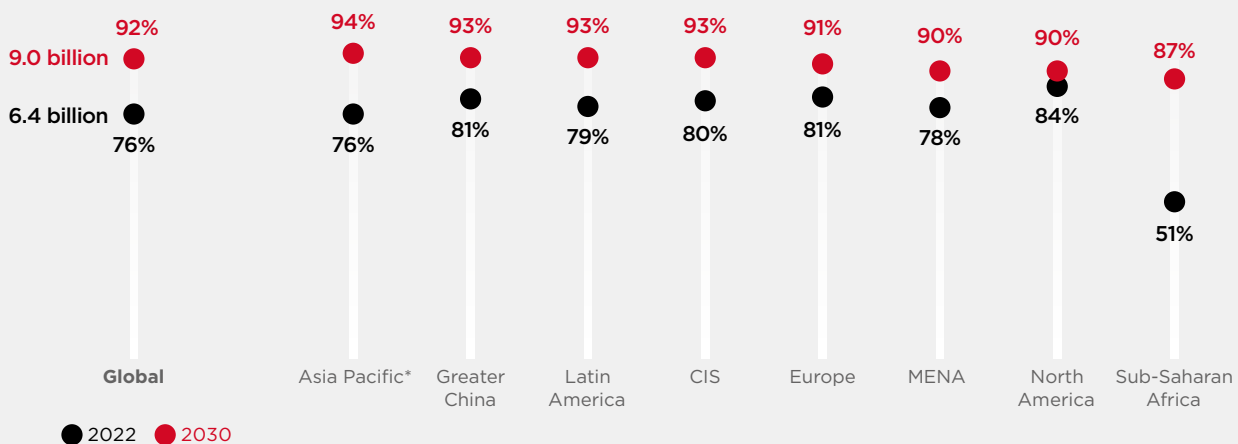
There will be 9 billion smartphone connections by 2030, equivalent to 92% of total connections

Emerging markets in Asia Pacific, Latin America and Sub-Saharan Africa will see the biggest increase in smartphone adoption, helped by increasing affordability. Average selling prices for smartphones continue to decline and initiatives are proving successful in driving uptake.

Meanwhile, most new phone users are digital natives who rely on devices for multiple activities beyond traditional voice calls and SMS. This factor will sustain demand for smartphones across every region for the foreseeable future.

Figure 5
Smartphone adoption

Percentage of connections (excluding licensed cellular IoT)



*Excludes Greater China
Source: GSMA Intelligence

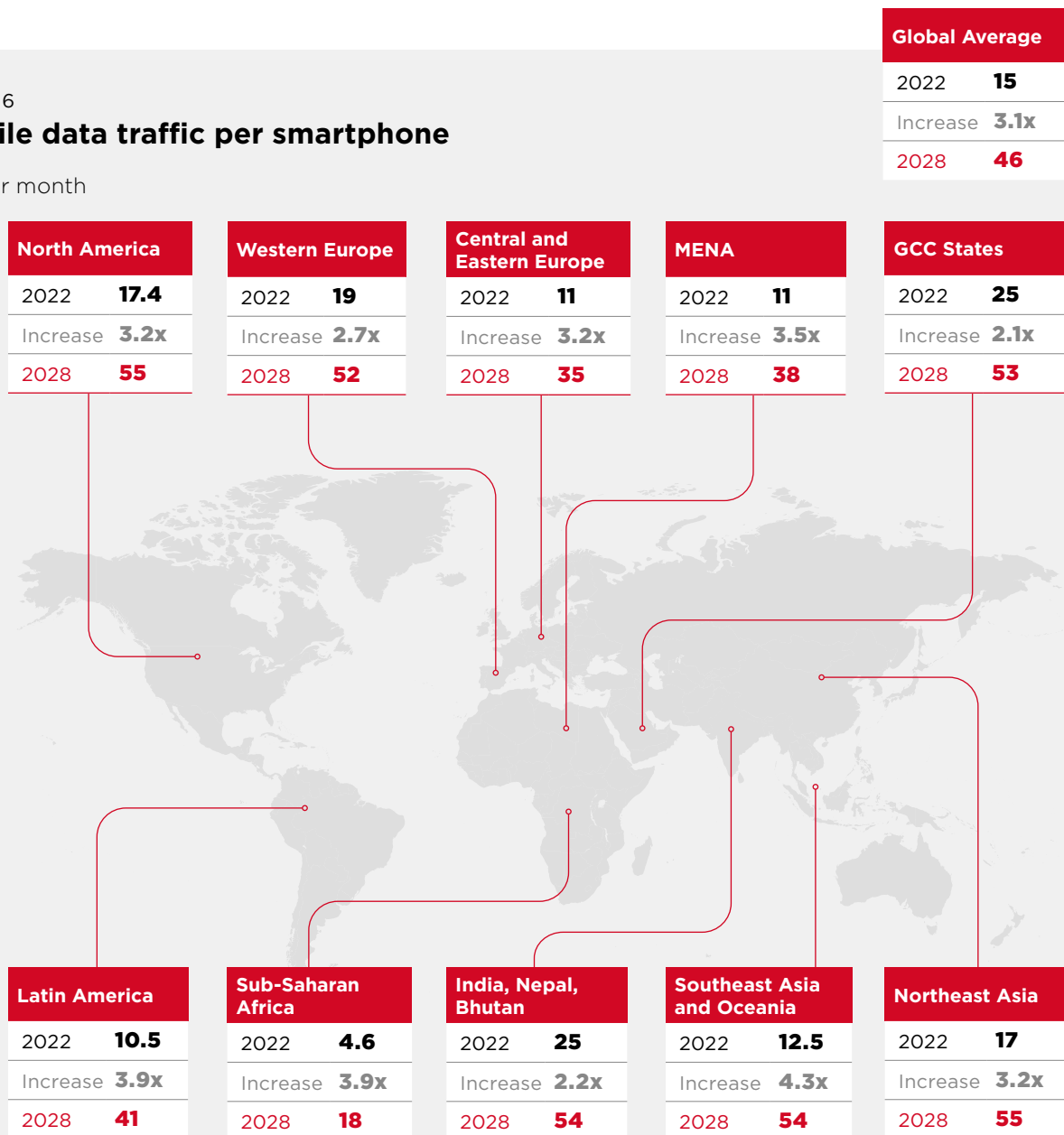
Globally, smartphone data traffic will rise more than threefold in the period to 2028, with the biggest users in North America and Northeast Asia

Mobile traffic growth is driven by a combination of factors, including video streaming and online gaming. Video traffic is estimated to account for around 70% of all mobile data traffic, rising to 80% in 2028.²

5G is also a key driver of mobile data traffic growth, as evidenced by the technology's growing share of overall mobile data traffic. According to a GSMA Intelligence survey, 5G subscribers are more interested than 4G users in adding services and content to their mobile contracts.³

Figure 6
Mobile data traffic per smartphone

GB per month



Source: GSMA Intelligence based on Ericsson Mobility Report November 2022

2. Ericsson Mobility Report November 2022

3. [Analysing the behaviour of early 5G users: 10 things to know when planning consumer 5G strategies](#), GSMA Intelligence, 2021

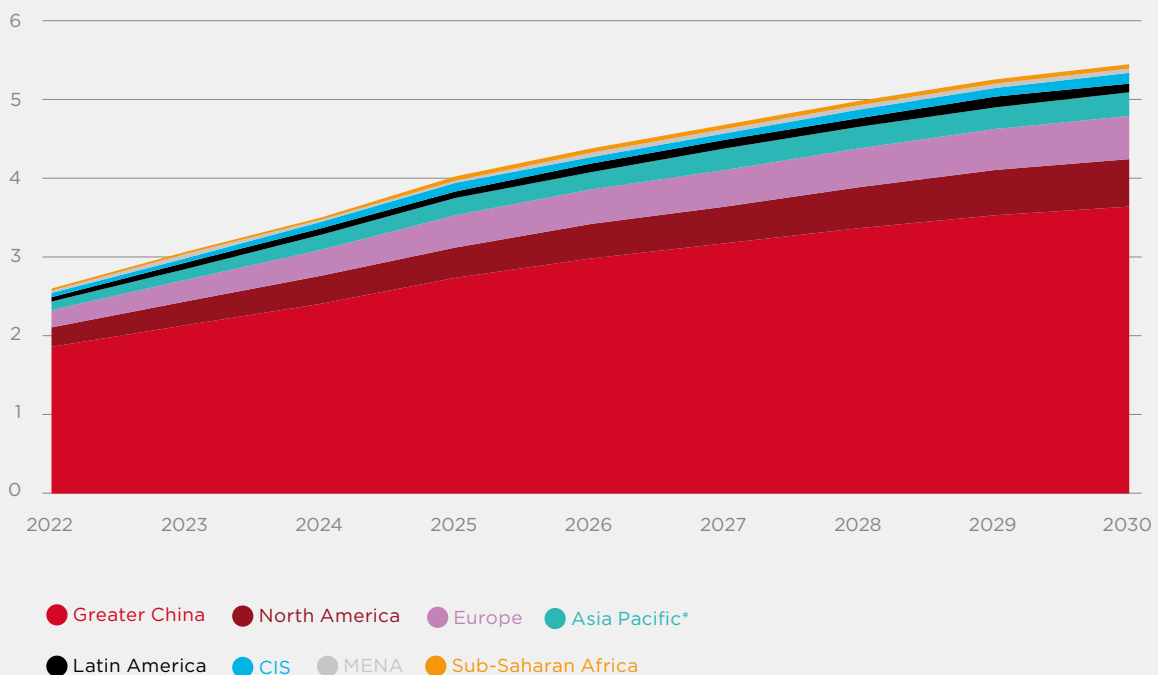
The total number of licensed cellular IoT connections will double to 5.3 billion by 2030, with Greater China accounting for two thirds

China recorded 1.84 billion cellular IoT connections in 2022, according to the Ministry of Industry and Information Technology (MIIT), making it the first major economy to record more cellular IoT connections than mobile users. Europe and the US will jointly account for a fifth of total connections by 2030.

IoT will continue to grow in 2023 and beyond with new flavours of IoT emerging, including passive (or ambient) IoT. This refers to IoT sensors that are smaller and cheaper compared to previous generations of IoT (e.g. NB-IoT and LTE-M) and are powered by radio waves, solar, wind, vibrations and heat.

Figure 7
Licensed cellular IoT connections

Billion



*Excludes Greater China
Source: GSMA Intelligence



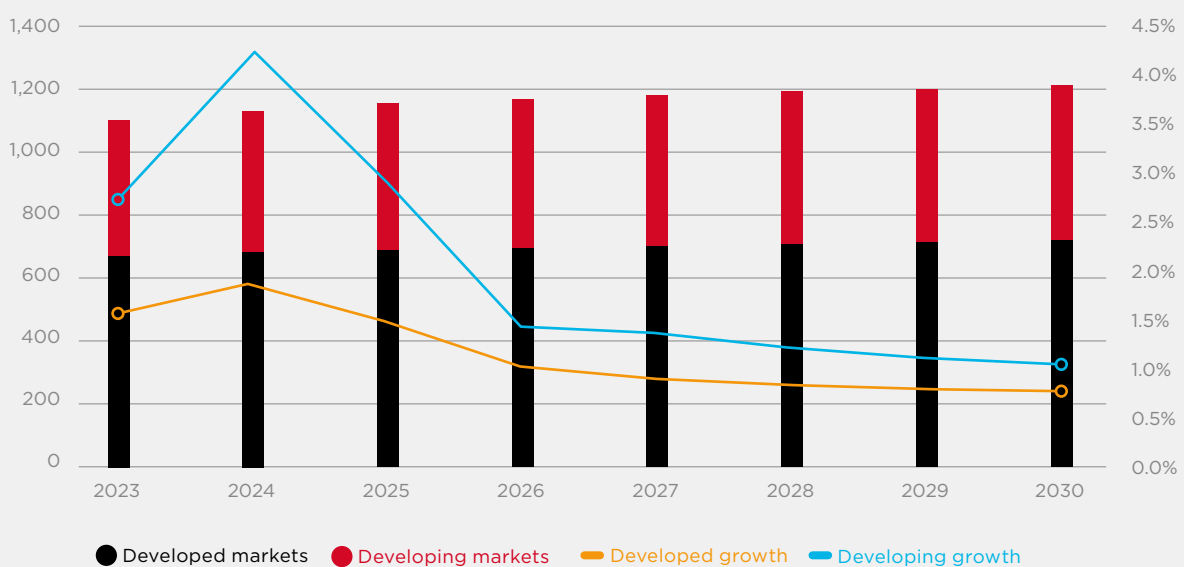
Revenue growth is expected to remain in positive territory in both developed and developing regions for the period to 2030

Revenue beyond core continues to support revenue growth, but this varies significantly as a percentage of total revenues (15–40%) among operators. The diversification of service offerings, often organically or through M&A, has become a strategic imperative for operators amid continued cannibalisation of core communications services by OTT players.

Gaming, financial services, cloud and security are among the leading areas in terms of operator activity. Services, however, vary by market. For example, mobile money is a key revenue growth driver in Sub-Saharan Africa, media and entertainment is dominant in Europe and North America, and online gaming and cloud are top services in Northeast Asia.

Figure 8
Mobile revenue and year-on-year growth

Billion



Source: GSMA Intelligence

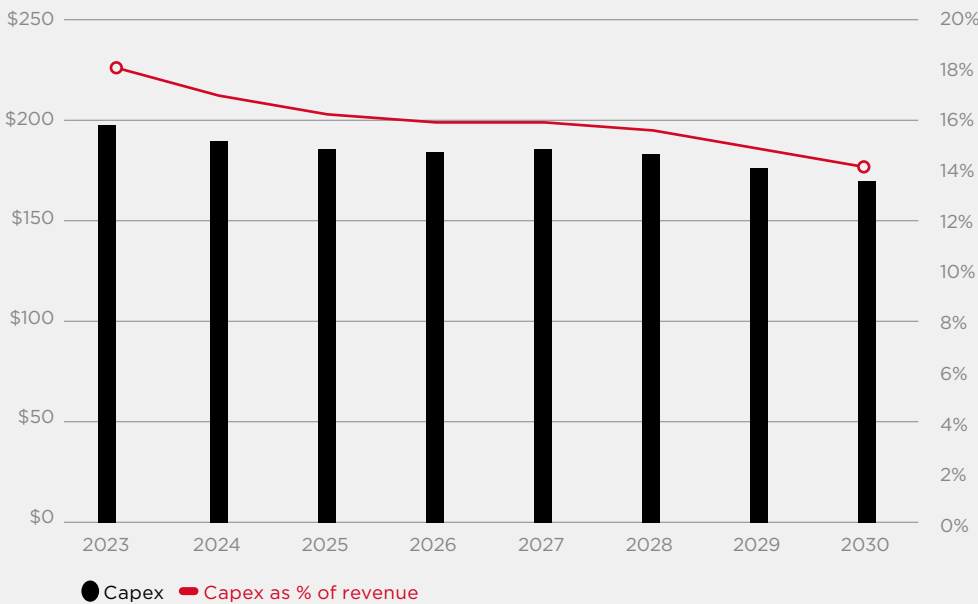
Between 2023 and 2030, operators will spend \$1.5 trillion on their mobile networks

Following extensive 5G network buildout in the last few years, which resulted in record capex intensity in some markets, overall capex will begin to trend downwards in the coming years as operators turn their focus to generating returns on their investment.

This trend will not be uniform across all markets; in emerging 5G markets, capex will continue to accelerate over the forecast period on 5G network rollout. Overall, 92% of operators' capex between 2023 and 2030 will be spent on 5G network deployment.

Figure 9
Mobile operator capex

Billion



5G as a share of total spend, 2023-2030: 92%

Source: GSMA Intelligence

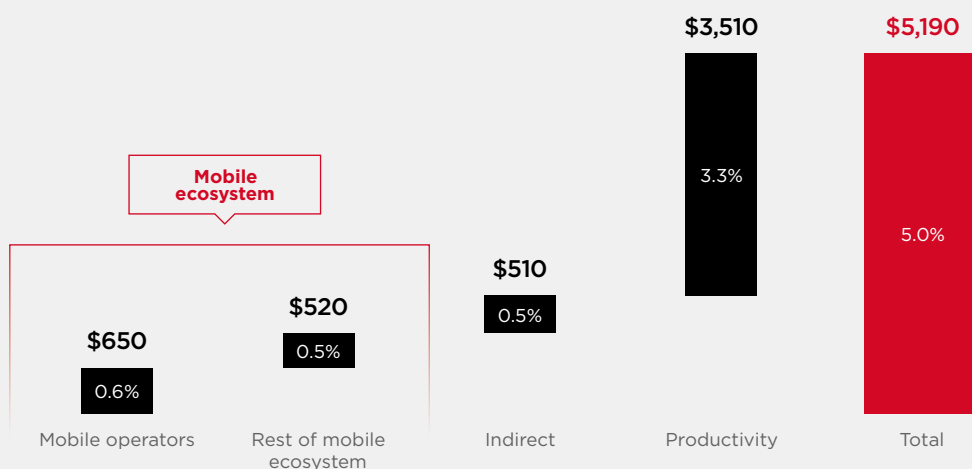
In 2022, the mobile sector added \$5.2 trillion of economic value to the economy

In 2022, mobile technologies and services generated 5% of global GDP, a contribution that amounted to \$5.2 trillion of economic value added. The greatest benefits came from productivity effects, which reached \$3.5 trillion, followed by mobile operators, which generated \$650 billion.

Figure 10

Total economic contribution of the mobile industry, 2022

Billion



Source: GSMA Intelligence



At the end of the decade, mobile's economic contribution will surpass \$6 trillion

By 2025, mobile's contribution will reach \$5.6 trillion and by 2030 will exceed \$6 trillion as countries around the world increasingly benefit from the improvements in productivity and efficiency brought about by the increased take-up of mobile services.

Figure 11
Economic impact of mobile

Billion



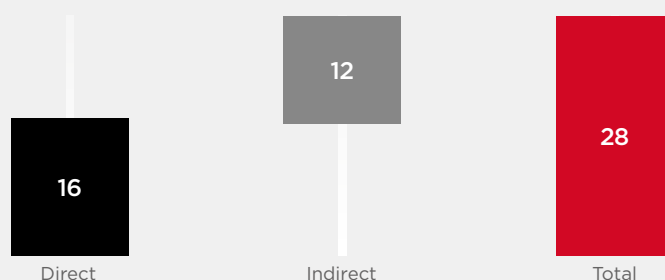
Source: GSMA Intelligence

The global mobile ecosystem supported 28 million jobs in 2022

Mobile operators and the wider mobile ecosystem provided direct employment to around 16 million people across the world. In addition, the economic activity in the ecosystem generated 12 million jobs in other sectors, meaning that around 28 million jobs were directly or indirectly supported.

Figure 12
Employment impact of the mobile industry, 2022

Jobs (million)



Source: GSMA Intelligence



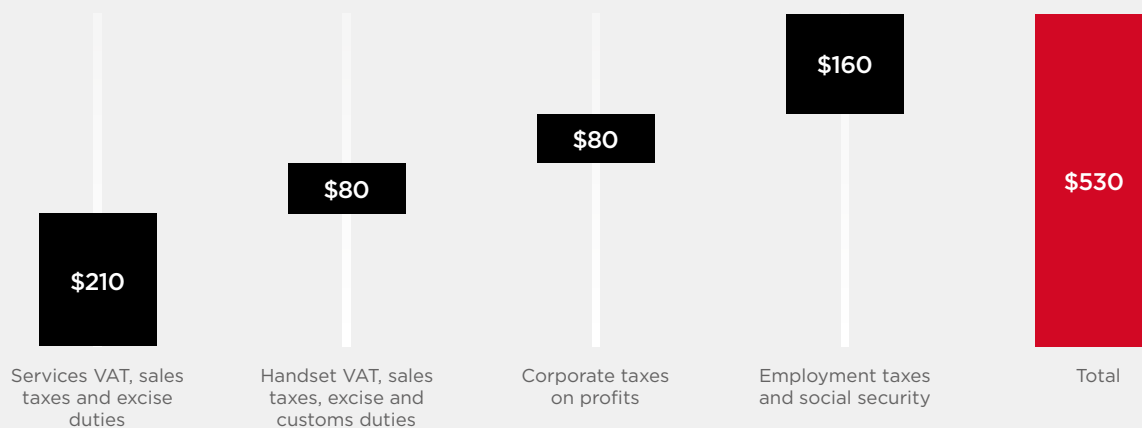
The fiscal contribution of the mobile ecosystem reached \$530 billion in 2022

In 2022, the mobile sector made a substantial contribution to the funding of the public sector, with around \$530 billion raised through taxes on the sector. The biggest driver was services VAT, sales taxes and excise duties, which generated \$210 billion, followed by employment taxes and social security, which generated \$160 billion.

Figure 13

Fiscal contribution of the mobile industry, 2022

Billion



Source: GSMA Intelligence

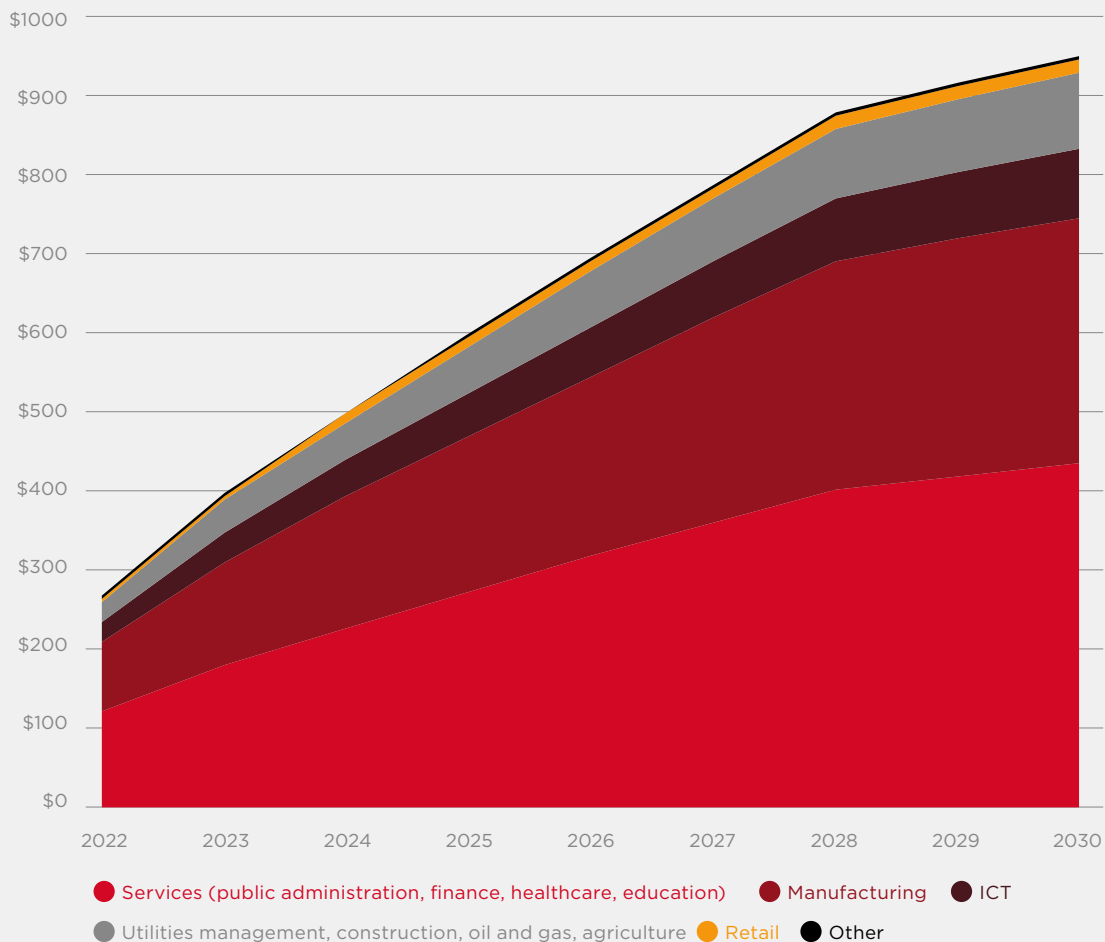
5G will add almost \$1 trillion to the global economy in 2030

5G is expected to benefit the global economy by more than \$950 billion in 2030, or more than 15% of the overall economic impact of mobile. Much of this will materialise in developed regions, including East Asia and the Pacific, North America and Europe, which are expected to see strong growth in the next five years. Towards the end of the decade, low- and middle-income countries are expected to realise an increasing proportion of 5G economic benefits as the technology starts to achieve scale and widespread adoption.

The services and manufacturing industries will benefit the most from 5G technologies over the next decade. The impacts on other economic sectors are expected to be of lower magnitude but will increase as they start to incorporate 5G use cases.

Figure 14
Annual global 5G contribution by industry

Billion



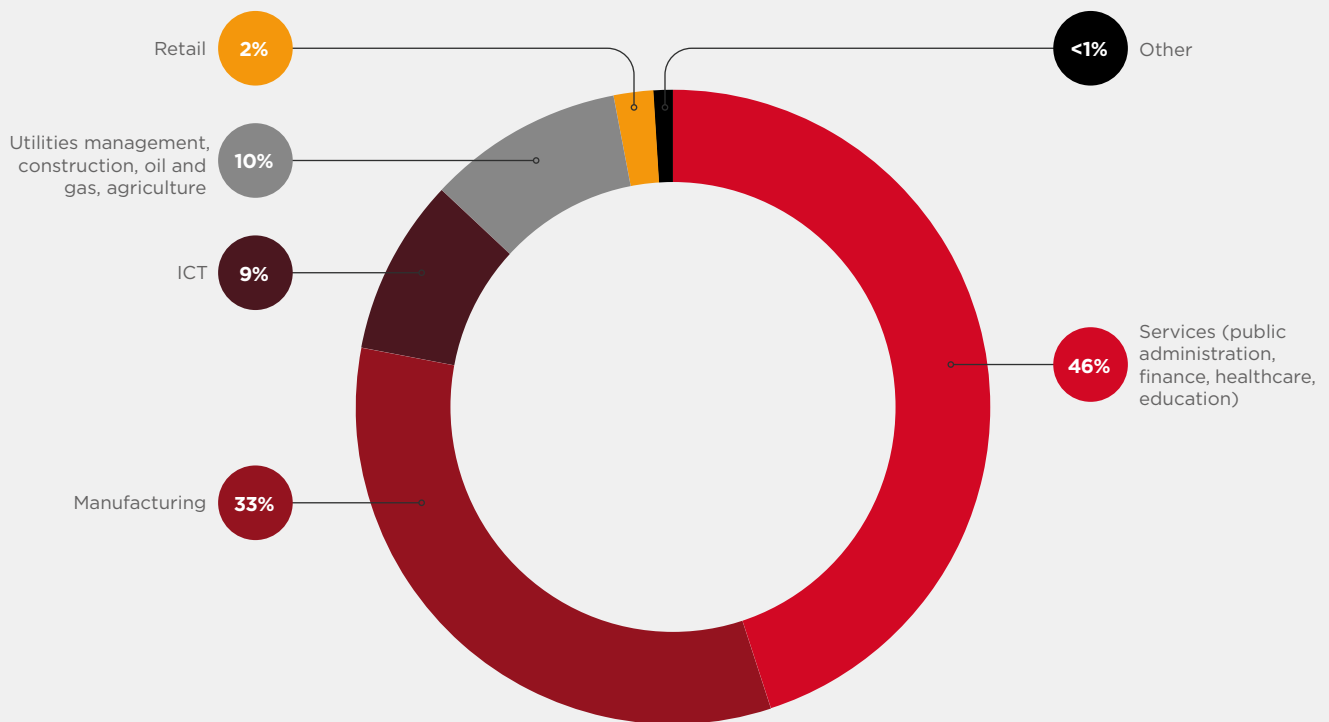
Source: GSMA Intelligence

The benefits of 5G will be spread across the economy, with a focus on services and manufacturing

5G is expected to benefit all economic sectors of the global economy, although some industries will benefit more than others due to their ability to incorporate 5G use cases in their business. Over the next 10 years, 46% of benefits are expected to be realised in the services sector and 33% in manufacturing, driven by applications such as smart factories, smart cities and smart grids.

Figure 15
Global 5G contribution by industry, 2030

Percentage of total benefit



Source: GSMA Intelligence



02

Mobile industry trends



2.1

The 5G monetisation imperative

The rollout and adoption of 5G has been faster than that of previous mobile network generations. As of January 2023, 229 operators in 87 markets had launched mobile 5G services. Throughout 2023, some 30 new markets will launch 5G mobile services; importantly, many of these will be developing markets across Africa and Asia, making 5G a truly global technology and taking the total number of connections to 1.5 billion by the end of the year.

As 5G adoption continues to scale, the monetisation imperative will grow. Awareness of 5G is high, but a significant share of consumers still do not see a reason to pay a premium to upgrade from previous generations. GSMA Intelligence survey evidence suggests that around 50% of people see 5G as predominantly a speed upgrade rather than something genuinely new compared to 4G. This has led to increasing competition and price pressure, which can be seen in the form of retail prices for 5G tariffs that are often on a par with those for 4G (or at a small premium).

There are some exceptions. Thailand's AIS reports a 10-15% ARPU uplift from 5G and Elisa reports a €3 per month average billing uplift when customers upgrade to 5G in Finland. In South Korea, following the launch of 5G in mid-2019, mobile ARPU returned to growth in 2020 and 2021 after several quarters of decline. Limited reporting from other operators and regulators makes it harder to determine the impact of 5G launches elsewhere.

The greatest opportunities for operators are likely to come from the link between mobile devices, 5G and digital services. GSMA Intelligence research shows that 5G users are more interested in adding digital services and entertainment content to their mobile contracts compared to 4G users (50% for 5G users across the nine categories of add-ons compared to 38% for 4G users).⁴ This highlights how 5G can drive greater smartphone usage beyond communications services and facilitate new revenue opportunities for operators by developing their own services and partnering with third parties. Initiatives such as Verizon's +Play demonstrate the range of content partnerships that operators can explore across entertainment, gaming, education, news, fitness and other areas.



4. [Smartphones and beyond: device innovation continues but incremental value lies in digital services](#). GSMA Intelligence, 2022

5G FWA takes centre stage

There has been renewed interest in FWA solutions as a key use case for 5G networks. As of January 2023, more than 90 fixed broadband service providers (the vast majority of which are mobile operators) had launched commercial 5G-based fixed wireless services across over 48 countries. This means that around 40% of 5G commercial mobile launches worldwide include an FWA offering – a relatively high proportion at this early point in the generational cycle. This could rise further as operators take stock of pilots, demand and return on investment.

5G FWA solutions provide an increase in speeds of over 10× compared to 4G FWA, along with substantial improvements in capacity, due to a range of technological advancements, which enables FWA to target a broader market. In the US, for example, T-Mobile surpassed 2.5 million 5G FWA customers by the end of 2022 and by 2025 it expects to have 7-8 million FWA subscribers, while Verizon is targeting 4-5 million FWA subscribers in the same period.

This would give FWA a share of around 10% of the US fixed broadband market – an indication of the technology’s underlying potential. Interest in 5G FWA is also strong in several GCC states, including Oman, where it accounts for 21% of fixed broadband subscriptions (and 4G FWA accounts for a further 18%).⁵

Looking ahead, 5G FWA penetration growth will likely be strongest in markets where the fixed broadband technology mix is skewed towards DSL (such as Austria, the Nordic countries, Bahrain and Australia), as there is the clearest reason to switch. Countries with low fixed broadband penetration but rising incomes (such as the Philippines and South Africa) will also see faster-than-average growth. As 5G rollouts expand into developing markets, the list of markets with fast growth will expand further.⁶

Figure 16

Markets where at least one operator has commercially launched 5G FWA services



Data correct as of January 2023
Source: GSMA Intelligence

5. [5G FWA in action](#), GSMA Intelligence, 2022

6. [The changing shape of fixed broadband and pay TV: major trends impacting the outlook](#), GSMA Intelligence, 2022

2.2

Private wireless networks rise to prominence

Private wireless networks are not new, having been deployed on LTE spectrum for several years. Until recently, however, installations had mostly been low-profile niche offerings that lack the capabilities that 5G now offers. This is a key reason why private wireless solutions have come back in vogue, as they are a means for monetising 5G in the enterprise segment. Growing demand for private wireless solutions can also be attributed to the digital transformation programmes of large enterprises, which have continued to gather pace in spite of (and sometimes because of) the Covid-19 pandemic.

Industrial premises in the form of factories and warehouses are a natural setting for private wireless networks. Multiple use cases involving manufacturers

using private 5G to automate assembly lines are currently in testing or live operation. This includes stationary and mobile robotics, automated guided vehicles (for transporting goods), digital twins and drones (site surveying and security). Strong growth in private networks is also expected over the next few years in sectors such as transport and logistics as well as media and entertainment, as 5G's enhanced capabilities in terms of capacity, latency and reliability can facilitate new use cases within a private wireless setting. For example, AT&T's 'Private Cellular Networks - Events' is a portable, customisable 5G data-only solution that is rapidly deployable to provide high and ultra-fast throughput for live video streaming and immersive fan experiences.⁷

The operator opportunity

Around half of operators expect private wireless to account for over 10% of their total enterprise revenues by 2025, according to a GSMA Intelligence survey. This finding holds across all operator sizes and regions. The contribution of private wireless to operator enterprise revenues should rise in the second half of the decade as private 5G network equipment and devices become more readily available.

As such, private networks represent a sizeable incremental revenue opportunity for operators. However, it is not a given that end-user enterprises that need local custom networks will view operators as the first partner of choice. GSMA Intelligence research indicates that less than a quarter of enterprises rank operators as their preferred partner for building a private wireless network.⁹ Therefore, to fulfil their revenue ambitions for private networks, operators need to consider the following:

- **Revenue beyond connectivity:** Operators expect connectivity to be the largest individual source of revenue associated with private 5G networks (see Figure 17). The focus on connectivity is not surprising since this is the core business of operators. However, it is also important for operators to grow their expertise in other areas (security, professional services and spectrum management) to maximise revenue from private

wireless deployments. Orange and Telefónica are among the operators to have made recent acquisitions to build their enterprise security capabilities.

- **Dedicated versus hybrid:** Operators have the opportunity to sell both dedicated and hybrid private wireless solutions.¹⁰ For prospective enterprise customers, these options entail trade-offs centred on cost versus the level of service customisation. The hybrid model, for example, generally offers a cheaper means of connectivity. However, data sovereignty and service reliability are not guaranteed such that it would be in a dedicated private wireless deployment, for which a premium is paid. Offering private wireless solutions in both forms allows operators to target different market segments.
- **The importance of collaboration:** For private networks to scale, solutions need to become cheaper as well as easier and faster to install and operate. This is driving demand for pre-integrated solutions with supporting infrastructure. Operators can forge partnerships with other ecosystem players to build solutions containing service management tools and billing systems, edge and cloud integration, and mechanisms for handling data authentication and security.

7. [AT&T: Commercialising private 5G networks for live events and immersive experiences](#), GSMA Intelligence, 2022

8. [Operator revenue diversification: growth beyond core continues as Covid-19 spurs digitisation](#), GSMA Intelligence, 2021

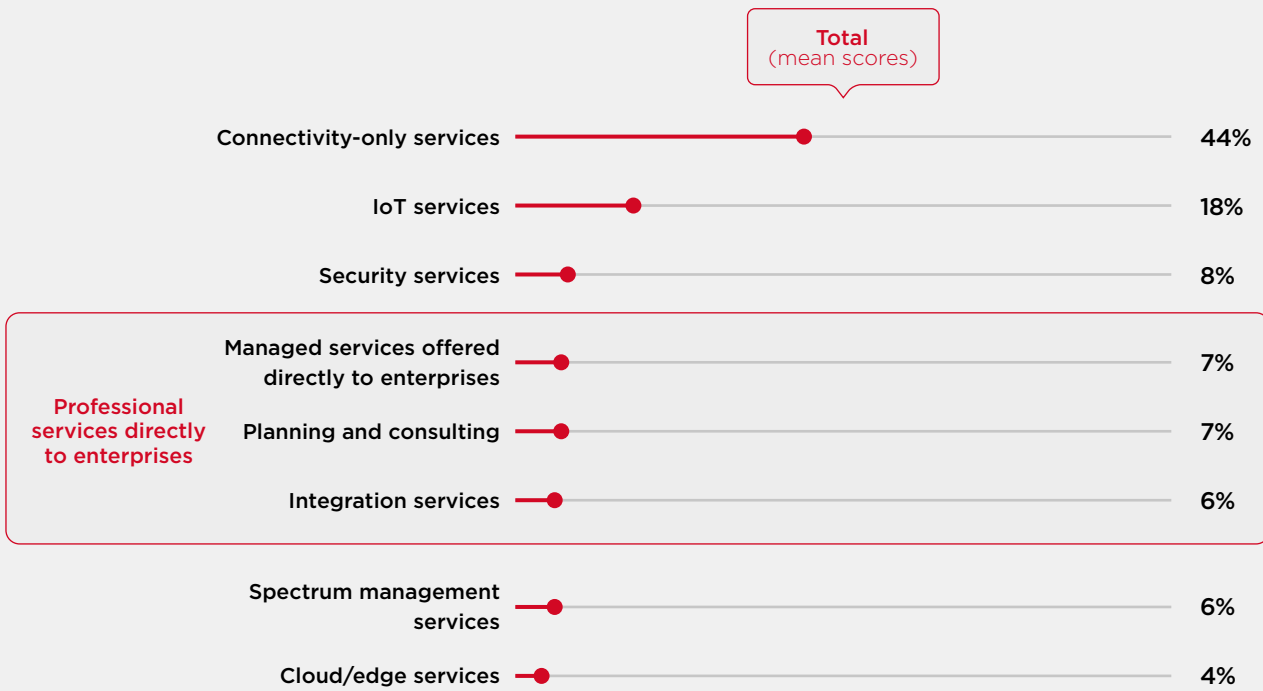
9. [5G for the enterprise: headway, hurdles and the horizon for operators](#), GSMA Intelligence, 2022

10. Hybrid networks allow operators to offer privates network fully integrated into their public mobile network. For example, see "Vodafone claims hybrid private 5G first with Porsche", Mobile World Live, December 2022

Figure 17

5G private wireless networks revenue distribution

Thinking of revenue opportunities coming from 5G private wireless networks, what is the revenue distribution that you expect by 2025? Select percentage value (0-100%)



Source: GSMA Intelligence Operators in Focus: Enterprise Opportunity Survey 2022



2.3

The shift to a circular economy

The benefits of the circular economy (see Figure 18) and its necessity for telecoms equipment will be key talking points in 2023. The shift towards sustainability requires all industries to examine how they use resources and this is particularly important for growing sectors such as telecoms. Technologies that connect people continue to improve and 5G penetration is growing quicker than that of any other wireless technology before, which in turns is making the demand for telecoms equipment and services higher than ever.

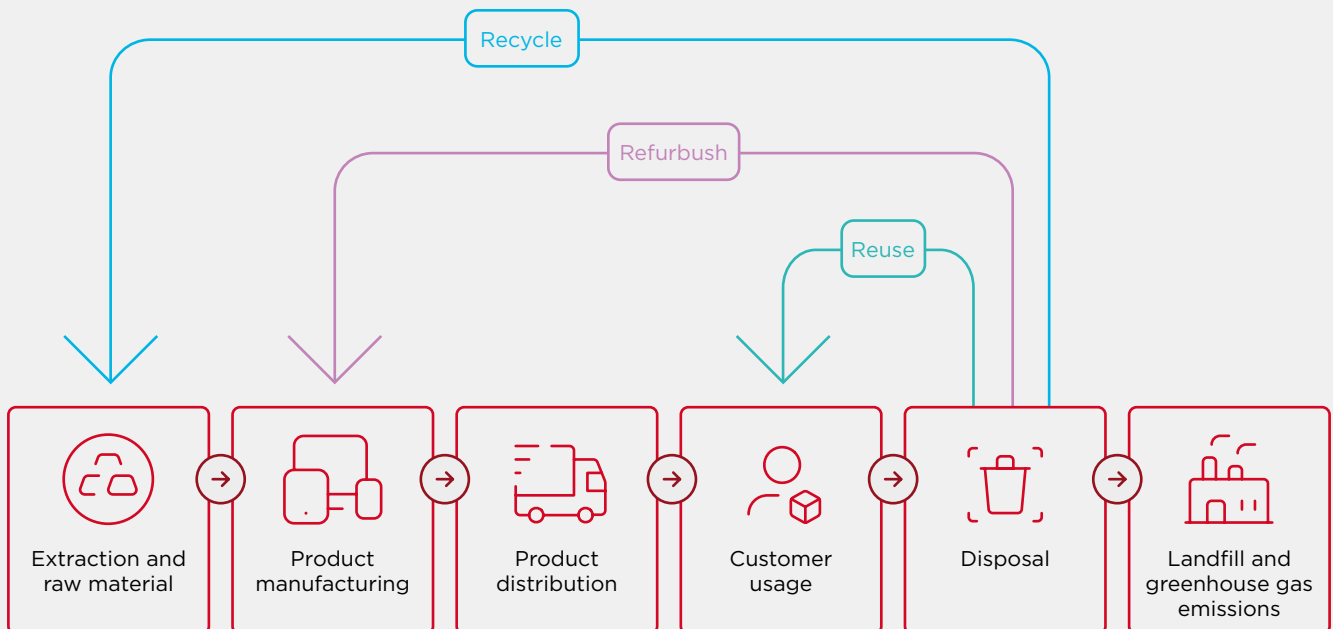
Only 8.6% of the global economy, including the ICT sector, is circular,¹¹ which means less than 10% of the material used in a year is recycled or reused in some way. Overall, 91.4% of economic activity follows a linear approach to products: raw materials are

extracted, products are manufactured, customers use the products and then the products are discarded with limited reuse and recycling. This is creating a significant strain on resources as society's demand for goods increases and the planet's ability to provide raw materials decreases.

In response to this existential threat, the concept of a circular economy has been developed as a transformative model to reutilise products, parts, components and materials in successive production cycles to reduce waste and pollution. Here, the guiding principles of reuse, recycle and refurbish are used to extend the life of a product and, consequently, reduce or eliminate waste in the production and usage cycle.

Figure 18

Illustration of the circular economy concept



Source: GSMA

11. <https://www.circularity-gap.world/updates-collection/circle-economy-launches-cgr2020-in-davos>

Mobile network operators and telecoms equipment vendors are accelerating plans to move away from the linear approach and embrace circularity during product and service development. Examples of this include the following:

- **Telefónica** launched its Circular Economy Plan in 2022, with the following commitments: reusing, reselling or recycling 100% of its network equipment by 2025; refurbishing and reusing 90% of fixed equipment (routers and decoders) collected from customers by 2024; introducing circularity criteria in all purchases of customer electronic equipment in 2025; and refurbishing 500,000 mobile devices per year by 2030.¹²
- **Orange** and **Nokia** are working together to increase the use of refurbished equipment in telecoms infrastructure. All Orange subsidiaries can purchase refurbished network equipment via BuyIn, the procurement alliance of Orange and Deutsche Telekom. Orange has also launched its 'Re' initiative, which aims to collect, repair, reuse and recycle mobile devices, across its European operations.

- In 2022, **Vodafone** announced an initiative to extend the life of new mobile phones and encourage customers to trade in or recycle their old devices by offering a comprehensive and convenient suite of services, including insurance, support and repairs for their devices.
- **Ericsson** collects equipment that has reached its end of life through its Product Take-Back programme, which is present in 180 countries. In 2021, the vendor retrieved 8,800 metric tons of equipment.¹³
- **Nokia** collects legacy products from customers, even if they were manufactured by a third party. In 2020 and 2021, the vendor processed 5,870 metric tons and 3,980 metric tons of obsolete products and parts, respectively. Nokia has set a target to be 95% circular across its value chain – including its own operations, product manufacturing and product takeback – in 2030.¹⁴

Accelerating the journey to circularity: key principles for the telecoms industry

The traditional designs of wireless communications equipment primarily focus on performance improvement. However, circularity is important for networks to operate in a more sustainable and energy-efficient way, and for the industry to make progress towards realising its climate goals. There can also be economic benefits for operators in the form of capex savings from reusing network equipment. To successfully achieve greater circularity, the telecoms industry can follow four main principles:

- **Reducing waste products, components and critical raw materials:** Greater recycling of components and raw materials in remanufacturing processes is essential. Eco-design principles alongside proper documentation and regulation to increase reliability are good first steps to lower impact.
- **Optimising the sourcing, reusing and repurposing of existing network equipment:** Current market fragmentation has to be reduced to create a global second-hand market on a larger scale. Many barriers still exist, one of them being a lack of cooperation on value share.
- **Harmonising the methods of evaluation to generate a common understanding:** An integrated approach must be agreed upon with unified environmental metrics and a recognised benchmark method for universal comparison.
- **Redesigning the supply chain around the circular principles:** To ensure full support and implementation, a new circular business model with a stronger business case needs to emerge. Contractual, regulatory and design barriers could be re-engineered to become incentives.

12. "Telefónica presents its Circular Economy Plan in line with the GSMA strategy", Telefónica, January 2023

13. Sustainability and Corporate Responsibility report, Ericsson, 2021

14. People & Planet Report 2021, Nokia, 2021

2.4

The metaverse continues to gain traction

Momentum for the metaverse continues to grow, alongside advancements in enabling technologies like 5G, AI and wearables. The increasing interest from key stakeholders and ecosystem players has led to the emergence of important building blocks for the advancement of the metaverse. At the core is connectivity, with 5G and associated tech such as edge and network slicing set to enable various extended reality (XR) and metaverse applications. The Telecom Infra Project (TIP) has formed the Metaverse-Ready Networks Project Group, a working group to deliver solutions and architectures that enhance network readiness to support metaverse experiences.

Beyond networks and connectivity, the journey towards the metaverse is being supported by an increase in activity in the following areas:

- **Content:** Sectoral investments and the push from leading companies are encouraging content creation for metaverse applications. Gaming, video and music are expected to be at the forefront of content development in 2023. Proto-metaverse applications, such as Roblox and Fortnite, continue to accelerate content innovation, while metaverse platform owners are increasingly building partnerships to ensure content availability. In October 2022, Meta formed a partnership with NBCUniversal that will enable fans of TV series The Office to experience the content in the metaverse. The deal also includes content from production studios such as Blumhouse and Dreamworks.
- **Standards:** Along with new content and platforms, standards will be an important factor in the evolution of the metaverse. In June 2022, several organisations, including Meta, Microsoft, Qualcomm and Huawei, jointly launched the Metaverse Standards Forum, bringing together leading standards organisations and companies for industry-wide cooperation on the interoperability standards needed to build the open metaverse. The creation of a metaverse standards group reflects the importance of ecosystem collaboration to drive new developments while ensuring coordination and interoperability.
- **Devices:** The early days of the metaverse have certainly boosted interest in XR devices. The metaverse – with its vision of an all-encompassing digital world but more importantly widespread industry buy-in – has become a focal point for XR. There is an expectation that an ever-strengthening metaverse ecosystem should help deliver widespread integration of immersive experiences in both the consumer and enterprise markets (but mainly the former), with these experiences accessed mainly through XR devices. A supporting example of this is HTC's new mixed reality headset, Vive XR Elite, which HTC describes as a gateway to the metaverse.



Telecoms operators explore opportunities beyond connectivity

The growing metaverse provides new opportunities for operators, with an increasing number of them taking steps to unlock potential new revenue streams across different market segments. These include new 5G monetisation opportunities and content delivery models, improved customer experience and device sales, such as the following:

- **Orange Spain** has launched a virtual store environment in the metaverse, offering the consumer the ability to browse and experience products.
- **KT** in South Korea has partnered with local startup TCAG to create a cloud-based streaming digital twin gallery, allowing users to explore various artworks in the metaverse regardless of time and place.

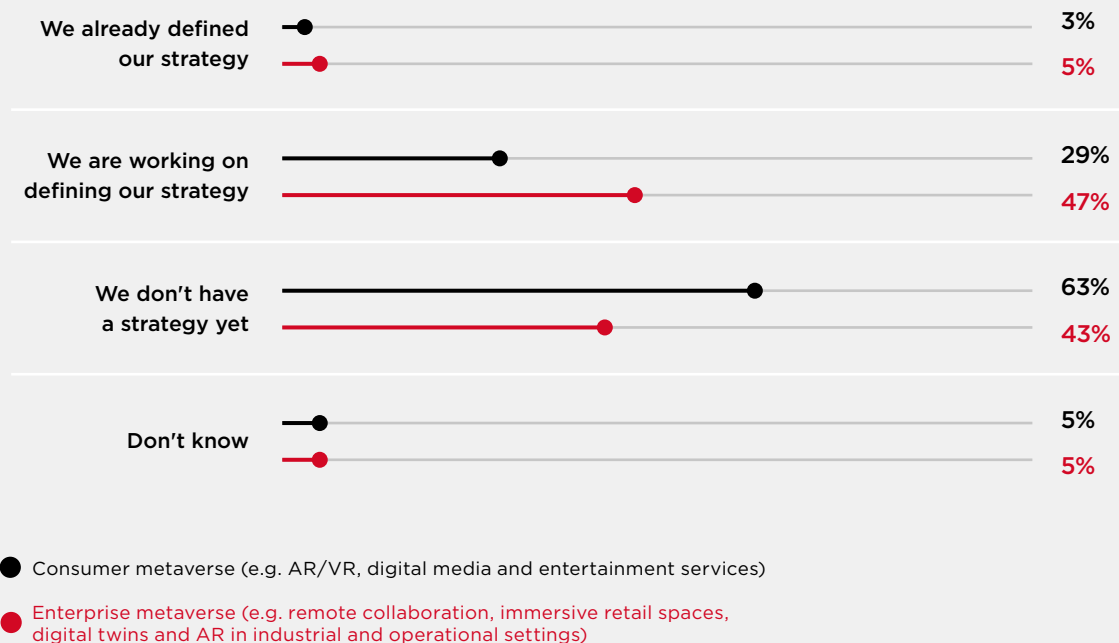
- **Telefónica** has actively embraced the metaverse and held its first Telefónica Metaverse Day in September 2022, where it provided more details about its metaverse strategy and roadmap while showcasing a number of immersive experiences.

Although it is still early days for the metaverse, over half of operators are working on defining their enterprise metaverse agenda or have already done so. The respective figure for the consumer metaverse is somewhat smaller (one in three), with operators in Asia Pacific¹⁵ leading the way compared to other regions (43% of operators in Asia Pacific versus 30% in North America, which comes in second place regionally). The proportion of operators without a metaverse strategy (63% for the consumer metaverse and 43% for the enterprise metaverse) highlights the need for innovation and partnerships to identify use cases and network requirements (see Figure 19).

Figure 19

Strategies for the metaverse: state of play

Where are you with your strategy for the metaverse? (Percentage of operators)



Source: GSMA Intelligence Operators in Focus: Enterprise Opportunity Survey 2022

15. Includes Greater China



SK Telecom leads the way in exploring operator metaverse opportunities

First launched in South Korea in 2021, SK Telecom's Ifland metaverse platform continues to grow rapidly. As of October 2022, Ifland had accumulated a user base of 12.8 million, according to a company statement, and has now been introduced in 49 international markets across North America, Europe, the Middle East and Asia. Ifland's global expansion relies on partnerships with other operators, including NTT Docomo, e&, Deutsche Telekom and Singtel.

The expansion of Ifland highlights the increasing role of operators in the metaverse space along with the growing opportunity for collaboration and growth. SK Telecom plans to launch Ifland 2.0, with specialised features for different regions and new functions to enhance user participation.

2.5

Opportunities in fintech for mobile industry players

Fintech has transformed the way financial services cater to consumers and business alike. The fintech sector was already gaining traction globally before the Covid-19 pandemic, but periods of lockdown and the resulting shift to digital services served as a catalyst for product innovation, investments and new entrants. Fintech companies operate across multiple financial services sectors that are being disrupted by digital transformation. This has resulted in numerous established product segments and ongoing innovation to develop new ones.

Digital payments is by far the most widely available and adopted fintech service, which has benefited

from the rise of e-commerce and the demand for faster, safer and lower-cost payment solutions from consumers and businesses. The array of digital payment solutions is also increasing, with options including mobile payments, QR code payments, cross-border transactions, contactless payments and blockchain technology transactions. Some of the most capitalised fintech companies globally, such as Visa, Mastercard, Paypal and Stripe, operate within the digital payments segment.

Other fast-growing fintech segments besides payments are highlighted in Figure 20.

Figure 20

Selected fintech segments

Segment	Description	Example companies
Lending	Traditional credit cards and bank loans replaced by buy now pay later (BNPL) agreements, peer-to-peer financing, payday loans etc.	Klarna, Affirm, Funding Circle, Lending Club
Digital bank/ neobank	Also known as 'challenger banks', they offer all products and services online, and operate with few or no physical branches.	Revolut, Koho, Kuda, Kakao, Movii, Rocker
Personal finance	Using technology to assess customers' needs and provide them with products that will streamline and grow their finances.	Mint, Credit Karma, WalletHub, NerdWallet
Institutional investors	Investing capital on behalf of customers. Services include the buying and selling of stocks or securities, bonds, mutual funds and investment funds.	BlackRock, Vanguard Asset Management, BNY Mellon Investment Management
Centralised crypto exchanges	Regulated, centralised crypto exchanges provide digital currency investors with a more secure platform to buy and sell cryptocurrencies.	Binance, Kraken, KuCoin, Coinbase
Sustainable finance	Companies raising environmental consciousness and accountability, enabling financial inclusion and creating alternatives to incumbent service delivery and predatory lending practices.	MioTech, Pelt8, Dodo,

Source: GSMA Intelligence



Market outlook and opportunities for mobile operators

Several fintech companies, particularly in the payments segment, operate globally, but the vast majority of the estimated 26,000+ fintech companies¹⁶ operate only within local or regional markets. 2021 was a bumper year for fintech companies, with total investments topping \$225 billion.¹⁷ Although investor sentiment fell sharply in 2022, mainly due to the deteriorating global political and macroeconomic environment, the fundamentals of growth – including high demand, digital-centric lifestyles and enabling regulations – remain strong.

The fragmented nature of the market and the positive long-term growth outlook raises the prospects for consolidation and interest from established financial institutions and companies in other sectors looking to capitalise on the fintech opportunity through strategic investments, collaborations and partnerships.

Mobile operators are not new entirely new players in the fintech ecosystem; MTN, Safaricom, Tigo and Turkcell have been offering a variety of financial services through mobile money and digital wallet platforms for the better part of the last decade, with revenue contribution as a percentage now in double digits in several markets. For example, M-Pesa recorded a total transaction value of KES29.55 trillion (\$236.4 billion) in FY 2022, contributing KES107 billion (\$856 million) or 38% of Safaricom's service revenues.¹⁸

More recently, a number of operators across different regions have announced plans to explore new opportunities in the fintech sector as part of strategies to generate revenues beyond core telecoms services. Examples include e&'s new fintech company, e& money, which has a suite of services covering merchant payments, remittances, bill payments, lending, investments, network-branded cards and insurance; Orange's digital banking service, Orange Bank, which now has nearly 2 million customers in Europe and 800,000 in Africa; and STC's mobile wallet service, STC Pay, which has since evolved into a leading fintech service in the Middle East and North Africa, with nearly 10 million customer accounts.

Mobile operators have strong reasons to participate in the fintech industry, as they can leverage their scale and extensive reach, strong customer relationships, advanced analytics and diverse partnerships to create or support innovative and secure solutions. While most fintech solutions have been designed to function on mainstream networks, the advent of 5G and edge capabilities offers the possibility of new solutions and improvements to real-time delivery applications. In 2021, Verizon and Mastercard formed a strategic alliance to bring 5G to the global payments industry. New products would employ 5G networks and mobile edge computing (MEC) to reduce the amount of hardware retailers require to deliver self-checkout services.

16. Statista

17. Statista

18. Safaricom company statement

03

Mobile industry impact



3.1

The mobile industry's impact on the SDGs

In 2016, the mobile industry became the first sector to commit to the 17 UN Sustainable Development Goals (SDGs). Each year since then, the GSMA has measured the impact of the mobile industry across all SDGs.¹⁹ The most recent analysis shows that the mobile industry increased its impact on all SDGs in 2021, with the average year on-year increase accelerating compared with 2020. The average SDG impact score across the 17 SDGs reached 53 (meaning the mobile industry is achieving 53% of what it could potentially contribute to the SDGs), up from 49 in 2020 and 32 in 2015. Other highlights include the following:

- There are now 11 SDGs where mobile's contribution is over 50, compared to six SDGs in 2020 and none in 2015.
- The mobile industry continues to achieve its highest impact on SDG 9: Industry, Innovation and Infrastructure, driven by the reach of mobile networks and take-up of mobile internet services.
- The biggest improvements were recorded in the industry's contribution to SDG 1: No Poverty, SDG 2: Zero Hunger and SDG 4: Quality Education. This is due to the increasing proportion of people using mobile for activities such as accessing government services, applying and searching for jobs, and obtaining educational information for themselves or their children. There was also an improvement in the affordability of mobile data and devices. This comes after affordability worsened in 2020 because of the decline in per capita income due to the Covid-19 pandemic.

While it is important to recognise the mobile industry's accelerated progress on the SDGs in 2021, it is worth noting that the industry is not on track to maximise its contribution to the goals by the 2030 deadline. Growth in the average SDG mobile impact score remains below pre-pandemic levels, highlighting the need for renewed efforts from the mobile industry and its partners.

One area where the mobile industry is increasingly focusing its attention is digital inclusion, which relates to sustainable development through four main pillars: inclusive access, inclusive planet, inclusive connectivity and inclusive business. Accelerating the rate at which people are included in the digital economy is a vital step in changing lives and delivering on the 2030 agenda.

¹⁹ [2022 Mobile Industry Impact Report: Sustainable Development Goals](#), GSMA, 2022

Figure 21

The mobile industry can drive digital inclusion in several ways



Inclusive access:

connecting everyone to mobile internet

The pandemic has emphasised the urgency of closing the digital divide, with 3.5 billion people still unconnected and excluded from the benefits of digital services. While great strides have been made to extend network coverage, the usage gap remains sizeable. The mobile industry is focusing on initiatives to tackle this issue, which generally relates to a lack of affordability, digital skills and relevance, as well as safety concerns.



Inclusive connectivity:

making the most of the mobile internet

Usage of mobile-enabled activities reached new heights in 2021 as mobile subscribers ventured further into online services. That said, there remains a gap in usage of mobile-enabled services between high-income countries and low- and middle-income countries, highlighting the need for action from the mobile industry and its partners. Mobile operators can bring new services and products to market that meet users' needs in areas such as digital education, finance and healthcare. It is also important to continue upgrading networks to enable users to access a broader range of services, such as those requiring faster download speeds and lower latencies.



Inclusive planet:

building a greener society

While net zero commitments and strict emissions reduction targets have been made by operators that together cover one third of global market share by connections, there is still a way to go for these pledges to become universal. Operators and their partners must deliver a wide range of innovations to improve energy efficiency in mobile networks while accelerating the substitution of renewable energy in place of fossil fuels to lower the emissions of the mobile industry.



Inclusive business:

understanding the benefits of being a purpose-driven company

There has been strong momentum from mobile operators worldwide to integrate purpose into core business strategies, such as by developing new services targeting underserved segments of the population. The growth in the issuance of green bonds in the mobile sector, whereby operators are securing funding on the basis of achieving social and environmental – rather than purely financial – targets, also demonstrates this move towards stronger environmental, social and governance (ESG) integration. Operators can derive several benefits from operating responsibly, such as improved customer acquisition, talent acquisition and risk management.

Source: GSMA

3.2

Mobile's impact on digital inclusion: tracking progress in Vietnam and Zambia

The GSMA's Mobile Connectivity Index (MCI) helps mobile industry stakeholders to focus efforts and policy actions to address the prevailing coverage and usage gaps. The latest iteration²⁰ measures the key enablers of mobile internet connectivity across 170 countries (representing 99% of the world's population) against 42 indicators for the period 2014-2021.

The indicators are grouped into four overarching enablers: infrastructure; affordability; consumer readiness; and content and services. Together, these provide objective, quantitative metrics to track the key enablers of mobile internet adoption and usage, as well as insights from consumers on what they use mobile internet for or what prevents them from using it.

Vietnam and Zambia are two countries that have made significant progress on the MCI since 2014. The following case studies map their journey to achieving better connectivity and highlight notable success factors.



Vietnam

Vietnam is the third-most improved country in the MCI since 2014 and the most improved country in Asia Pacific, increasing its score from 51 to 73 over seven years. Mobile internet use in the country nearly doubled from 27% of the population in 2014 to 53% in 2021. More than two thirds of adults in the country are now using mobile internet, with adoption accelerating after the outbreak of Covid-19. This improvement has been broad and driven by better performance across all four enablers:

- **Infrastructure:** 4G networks were not available in 2015 but reached 95% of the population by 2018, following accelerated rollouts by operators.
- **Affordability:** In 2021, 1 GB of monthly data was less than 0.3% of monthly GDP per capita, compared to 1.5% in 2014.

- **Content and Services:** There has been a significant increase in the development of local content, with almost 600,000 mobile applications available in local languages in 2021 (an increase of more than 700% since 2014). Vietnam's score on the UN's e-government index also increased from 42% in 2014 to 65% in 2021, while penetration of social media has significantly increased from 25% to 78% over the same period.

Going forward, the government of Vietnam has set out its key digital goals in the National Digital Transformation Programme, which is focused on the digitalisation of government services and administration, businesses and wider society. It aims to make 80% of public services available online, including through mobile devices, and to digitise 70% of customer transactions. The government is also aiming to upgrade mobile infrastructure and make 5G universal by 2030, enabling new services and improved networks.

20. [The State of Mobile Internet Connectivity 2022](#), GSMA, 2022



Zambia

Zambia's MCI score increased from 21 in 2014 to 41 in 2021, making it the most improved country in Sub-Saharan Africa over the period. Mobile internet adoption among adults almost doubled from 18% in 2015 to 35% in 2021, while the gender gap in mobile ownership reduced from 13% to 6%.

This performance is the result of improvements in infrastructure, driven by operator investments, and affordability:

- **Infrastructure:** 2G coverage increased from 78% to 98% between 2014 and 2021 and is now almost universal. In the same period, 3G coverage increased from 38% to 82%, while 4G coverage increased from 9% to 69%.
- **Affordability:** 1 GB of data now costs less than 2% of monthly GDP per capita, compared to more than 10% in 2014, demonstrating Zambia's efforts to achieve the '1 for 2' affordability target. The cost of an entry-

level device has fallen from more than 50% of monthly GDP per capita in 2016 to less than 20% in 2021, as a result of cheaper smartphones and smart feature phones, including the MTN Ka Toffee smart feature phone, which is priced at less than \$20.

Operators are attempting to address the various barriers to internet adoption. For example, MTN Zambia introduced the MTN Data Smart programme, which aims to improve consumers' understanding of and ability to use mobile internet and apps. In addition, Airtel Zambia has partnered with the Smart Zambia Institute, Ministry for Education and the ITU to provide digital skills training to schoolgirls. However, the policy environment for mobile operators is challenging, especially around taxation, where the government needs to align with best-practice principles to avoid distorting markets and investment.

3.3

Mobile's impact on climate technology: Indonesia case study²¹

Indonesia, an archipelago nation, faces multiple climate concerns and the Indonesian government continues to respond strategically to these. But tech startups and the rapidly growing digital economy are also contributing to climate technology solutions to improve climate mitigation and adaptation outcomes. These solutions contribute to renewable energy, energy efficiency, smart agriculture, integrated waste management and the circular economy.

Indonesia has seen rapid growth in its mobile technology as well. Nearly 55% of Indonesians subscribe to the mobile internet, while the increasing use of smartphones means that the country is set to become the fourth-largest smartphone market

in the world. The expansion of climate technology solutions, together with the rapid adoption of mobile technology, provides opportunities for mobile climate solutions in Indonesia.

Mobile-enabled climate technology refers to any mechanism that, with the use of mobile-based devices, enables carbon emissions to be avoided or supports climate adaptation efforts. Most solutions are concentrated at the network level with almost equal distribution for infrastructure and software solutions. These solutions primarily focus on renewable energy, energy management, sorting and recycling, waste collection and route efficiency.

21. [The State of Mobile-Enabled Climate Technology in Indonesia](#). GSMA, 2022

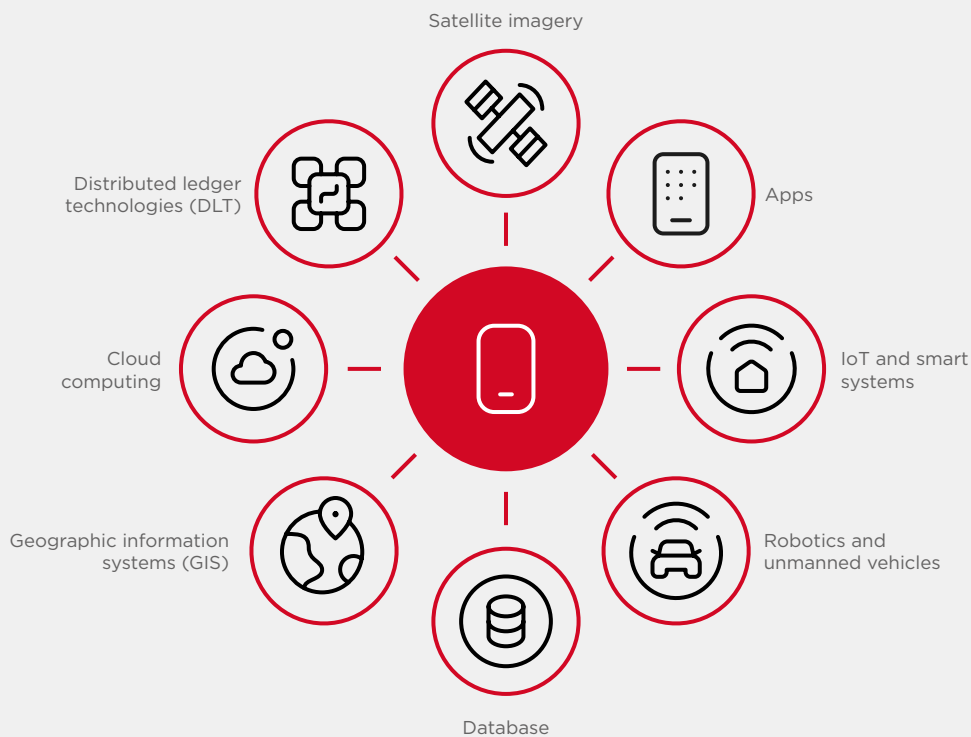
Natural resource management solutions focus more heavily on forestry management and marine ecosystem management at the network level. Emerging technologies such as blockchain and AI are becoming key climate technologies with rising adoption. In addition, drones and robots are being piloted for climate-related solutions, indicating growing interest from stakeholders. At the sector level, most climate technology solutions are in the energy and waste sectors.

Mobile climate technology in Indonesia contributes to the energy, waste and circular economy areas. There has been a variety of mobile-based applications in Indonesia, although the market for climate solutions is still maturing. Some barriers that need addressing include the availability of mobile and digital infrastructure in remote areas and access to affordable and connected devices. Nevertheless, Indonesia offers a huge opportunity for operators to grow and accelerate the adoption and scale of digital solutions addressing climate issues, as well as waste, energy and natural resource management. Examples of existing solutions include the following:

- **IoT-based solution for smart recycling:** Rekosistem is a responsible waste management startup that aims to create a sustainable ecosystem using mobile technology and environmentally friendly methods. Rekosistem created ReBox, an IoT-enabled waste container designed to improve recycling by optimising waste segregation and collection rates. Users are rewarded for proper disposal through the Rekosistem mobile app. As of June 2022, Rekosistem’s total recycled waste has exceeded 1,000 tons, originating from around 50 corporations and 11,000 households.
- **Mobile app for waste management:** Gringgo is a mobile app for monitoring and collecting data on waste treatment in Bali. Waste collectors can use the app to collect information on the economic value of waste. Residents can also use it to monitor and obtain information on the nearest service available. The app uses photos and AI technology to calculate the value of waste. The aim is to educate users about the value of waste, increase recycling and make waste collection and processing more efficient.

Figure 22

Mobile-enabled technologies for climate technology solutions



Source: GSMA

04

Mobile industry enablers



4.1

Policies for growth and innovation

Telecoms infrastructure is the foundation of all modern digital economies. It plays a crucial role in helping governments, at both national and transnational levels, to achieve economic growth, digital inclusion, social mobility and environmental objectives. Yet the mobile industry faces a paradox: although connectivity is one of the most critical economic enablers – transporting ever-greater volumes of data over continuously evolving networks – the business of connectivity faces challenges due to declining revenues and shrinking investment resources to meet the growing demands, a situation compounded by macroeconomic conditions.

5G investment challenge

The volume of data crossing telecoms networks is growing exponentially as more people take advantage of broadband connectivity and the demand for data-heavy digital content such as streaming video proliferates. Remarkably, more than half of all internet traffic today is generated by only six global internet companies.

To accommodate the rising flows of digital traffic and sustain service performance, mobile operators must constantly invest in order to expand their network capacity, close coverage gaps and deploy new technologies. Depending on individual market circumstances, sector-specific regulatory and fiscal requirements (such as asymmetric regulatory obligations, sector-specific taxes and fees, network deployment costs and restrictions), combined with market imbalances along the digital value chain, put additional pressure on operators' ongoing investments to maintain, expand and evolve their networks to meet the expectations of their customers and achieve broader public policy objectives.

Eroding market conditions have made it more difficult for mobile operators to keep pace with investments to meet digital policy targets, and operators in some regions are generating low, and sometimes even single-digit, returns on capital.

Policymakers can take action to rebalance the digital ecosystem and create fairer business conditions for mobile operators. Such moves can ensure that operators have the investment resources to build out remaining 4G infrastructure as well as 5G networks at scale and pace, and to introduce new network services that will enable the digital economy in the coming decades.

In Europe, operators have called for regulation that would require a fair contribution by the largest originators of network traffic towards investment in the network infrastructure their services rely on. Establishing a fair contribution will support investment in resilient and secure connectivity infrastructure while creating an incentive for these players to optimise their traffic delivery.

All segments of the internet ecosystem should have the opportunity to make fair returns in a competitive marketplace. Industry leaders, stakeholders and policymakers need to engage in dialogue where this is not the case, to ensure that regulatory asymmetry, market distortions or other factors do not limit this opportunity, and that the right incentives for digital infrastructure investment are in place to support the long-term growth of the ecosystem.

Reconciling mobile sector taxation with digital policy objectives

A lean and well-structured tax regime for telecommunications will promote the health and sustainability of the mobile sector while generating reasonable revenues for the government. In contrast, a poorly structured tax regime will have a distortive impact, reducing affordability of mobile services, undermining operators' investment in mobile infrastructure and decreasing government revenues over the long run. This can limit the impact of mobile telecommunications on the broader economy.

For many countries, mobile-sector taxation reform would trigger greater adoption and use of mobile connectivity. This would generate higher GDP and tax receipts for governments in the medium term from the resulting rise in economic activity and productivity across the economy. Governments should therefore balance the objectives of government funding through mobile-sector taxation with fostering digital development.

Based on internationally accepted principles of taxation, an optimal tax framework should incorporate the following recommendations:

- Sector-specific levies should be reduced or removed, making the tax regime more equitable and broadly based, thereby improving the financial sustainability of the industry.
- The tax regime should be simple, easily understandable and enforceable to minimise compliance costs.
- The overall tax burden on mobile consumers (e.g. SIM activation, excise taxes, additional VAT on handsets) should be reduced to improve affordability and demand for mobile services.
- Taxes on profits should be preferred to taxes levied on revenues.

Market-led consolidation in the mobile sector

As demand for high-speed, high-quality mobile connectivity continues to grow, market conditions must sufficiently incentivise investment in network infrastructure and services. To this end, authorities should avoid interventions that impose a certain market structure and, recognising the dynamics of a competitive mobile sector, allow the number of mobile operators to be determined organically as the market dictates. Given the level of sustained network investment that mobile operators are faced with, this may result in market consolidation (i.e. fewer players).

When assessing a mobile merger, policymakers should consider a range of factors, not only the expected price effects:

- **Innovation:** Market consolidation can accelerate the transition between technology cycles in the mobile industry, leading to improvements in the quality and innovation of services.

- **Investment:** A recent GSMA report²² indicates that many countries in Europe with a higher number of players²³ did not generate the optimal conditions for investment. From 2015 onwards, operators in European three-player markets invested more per connection than those in four-player markets, delivering faster download and upload speeds.
- **Price effects:** In the same report, there was no robust evidence found to suggest that Europe's four-player markets have produced lower prices than three-player markets in the past decade.

In other words, competition policy that favours a higher number of market players can cause significant efficiency losses related to costs, network quality and deployment by failing to give the appropriate weight to the long-term effects of investment and innovation on consumer welfare. The GSMA strongly recommends a balanced consideration of the effects of mergers on dynamic competition incentives and investments.

22. [Competition Dynamics in Mobile Markets](#), GSMA, 2022

23. Four-player markets

4.2.

Effective spectrum policy: meeting future connectivity demand

Spectrum availability and effective licensing continues to be critical to encourage the investment required to expand mobile access, meet the increase in demand for data services and enhance the quality and range of services offered. This year, all eyes will be on Dubai at the end of 2023, where the ITU's World Radiocommunication Conference 2023 (WRC-23) will take place from 20 November to 15 December.

WRC-23 is a chance to expand the availability of affordable 5G services and ensure future growth and innovation. It is an opportunity to build a spectrum roadmap going into the 2030s, address the digital divide and ensure 5G can benefit billions.

Spectrum in low and mid-bands are both on the conference agenda. On average, a total of 2 GHz of mid-band spectrum will be required per market to support the growth of 5G by 2030. At the same time, more low-band spectrum can deliver faster speeds in rural areas and lower the digital divide. For example, adding 600 MHz to existing low bands will raise download speeds by 30–50%.²⁴

Spectrum licensing, pricing and conditions

For planning efforts to make a real difference, the results at WRC-23 also need to be effectively licensed. As part of this work, countries should develop spectrum roadmaps that reflect growing demand. Roadmaps are an important means of ensuring there is sufficient spectrum for future demand from consumers and new technologies. Information on spectrum releases is critical for businesses to prepare investment plans, secure financing and develop arrangements for deploying different technologies.

The timely release of technology-neutral spectrum bands is also vital. An early release of spectrum drives better consumer outcomes, which is important in markets where long-term value, innovation and cost reductions are driven through relatively short technology cycles. If spectrum is released sooner, operators have more time to invest in new technologies to make them available nationwide. More spectrum also eases capacity constraints

In mid-bands, further harmonisation of the 3.5 GHz band is expected. However, getting to the required 2 GHz of mid-band capacity per market is challenging to reach without 6 GHz capacity as well. For this reason, one of the measures of success for WRC-23 will be the ability of delegates to secure 5G's future through the identification of 6 GHz spectrum for IMT, the ITU term for mobile. With this, conference delegates can help deliver fast, affordable mobile broadband to all parts of the world, lower the usage gap and narrow the digital divide.

Mid-band 5G spectrum will drive an increase of more than \$610 billion in global GDP in 2030, accounting for almost 65% of the overall socioeconomic value generated by 5G. Low and high bands will also drive big benefits and are necessary to deliver the most innovative services to everyone, irrespective of if they are on a factory floor or a rural location. Low bands will account for around \$130 billion of economic value in 2030, and high-band spectrum will add another \$220 billion, for a total of close to a \$1 trillion in additional GDP by the end of the decade.²⁵

in urban areas so that operators are better able to invest in rural areas. Conversely, unnecessary delays to spectrum awards risk harming mobile broadband service rollouts and leaving more people unconnected.

Spectrum carve-outs for vertical industries or local networks are causing a barrier to meeting this demand in some cases and should be avoided, especially in priority 5G bands (i.e. 3.5, 26 and 28 GHz). Approaches such as leasing or sharing are typically better options in these situations; a growing number of countries have decided to go down this route, though the benefits are still being proven.

The cost of spectrum also has a major impact. Governments and regulators should assign 5G spectrum to support their digital connectivity goals rather than as a means of maximising state revenues.

24. [Vision 2030: Low-Band Spectrum for 5G](#), GSMA, 2022

25. [The Socio-Economic Benefits of Mid-Band 5G Services](#), GSMA, 2022

Effective spectrum pricing policies are vital to support better quality and more affordable 5G services. In turn, that will help address issues such as the usage gap. High reserve prices, artificially limited spectrum supply (including set-asides) and poor auction design can all have a negative impact (i.e. slower mobile broadband and suppressed network investments).

There is a growing realisation among regulators and policymakers that spectrum auctions should be used to deliver quality to consumers rather than as a means to maximise state revenues. There were already positive signs of this in 2022 in countries such as India, Panama, Bangladesh, Colombia and Ecuador.

Regulators should also apply the right 5G spectrum licence terms and conditions and carefully consider best practice for awarding spectrum. Licences should be technology- and service-neutral to allow the upgrade of existing bands to 5G. Consulting with the industry will help maximise consumer benefits and ensure 5G is available for all.

To maximise the benefits of 5G, governments and regulators should:

- make available sufficient 5G spectrum and avoid limiting the supply via set-asides
- set modest reserve prices and annual fees to let the market determine spectrum prices
- carefully consider auction design to avoid unnecessary risks for bidders (e.g. avoiding mismatched lot sizes, which create artificial scarcity)
- develop and publish a 5G spectrum roadmap with the input of stakeholders to help operators plan effectively around future availability
- consult stakeholders on the award rules and licence terms and conditions, and take them into account when setting prices (onerous obligations reduce the value of spectrum).

Effective spectrum pricing policies are vital to support better quality and more affordable 5G services



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