GSMA™

The Mobile Economy Sub-Saharan Africa 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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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

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Executive summary

Mobile connectivity in Sub-Saharan Africa continues to drive digital transformation and socioeconomic advancements. This underlines the need for continued efforts to address the persisting barriers that impact mobile internet adoption in the region, particularly the affordability of devices, online safety concerns and the lack of digital skills. Meanwhile, authorities and enterprises see an opportunity to leverage growing 4G and 5G networks, alongside emerging technologies such as AI and IoT, to enhance productivity and efficiency in service delivery.

The adoption of 4G has accelerated in recent years, partly driven by the growing demand for faster speeds among younger consumers. Over the next five years, 4G adoption in Sub-Saharan Africa will more than double to 45%. 5G momentum is also growing, although the initial focus for 5G deployment is on urban areas and industrial locations, where there is greater need for the technology. 5G is expected to benefit the Sub-Saharan Africa economy by $11 billion in 2030, accounting for more than 6% of the overall economic impact of mobile.

5G is expected to benefit the Sub-Saharan Africa economy by $11 billion in 2030, accounting for more than 6% of the overall economic impact of mobile

Key trends shaping the mobile ecosystem

Growing 5G momentum

In 2022, there was a marked uptick in 5G-related activities in Sub-Saharan Africa, including 5G commercial launches in 15 countries and a growing number of spectrum allocations. This comes at a time when 3G is the most dominant technology in the region (accounting for 55% of total connections in 2022) while 4G is already dominant in other regions, implying network and customer readiness for the transition to 4G. The approach to 5G in the region will need to consider the current connectivity landscape and unique market features that could affect the rollout and adoption of the technology. 5G network ecosystem players in the region must also find ways to deliver cost-effective and efficient 5G networks, balancing investment and value creation.

Steering growth with AI

The emergence of new AI tools and use cases is accelerating the implementation of AI across various verticals and business processes. Most AI developments are occurring in advanced markets. However, the technology can be utilised in any scenario where there is sufficient data to draw insights. As a result, several industry players are already taking steps to apply AI across a variety of use cases in Sub-Saharan Africa. The potential benefit of AI in the region is significant, given that it can help offset the impact of limited resources and poor infrastructure in the delivery of many life-enhancing services, such as healthcare and education. Mobile operators in the region have employed AI at different levels, from improving network operations and customer services to achieving efficiencies and cost savings.

Climate-related risks spur circular economy principles

The concept of circularity has risen to the top of the agenda for policymakers and industry players in light of growing concerns around the generation of e-waste and unsustainable levels of consumption of natural resources. Although the technical lifespan of a mobile device is now between four and seven years, the average use period of mobile devices is only around three years. Governments and industry players have a role to play in incentivising consumers. This includes building new channels and suppliers to collect, refurbish and resell devices and implementing awareness campaigns on sustainability. Some operators in Sub-Saharan Africa are already taking a lead in this regard, with initiatives to drive circularity in mobile phones and other digital devices.
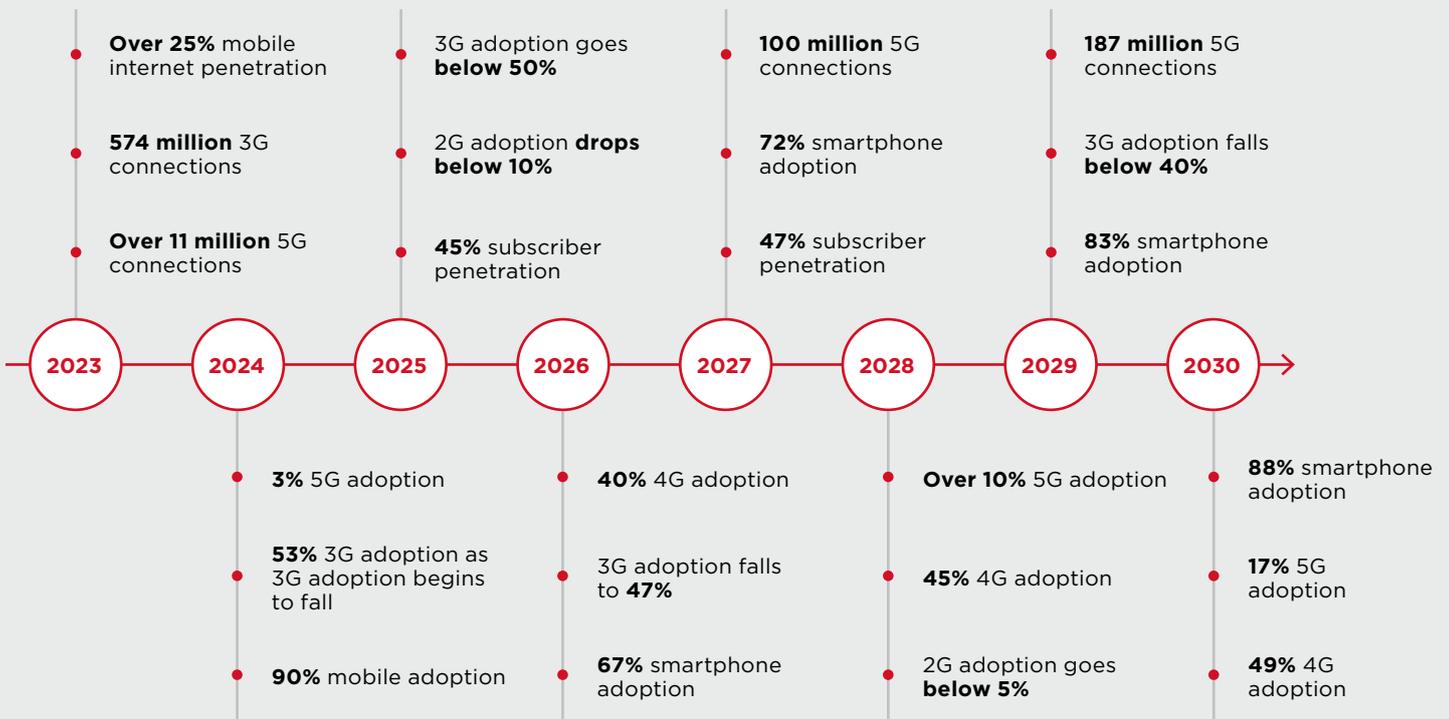
Improving smartphone access

Smartphone affordability is a key barrier to using mobile internet. The average selling price of smartphones in Africa has reduced significantly in recent years, with an influx of devices priced at below $100 – but the cost remains unaffordable for many. The challenge for manufacturers is to produce devices at low enough price points that align with local earning capacities and allow them to gain market share. To ease the current cost burden, operators offer a range of initiatives, including device financing plans, instalment payments and entry-level smartphones through partnerships with manufacturers.

Collaboration and innovation in fintech is on the rise

Fintech has become increasingly prominent in Sub-Saharan Africa, driven by the need to improve regional financial and digital inclusion. The industry has seen a rise in partnerships and innovation, leading to the diversification of products on offer, particularly in the payments segments. Operators have partnered with ecosystem players to expand products and offer options such as buy now, pay later (BNPL). At the same time, the growing fintech startup industry continues to attract investors, allowing them to improve access to a variety of financial products for both individuals and small businesses, such as microlending and B2B payments.

Key mobile industry milestones to 2030

2023
- **Over 25%** mobile internet penetration
- **574 million** 3G connections
- **Over 11 million** 5G connections

2024
- **3%** 5G adoption
- **53%** 3G adoption as 3G adoption begins to fall
- **90%** mobile adoption

2025
- 3G adoption goes **below 50%**
- 2G adoption **drops below 10%**
- **45%** subscriber penetration

2026
- **40%** 4G adoption
- 3G adoption falls to **47%**
- **67%** smartphone adoption

2027
- **100 million** 5G connections
- **72%** smartphone adoption
- **47%** subscriber penetration

2028
- **Over 10%** 5G adoption
- **45%** 4G adoption
- 2G adoption goes **below 5%**

2029
- **187 million** 5G connections
- 3G adoption falls **below 40%**
- **83%** smartphone adoption

2030
- **88%** smartphone adoption
- **17%** 5G adoption
- **49%** 4G adoption

Policies for safe and inclusive development

As cyberattacks continue to grow in scale and scope, governments face increasing pressure to protect their citizens and infrastructure and establish a framework for the mobile industry. Sub-Saharan Africa's rapid technological evolution makes the region an attractive target for fraud and cyberattacks.

Understanding, mapping and mitigating these existing and upcoming security threats in an objective, speedy and effective manner is essential. Some countries, including Eswatini, Ghana and Nigeria, already have comprehensive cybersecurity laws in place. Over the coming years, there will likely be an increased prevalence of legislative policies to promote cybersecurity related to critical infrastructure and supply chains.

Meanwhile, the International Telecommunication Union's (ITU) World Radiocommunication Conference 2023 (WRC-23) will take place from 20 November to 15 December 2023 in Dubai. Held under the auspices of the ITU, the conference is an opportunity to increase digital equality, widen harmonisation and provide a clear roadmap to address future spectrum capacity needs. The futures of low-band and mid-band spectrum are both on the agenda at WRC-23. For mid-bands, there is an opportunity to expand the harmonisation of 3.3–3.8 GHz, 4.80–4.99 GHz and 6 GHz at WRC-23. Because of Africa's high percentage of rural population and vast geography, low bands form a critical part of the region's digital future and can ensure that 5G delivers benefits for all consumers.
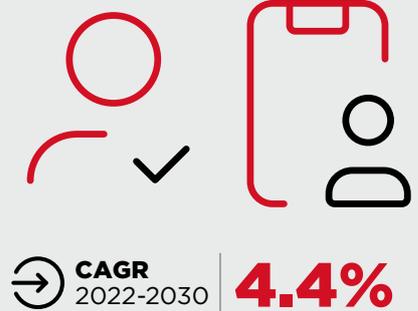
The Mobile Economy Sub-Saharan Africa

Unique mobile subscribers

2022
489m

2030
692m

43% 2022
50% 2030

Penetration rate
Percentage of population

CAGR 2022-2030 | **4.4%**

Mobile internet users

2022
287m

2030
438m

25% 2022
32% 2030

Penetration rate
Percentage of population
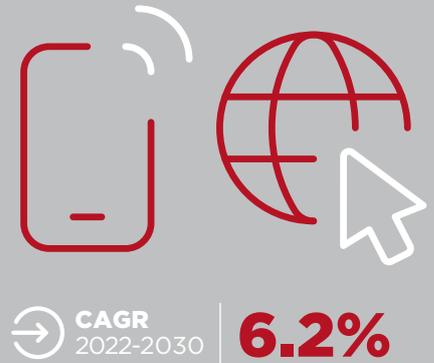
CAGR 2022-2030 | **6.2%**

SIM connections
(excluding licensed cellular IoT)

2022
980m

2030
1.36bn

Penetration rate
Percentage of population

86% 2022
99% 2030

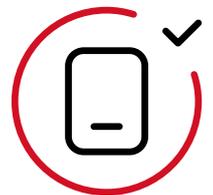**CAGR** 2022-2030
4.3%

4G Percentage of connections
(excluding licensed cellular IoT)

2022
22%

2030
49%

5G Percentage of connections
(excluding licensed cellular IoT)

2022
0.2%

2030
17%

Smartphones
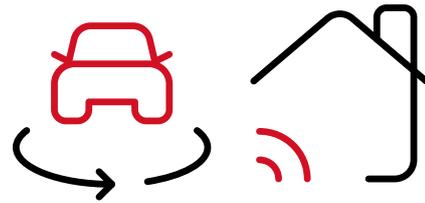Percentage of connections (excluding licensed cellular IoT)

2022 **51%**

2030 **88%**

Licensed cellular IoT connections

2022 **23m**

2030 **53m**

Operator revenues and investment

2022 **$48bn**

2030 **$58bn**

Total revenues

Operator capex

$75bn

2023 ⟶ 2030
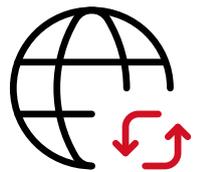
Mobile's contribution to GDP

2022 **$170bn**

8.1% of GDP

2030 **$210bn**

Public funding

2022 **$20bn**

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

Employment

1.4 million jobs
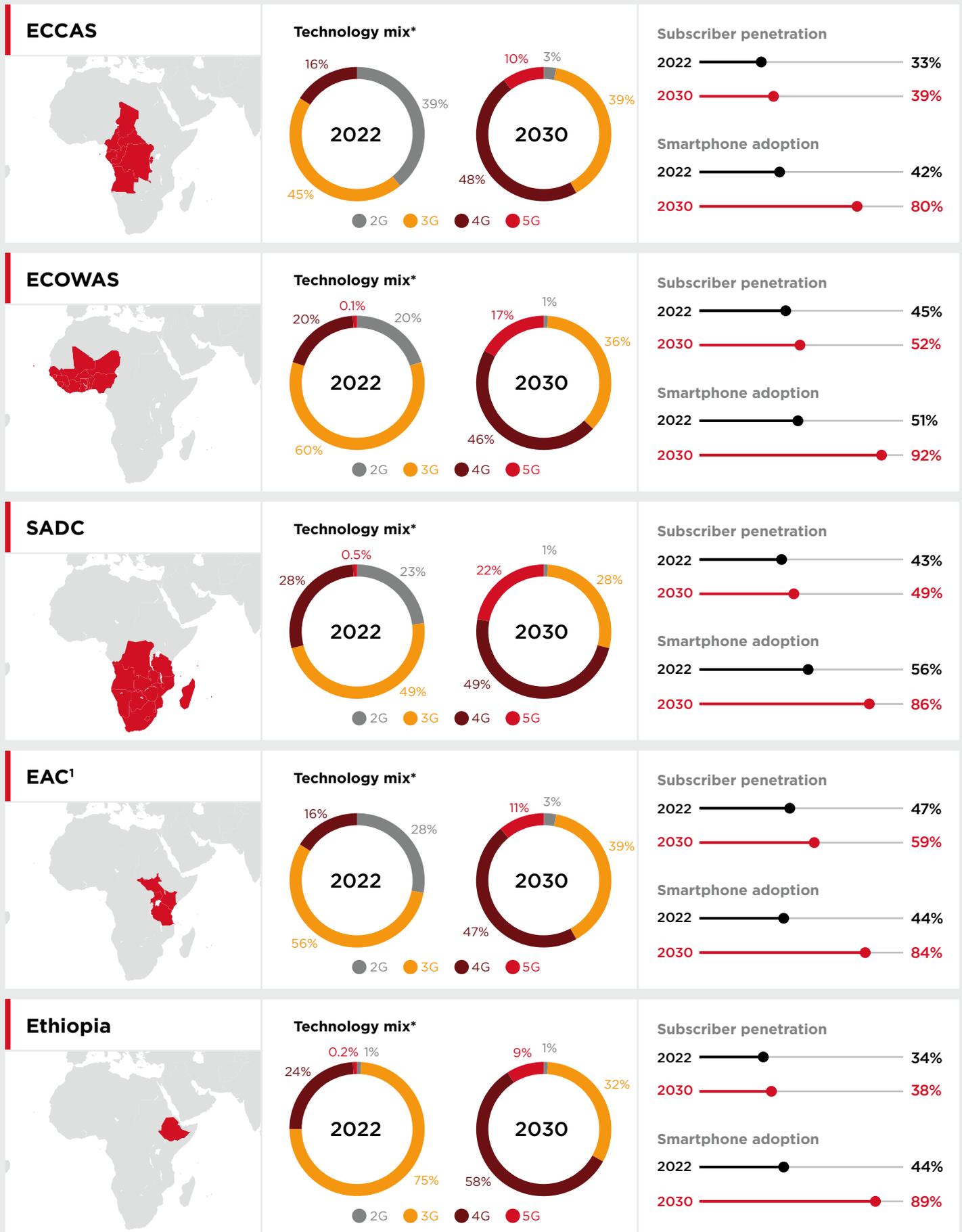
Directly supported by the mobile ecosystem in 2022

2.2 million jobs supported indirectly

Subscriber and technology trends

ECCAS

Technology mix*

2022: 2G 39%, 3G 45%, 4G 16%

2030: 2G 3%, 3G 39%, 4G 48%, 5G 10%

Legend: 2G, 3G, 4G, 5G

Subscriber penetration
- 2022: 33%
- 2030: 39%

Smartphone adoption
- 2022: 42%
- 2030: 80%

ECOWAS

Technology mix*

2022: 2G 20%, 3G 60%, 4G 20%, 5G 0.1%

2030: 2G 1%, 3G 36%, 4G 46%, 5G 17%

Legend: 2G, 3G, 4G, 5G

Subscriber penetration
- 2022: 45%
- 2030: 52%

Smartphone adoption
- 2022: 51%
- 2030: 92%

SADC

Technology mix*

2022: 2G 23%, 3G 49%, 4G 28%, 5G 0.5%

2030: 2G 1%, 3G 28%, 4G 49%, 5G 22%

Legend: 2G, 3G, 4G, 5G

Subscriber penetration
- 2022: 43%
- 2030: 49%

Smartphone adoption
- 2022: 56%
- 2030: 86%

EAC[1]

Technology mix*

2022: 2G 28%, 3G 56%, 4G 16%

2030: 2G 3%, 3G 39%, 4G 47%, 5G 11%

Legend: 2G, 3G, 4G, 5G

Subscriber penetration
- 2022: 47%
- 2030: 59%

Smartphone adoption
- 2022: 44%
- 2030: 84%

Ethiopia

Technology mix*

2022: 2G 1%, 3G 75%, 4G 24%, 5G 0.2%

2030: 2G 1%, 3G 32%, 4G 58%, 5G 9%

Legend: 2G, 3G, 4G, 5G

Subscriber penetration
- 2022: 34%
- 2030: 38%

Smartphone adoption
- 2022: 44%
- 2030: 89%

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* Percentage of total connections (excluding licensed cellular IoT)

1. The Democratic Republic of Congo joined the EAC in March 2022 but has not been included in the data for the EAC in this report.

01

The mobile industry in numbers

There will be more than 200 million additional unique mobile subscribers in Sub-Saharan Africa by 2030

There has been a steady growth of unique mobile subscribers in Sub-Saharan Africa. This will continue over the next seven years, taking the total to nearly 700 million by the end of 2030. Nigeria and Ethiopia will account for almost a third of total subscribers in 2030.

Mobile penetration in Sub-Saharan Africa will reach 50% by 2030; however, this will be much lower than the global average of 73% by the same year. Within the region, the penetration rate will be highest in Mauritius at 93% of the population.

Figure 1
Sub-Saharan Africa: mobile subscribers and penetration

Million, percentage of population
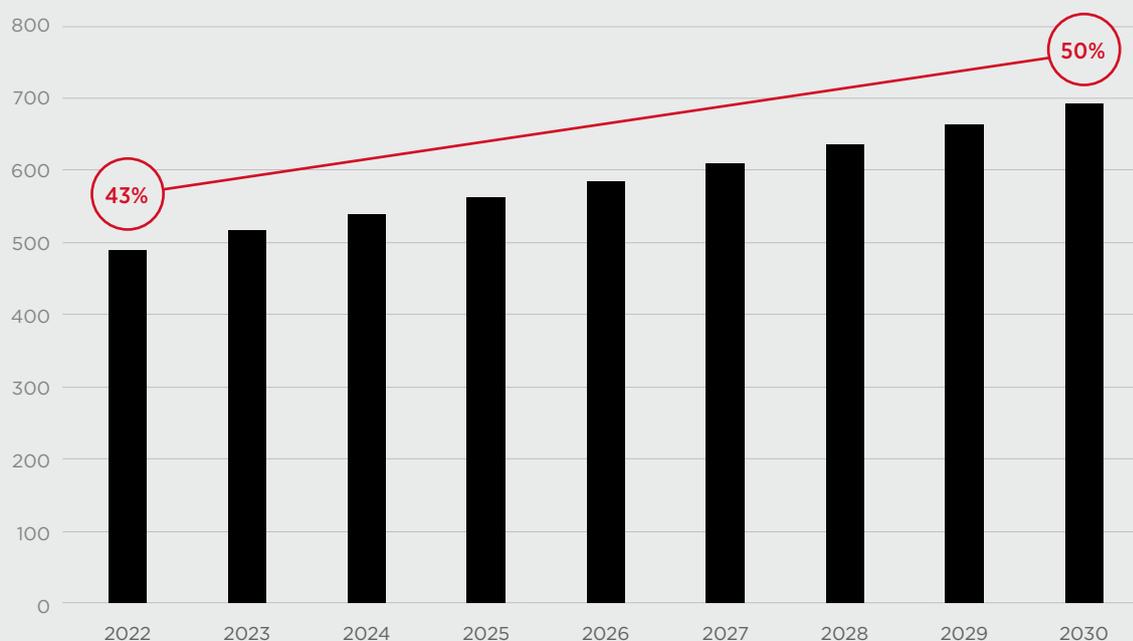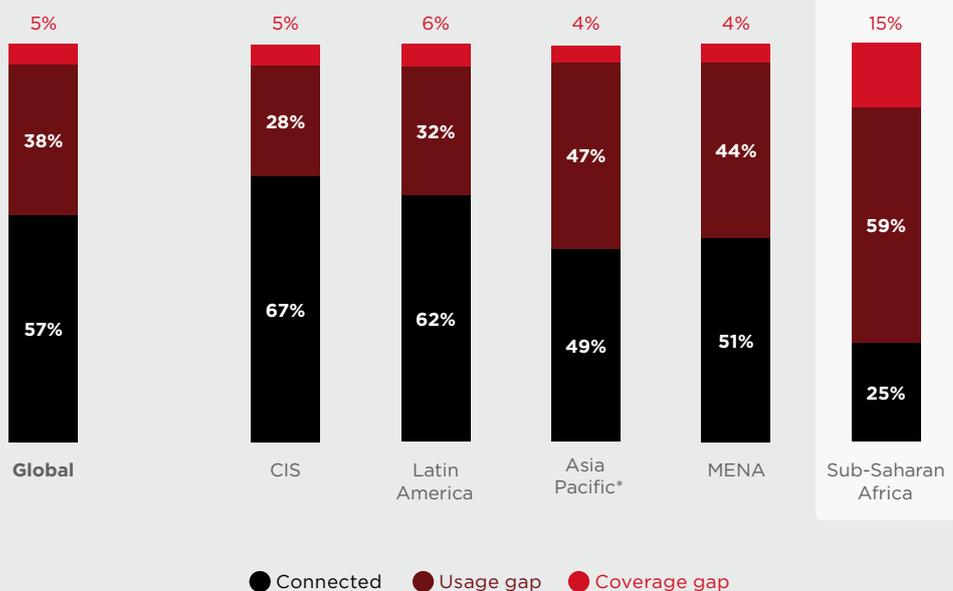

Source: GSMA Intelligence

The coverage gap in Sub-Saharan Africa has narrowed to 15%, but the usage gap remains significant

In 2022, Sub-Saharan Africa had around 287 million mobile internet subscribers. The mobile internet usage gap in the region is still significant, highlighting the impact of the barriers to mobile internet adoption, including lack of affordability and low levels of digital skills.

The mobile internet landscape in the region varies significantly: mobile internet penetration levels are over 50% in Mauritius, South Africa and the Seychelles, but still below 15% in Benin, Chad and the Democratic Republic of Congo.

Figure 2

Mobile internet penetration by region, 2022

Percentage of population

Region	Coverage gap	Usage gap	Connected
Global	5%	38%	57%
CIS	5%	28%	67%
Latin America	6%	32%	62%
Asia Pacific*	4%	47%	49%
MENA	4%	44%	51%
Sub-Saharan Africa	15%	59%	25%

● Connected ● Usage gap ● Coverage gap

* Excludes China
Source: GSMA Intelligence

# 4G adoption accelerates while 5G adoption also begins to rise

4G connections in the region will almost double by 2030, increasing the 4G adoption rate in Sub-Saharan Africa, as a percentage of total connections, to 49%. This will be driven by continued network upgrades and efforts to make 4G devices more affordable. This transition to 4G means that the number of connections on legacy networks (2G and 3G) will decline steadily in the coming years.

In July 2023, MTN and Airtel launched 4G LTE services in Rwanda after the government amended their operating licences to allow them to roll out the technology. The operators were previously only able to offer 4G services using the infrastructure of wholesale provider KT Rwanda Networks (KTRN). This development highlights the importance of competition at the infrastructure level to attract much-needed investment and improve services for consumers.

5G is also gathering momentum in the region due to operators' efforts to modernise and prepare their networks. 5G adoption is expected to grow more quickly in the second half of this decade, rising to 17% by 2030.

Figure 3

Sub-Saharan Africa: mobile adoption by technology

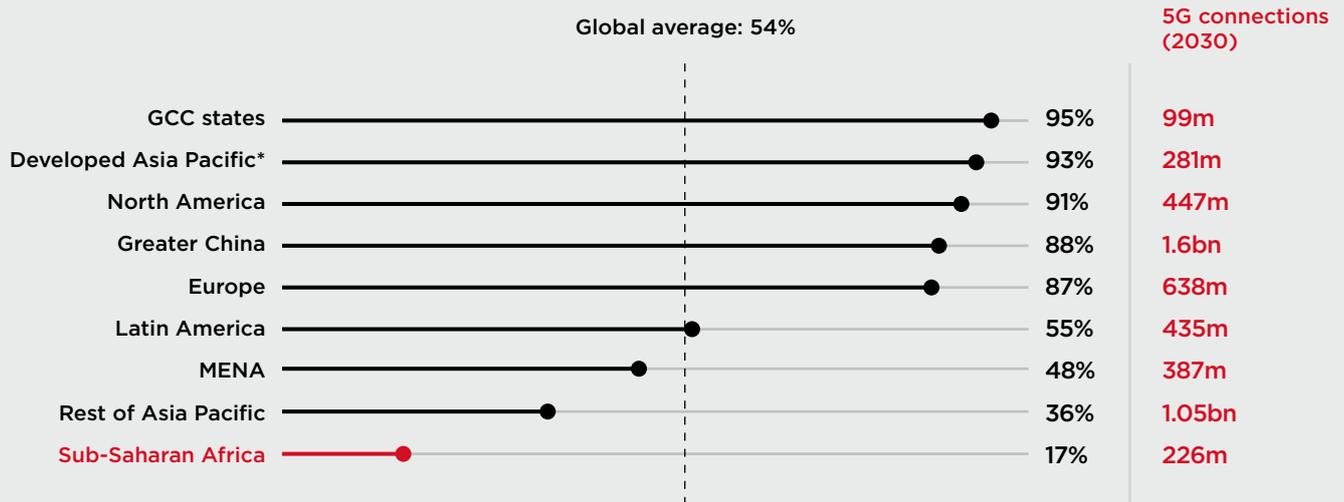Percentage of total connections
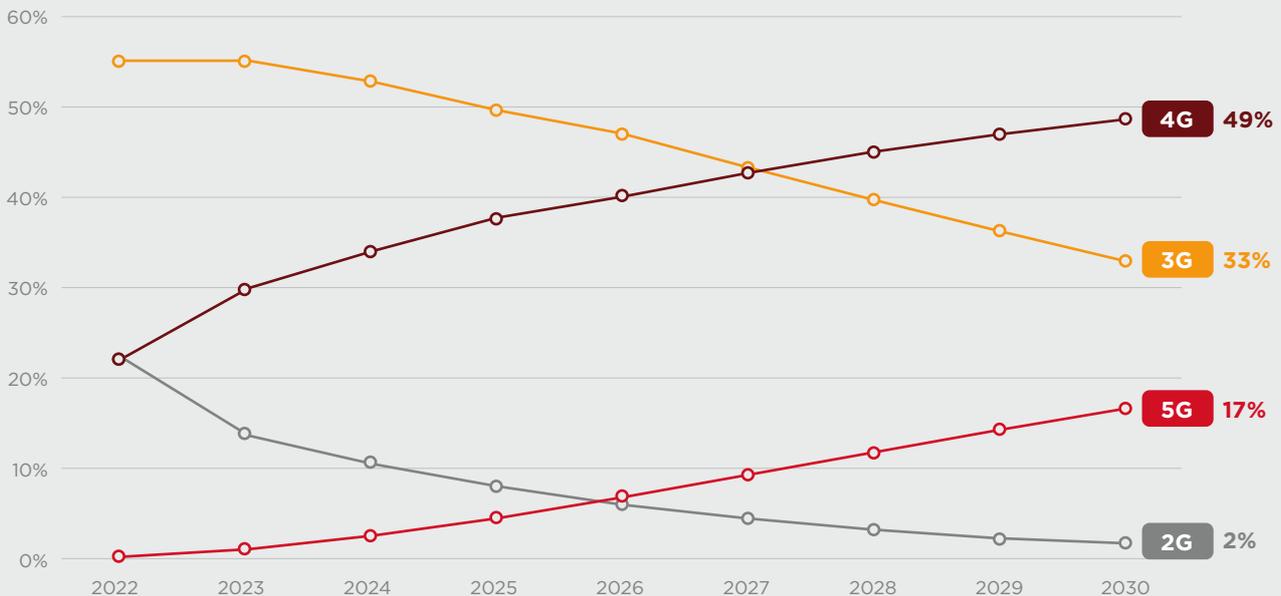
Source: GSMA Intelligence

There will be over 200 million 5G connections in the region by 2030

Sub-Saharan Africa will have 226 million 5G connections in 2030, equivalent to an adoption rate of 17%. Nigeria and South Africa will account for almost half of these connections. 5G growth in the region will be slow but steady, as a larger share of the customer base will continue to migrate to 4G.

Growing demand for internet is catalysing the growth of the 5G fixed wireless access (FWA) market in the region, with operators such as Orange Botswana and Telkom South Africa having launched commercial 5G FWA services. FWA will act as a primary broadband connection and help improve coverage in the region. At the same time, it will give operators an opportunity to increase their number of subscribers and build new use cases.

Figure 4
5G adoption in 2030

Percentage of total connections

Global average: 54%

	5G adoption	5G connections (2030)
GCC states	95%	99m
Developed Asia Pacific*	93%	281m
North America	91%	447m
Greater China	88%	1.6bn
Europe	87%	638m
Latin America	55%	435m
MENA	48%	387m
Rest of Asia Pacific	36%	1.05bn
Sub-Saharan Africa	17%	226m

* Australia, Japan, Singapore and South Korea
Source: GSMA Intelligence

# There will be over 1.2 billion smartphone connections in Sub-Saharan Africa by 2030

By 2030, smartphones will account for 88% of total connections in Sub-Saharan Africa, compared to the global average of 92%. There has been a substantial increase in the number of smartphone connections, partly due to increasing affordability.

However, there is still a large opportunity for the smartphone market in the region, given the usage gap and rising 4G and 5G adoption.

Figure 5

Sub-Saharan Africa: smartphone adoption

Percentage of connections (excluding licensed cellular IoT)
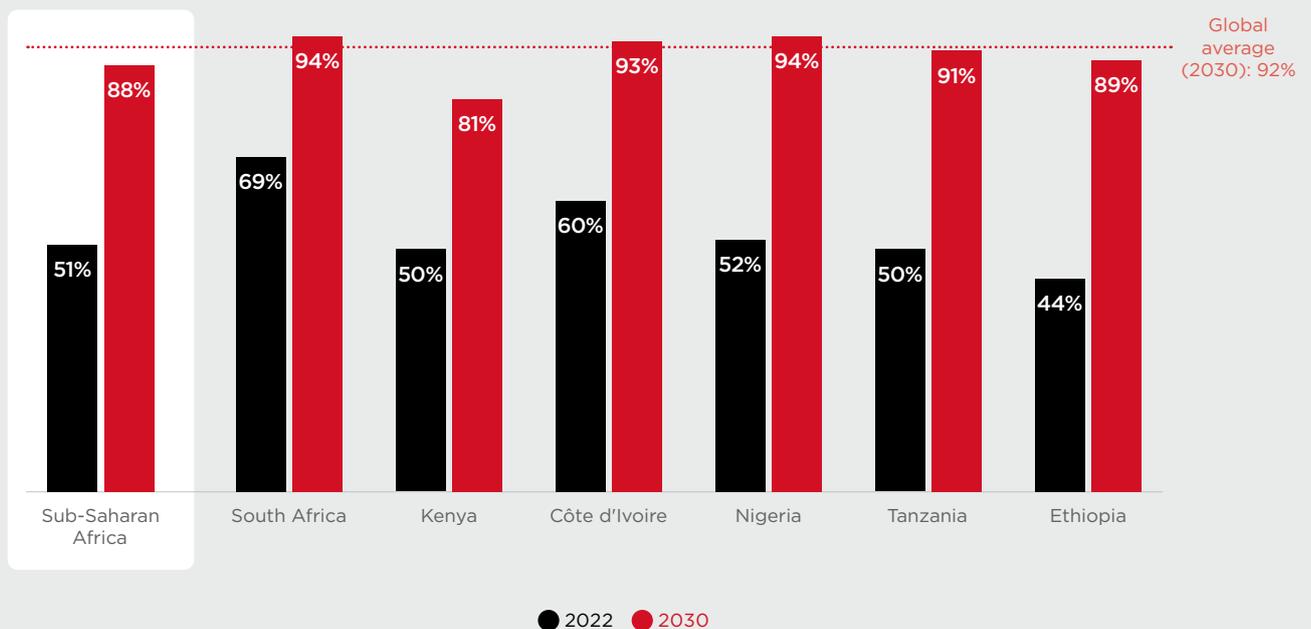
Source: GSMA Intelligence

Mobile data traffic set to quadruple in the region in the next five years
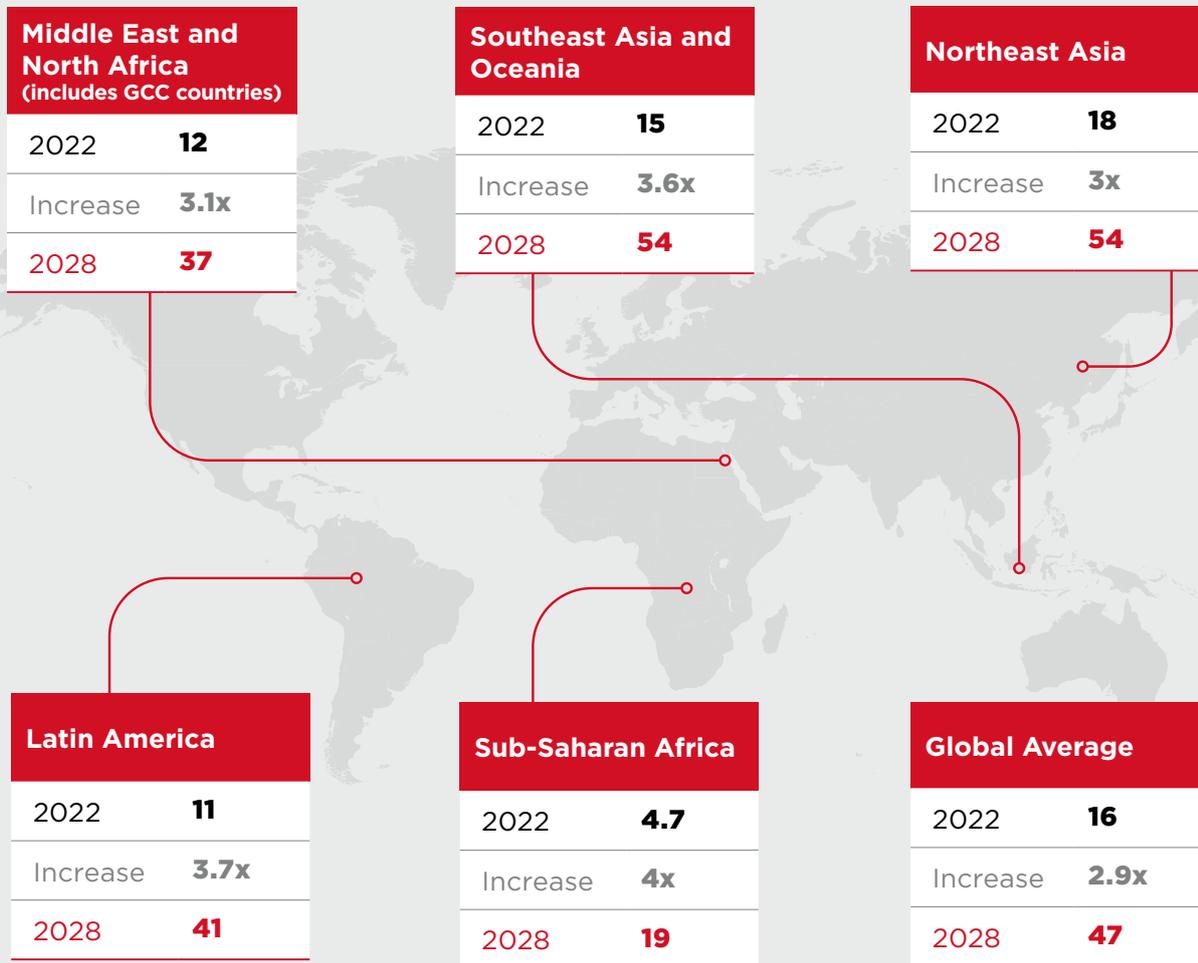
As service providers across Sub-Saharan Africa continue to invest in 4G and users migrate from legacy networks, mobile data traffic will rise considerably.

The increase in data traffic will be driven mainly by the growing usage of data-heavy services, primarily video streaming and online gaming. In Sub-Saharan Africa's streaming market, where most customers rely on mobile broadband for connectivity, competition is heating up among global streaming providers (e.g. Netflix and Amazon Prime Video) and local providers (e.g. Showmax and Wi-flix).

Figure 6

Mobile data traffic per smartphone

GB per month

Middle East and North Africa (includes GCC countries)	
2022	12
Increase	3.1x
2028	37

Southeast Asia and Oceania	
2022	15
Increase	3.6x
2028	54

Northeast Asia	
2022	18
Increase	3x
2028	54

Latin America	
2022	11
Increase	3.7x
2028	41

Sub-Saharan Africa	
2022	4.7
Increase	4x
2028	19

Global Average	
2022	16
Increase	2.9x
2028	47

Source: GSMA Intelligence, based on Ericsson Mobility Report June 2023

# Licensed cellular IoT connections will almost double by 2030

There will be around 53 million licensed cellular IoT connections in Sub-Saharan Africa by 2030. South Africa is the leading contributor of IoT connections in region and will cover almost half of the total connections in 2030. The region will see growth in IoT applications as 4G and 5G networks expand. Government initiatives to use innovative solutions as part of smart city programmes are also boosting IoT deployment in Sub-Saharan Africa.

IoT devices have reached households and businesses across the region, helping streamline processes and increase efficiency in the utilities sector, including through smart sensors for waste management in Kenya. Operators such as Safaricom continue to build IoT use cases and expand their NB-IoT activities. Operators are increasing IoT coverage by targeting a range of vertical use cases, including digital payments, smart metering and smart utilities, digital agriculture, digital health, telematics and fleet management.[2]

Figure 7

Sub-Saharan Africa: licensed cellular IoT connections

Million

● Rest of SSA ● Nigeria ● South Africa
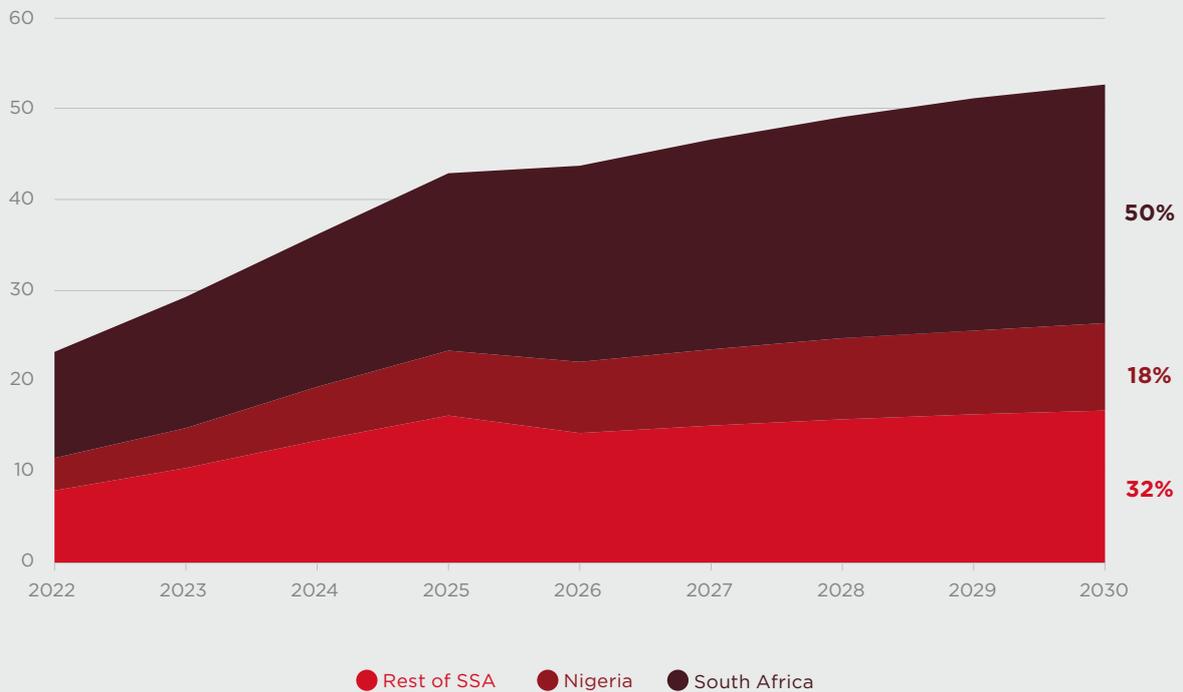
Source: GSMA Intelligence

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2. <u>Operators in IoT: progress in the last decade and pathway to sustained success</u>, GSMA Intelligence, June 2023

# Sub-Saharan Africa sees steady revenue growth as 4G adoption and data usage both rise

Revenue is expected to grow slowly but steadily in the region as operators continue to invest in 4G and 5G network deployments and diversify their services with new revenue streams.

Growing revenue from mobile money and mobile data services continue to underpin operator growth in Sub-Saharan Africa. For example, at the end of March 2023, Airtel Africa reported year-on-year increases in mobile money revenue of 29.6% and data revenue of 23.8%.[3] MTN also saw double-digit gains across both categories by the end of 2022.[4]

Figure 8

Sub-Saharan Africa: mobile revenue and year-on-year growth

Billion

● Revenue   ▬ Annual growth (%)
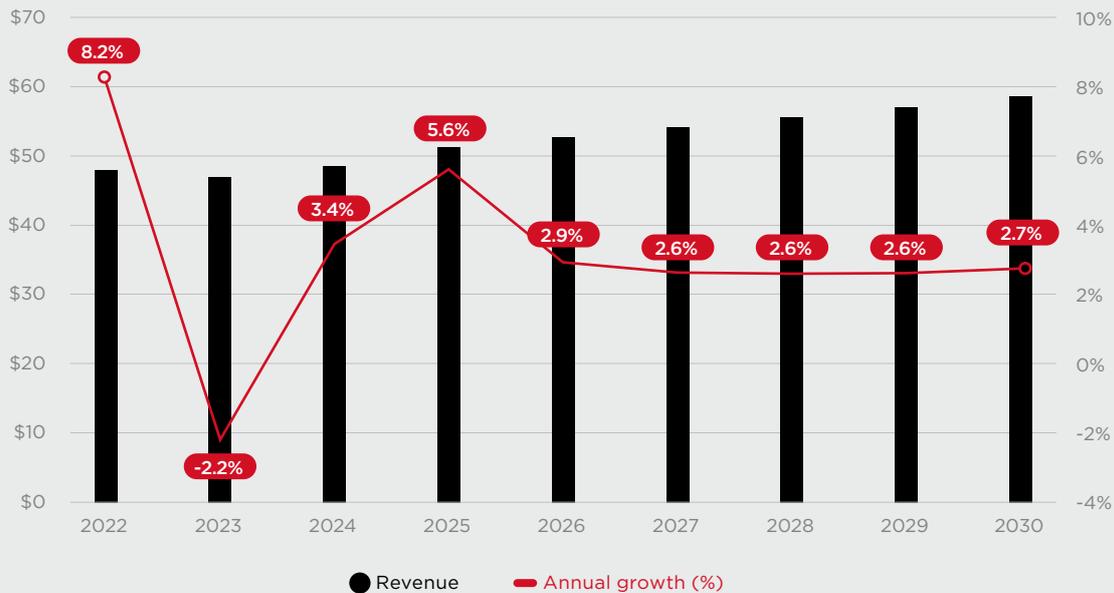
Source: GSMA Intelligence

3. "Airtel Africa Records Double Digit Revenue Growth, Rakes in $750m Profit", This Day, May 2023
4. "MTN revenue growth continues in Uganda, Rwanda", Connecting Africa, June 2023

Operators will spend $75 billion on their networks during 2023–2030, mostly on 4G

As a result of extensive 4G network buildout and growing 5G network deployments in Sub-Saharan Africa, capex will be on an upwards trajectory over the next few years. This will begin to trend downwards closer to 2030 as operators turn their focus to generating returns on investment.

The focus over the next few years will be on extending coverage, along with network upgrades. At the same time, operators will be ramping up investments to support the growing momentum behind 5G.

Figure 9
Sub-Saharan Africa: mobile operator capex

Billion

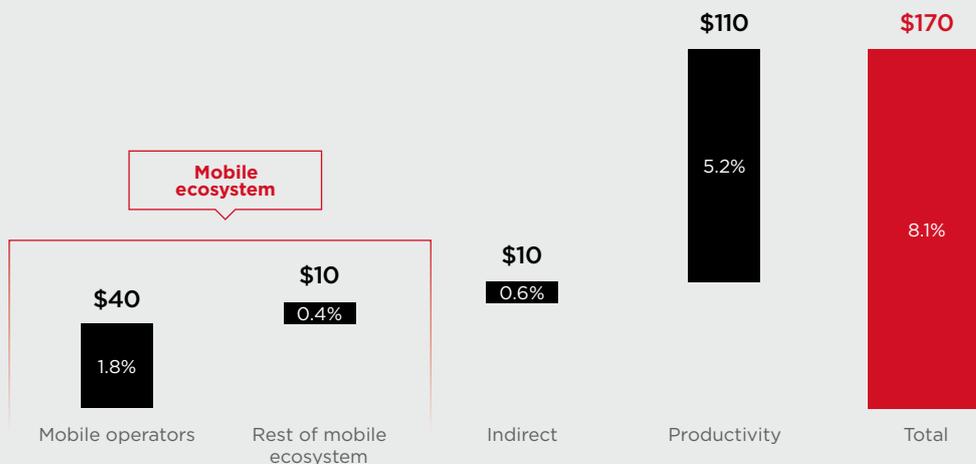Capex   Capex as % of revenue
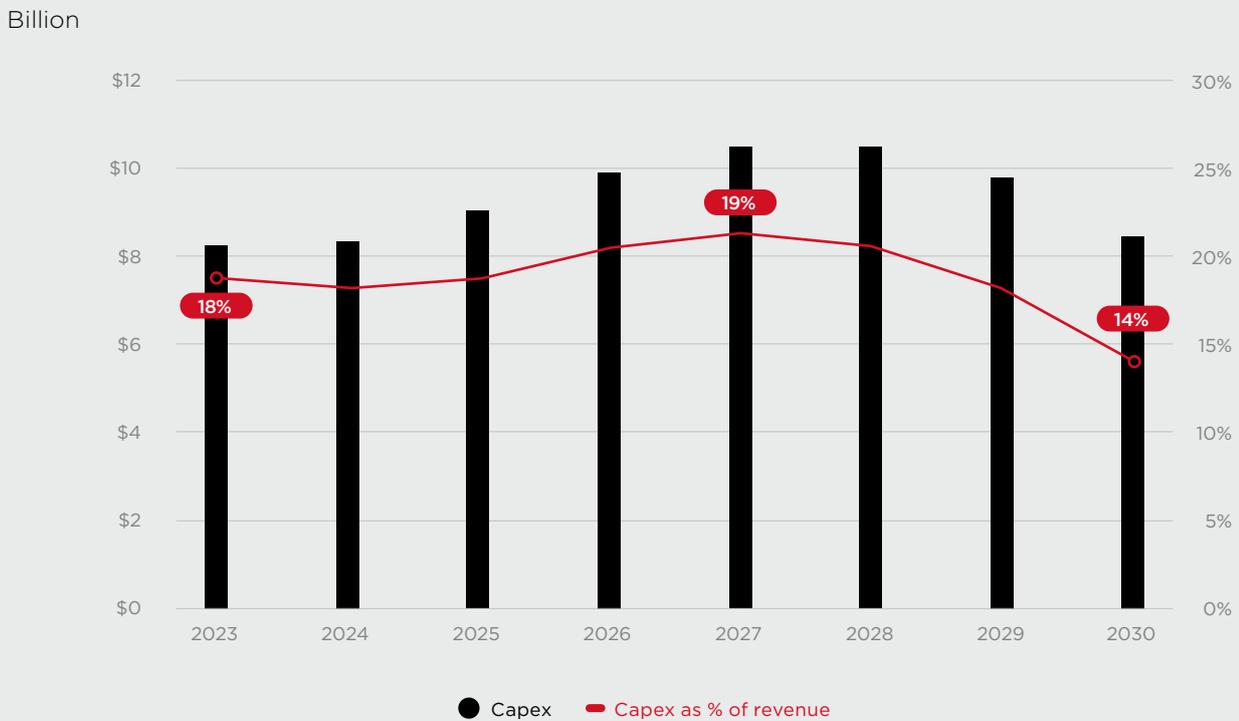
Source: GSMA Intelligence

Mobile added $170 billion of economic value to the Sub-Saharan African economy in 2022

In 2022, mobile technologies and services generated 8.1% of GDP across Sub-Saharan Africa, a contribution that amounted to around $170 billion of economic value added. The greatest benefits came from productivity effects reaching $110 billion, followed by mobile operators, which generated $40 billion.

Sub-Saharan Africa: total economic contribution of mobile, 2022

Billion

Mobile ecosystem

Mobile operators	Rest of mobile ecosystem	Indirect	Productivity	Total
$40	$10	$10	$110	$170
1.8%	0.4%	0.6%	5.2%	8.1%

Note: Totals may not add up due to rounding
Source: GSMA Intelligence

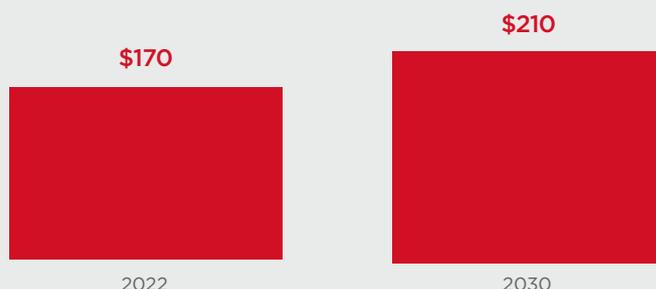# At the end of the decade, mobile's economic contribution will reach $210 billion

By 2030, mobile's contribution will reach approximately $210 billion in Sub-Saharan Africa, driven mostly by improvements in productivity and efficiency brought about by the increased take-up of mobile services.

Figure 11

Sub-Saharan Africa: economic impact of mobile
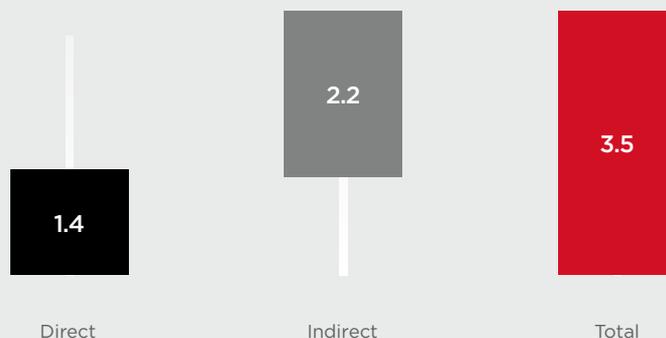
Billion

Source: GSMA Intelligence

The mobile ecosystem in Sub-Saharan Africa supported 3.5 million jobs in 2022

Mobile operators and the wider mobile ecosystem provided direct employment to around 1.4 million people across Sub-Saharan Africa. In addition, the economic activity in the ecosystem generated more than 2 million jobs in other sectors, meaning that around 3.5 million jobs were directly or indirectly supported.

Figure 12

Sub-Saharan Africa: employment impact of the mobile ecosystem, 2022

Jobs (million)

Note: Totals may not add up due to rounding
Source: GSMA Intelligence

The fiscal contribution of the mobile ecosystem reached $20 billion in 2022

In 2022, the mobile sector in Sub-Saharan Africa made a substantial contribution to the funding of the public sector, with around $20 billion raised through taxes on the sector. A large contribution was driven by services, VAT, sales taxes and excise duties, generating $10 billion, followed by corporate taxes on profits at $5 billion.

Figure 13

Sub-Saharan Africa: fiscal contribution of the mobile ecosystem, 2022

Billion

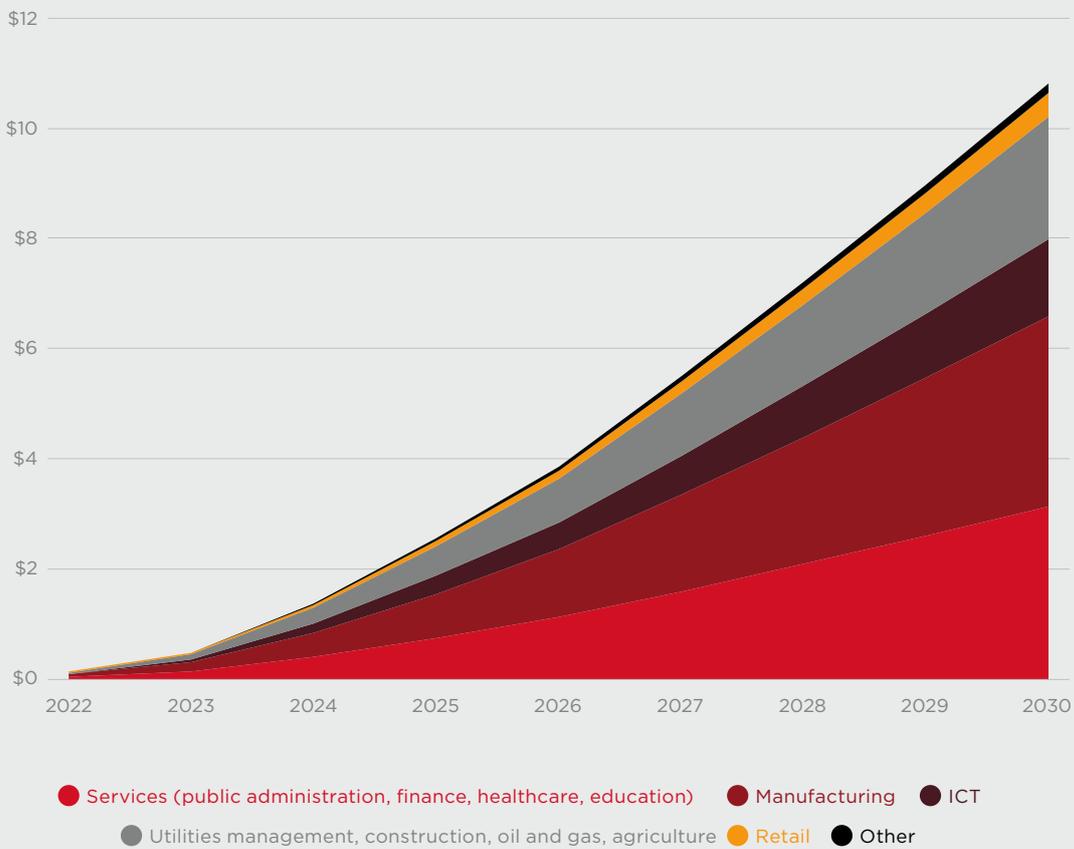|				
$10	$2	$5	$2	$20
Services VAT, sales taxes and excise duties	Handset VAT, sales taxes, excise and customs duties	Corporate taxes on profits	Employment taxes and social security	Total

Note: Totals may not add up due to rounding
Source: GSMA Intelligence

5G will add almost $11 billion to the economy in Sub-Saharan Africa in 2030

5G is expected to benefit the Sub-Saharan Africa economy by $11 billion in 2030, accounting for more than 6% of the overall economic impact of mobile. Much of the 5G benefit will materialise over the period to 2030, as some countries are in early stages of deployment and 5G economic benefits will increase as the technology starts to achieve scale and widespread adoption.

Figure 14

Sub-Saharan Africa: annual 5G contribution by industry

Billion

- ● Services (public administration, finance, healthcare, education)
- ● Manufacturing
- ● ICT
- ● Utilities management, construction, oil and gas, agriculture
- ● Retail
- ● Other
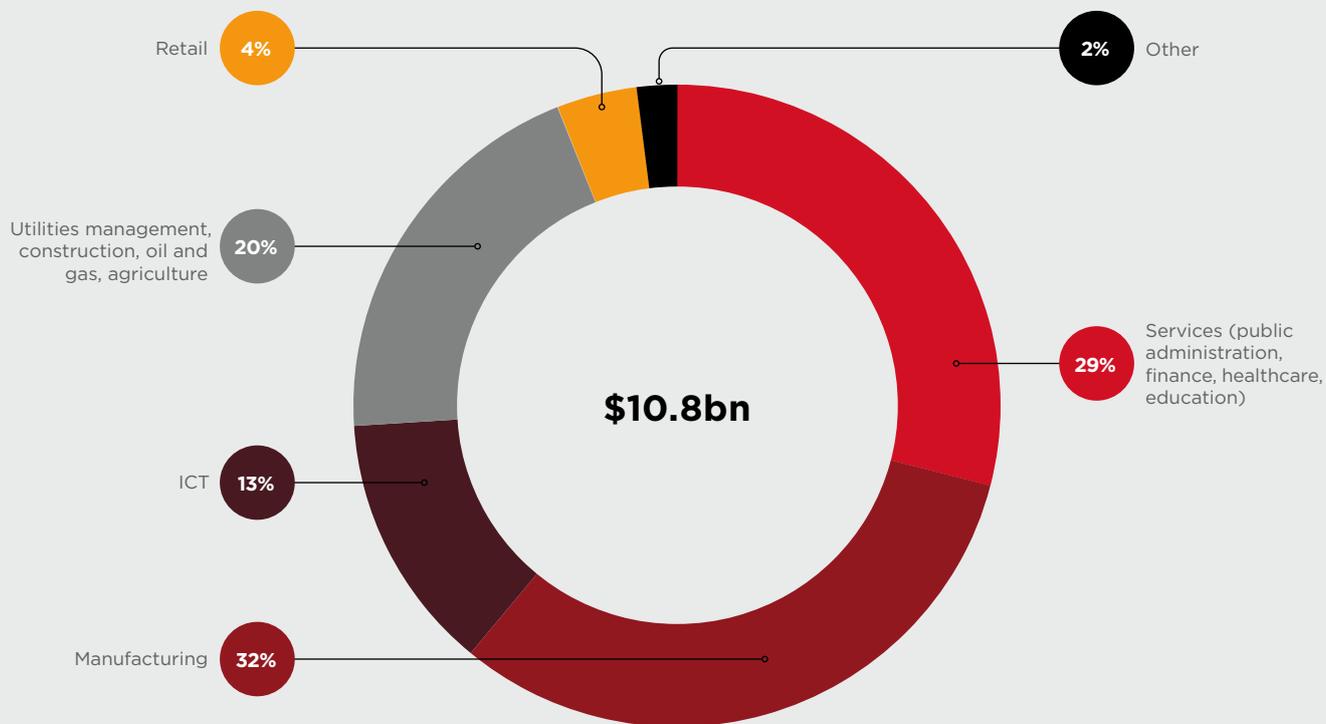
Source: GSMA Intelligence

Manufacturing and services will benefit the most from 5G in 2030

5G is expected to benefit most sectors of the Sub-Saharan Africa economy, depending on their ability to incorporate 5G use cases in their business. Over the period to 2030, 32% of the benefits are expected to come from the manufacturing sector, driven by applications such as smart factories, smart cities and smart grids, and 29% from the services sector.

Figure 15

Sub-Saharan Africa: 5G contribution by industry, 2030

Percentage of total benefit

Retail **4%**

2% Other

Utilities management, construction, oil and gas, agriculture **20%**

$10.8bn

Services (public administration, finance, healthcare, education) **29%**

ICT **13%**

Manufacturing **32%**

Source: GSMA Intelligence

02

Mobile industry trends
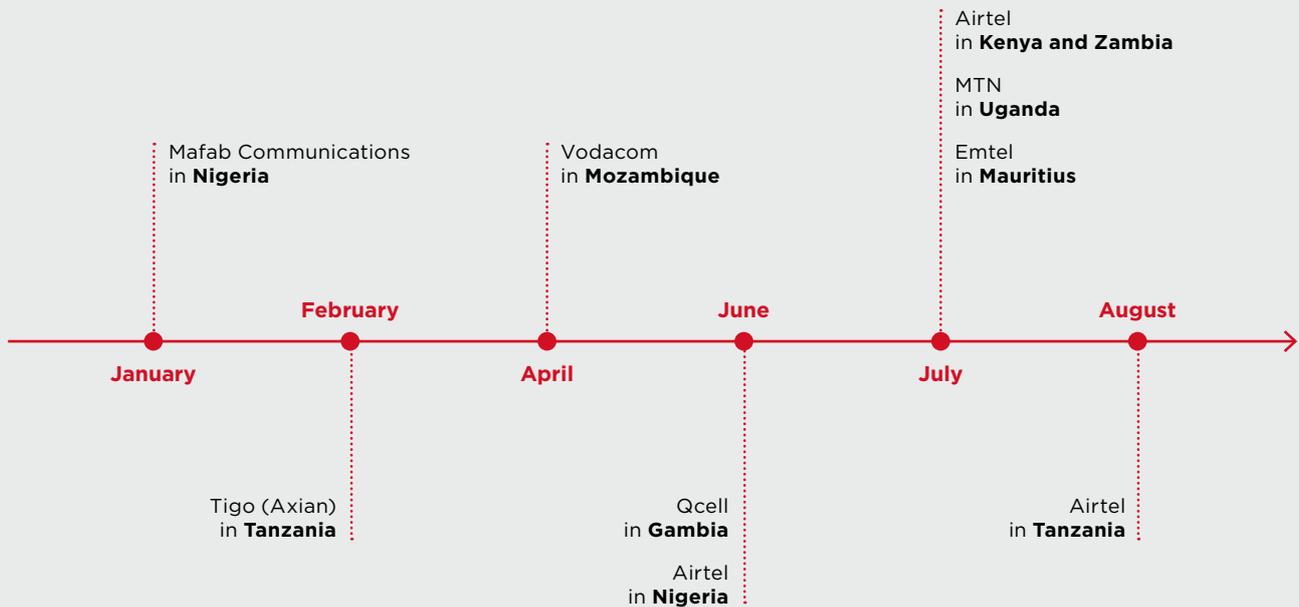
2.1
Growing 5G momentum

297 operators in 100 markets around the world have launched commercial mobile 5G services as of September 2023. By 2030, there will be more than 5.2 billion 5G connections, representing over half of total mobile connections globally. 5G networks will cover over 50% of the world's population in the same year.

In Sub-Saharan Africa, the momentum for 5G continues to grow. As of September 2023, 27 operators in 16 markets have launched commercial mobile 5G services in the region, while several others have plans for 5G launch. Governments and enterprises in the region are increasingly utilising technologies to tackle the biggest challenges faced by society, and 5G will play a key role in this area. This is especially important with regard to improving coverage, meeting the growing demand for enhanced connectivity and supporting new use cases across different verticals. Following the launch of 5G by Orange Botswana in November 2022, the Ministry of Health piloted the use of the technology on teleradiology (the transmission of radiological patient images, such as x-rays, CT scans and MRIs, from one location to another).

Figure 16

5G network launches in Sub-Saharan Africa in 2023*

Airtel
in **Kenya and Zambia**

MTN
in **Uganda**

Emtel
in **Mauritius**

Mafab Communications
in **Nigeria**

Vodacom
in **Mozambique**

February   June   August

January   April   July

Tigo (Axian)
in **Tanzania**

Qcell
in **Gambia**

Airtel
in **Tanzania**

Airtel
in **Nigeria**

* List not exhaustive
Source: GSMA Intelligence

Despite the growing momentum, the approach to 5G in the region will need to account for the current connectivity landscape and unique market features that could affect the rollout and adoption of the technology. The region's 5G network ecosystem players must find ways to deliver cost-effective and efficient 5G networks, balancing investment and value creation. This comes at a time when 3G is the most dominant technology in Sub-Saharan Africa (accounting for 55% of total connections in 2022) while 4G is already dominant in other regions, implying network and customer readiness for the transition to 4G.

In this context, 5G rollout in Sub-Saharan Africa will likely arrive in phases, starting in areas with stronger demand for 5G services, such as densely populated areas, and then spreading to other locations as the business case for the technology improves.

FWA boosting the adoption of 5G

FWA provides an opportunity to enhance last-mile connectivity for home broadband services. Although it is already frequently used as a substitute for fixed broadband, new global standards and 4G have improved the economics and performance of FWA in recent years. Looking ahead, 5G will further catalyse the growth of FWA in Sub-Saharan Africa, making it a primary broadband option.

Along with providing basic connectivity, FWA will help operators reach unconnected areas. FWA can also help operators and service providers compete in the home broadband and small business markets, eventually helping their businesses to grow more quickly. Although FWA solutions have been around for more than two decades, the performance improvements enabled by 5G offer a larger addressable opportunity for improving internet access and for commercialisation. This is driving renewed operator interest in the technology, reflected in the growing number of commercial deployments of 5G FWA in the region.

As of September 2023, 12 operators in the region provide 5G FWA services across 7 countries, including Botswana, Kenya, South Africa and Tanzania. These include MTN Nigeria, which launched commercial 5G services in September

Operators across the region have stepped up efforts to modernise and prepare their networks for 5G, emphasising fibre deployment for backhaul as well as network automation and virtualisation solutions to manage costs. However, FWA will be a primary use case for 5G in the region, given the growing demand for connectivity and limited FTTx infrastructure. FWA is an affordable broadband connectivity option for the last mile, where competing technologies, such as fibre or copper, fall short. Due to the prohibitive costs of extending fibre connectivity, most countries in the region have very low adoption of fibre-based fixed broadband services and have been focusing on extending mobile network coverage instead.

2022, Orange Botswana and Telkom South Africa. The number of FWA services will continue to rise as more operator networks are upgraded, more 5G networks are built out and more customer-premises equipment (CPE) devices (particularly 5G ones) are commercialised.

Operators are also leveraging FWA to improve other areas, such as education. For example, mobile operator Free and Ericsson will together provide FWA connectivity to schools in Senegal. The project will demonstrate how FWA can utilise existing mobile radio networks to effectively connect schools and bridge the educational divide.

While FWA has a lot of potential, practical limitations and regulatory considerations are holding back large-scale deployment in Sub-Saharan Africa. These include the high cost of CPE devices, low household incomes and the lack of sufficient spectrum for network deployment. That said, some operators are implementing measures, such as subsidies and payment in instalments, to make CPE devices more affordable for users. These efforts, along with the growing demand for connectivity, will sustain growth in the FWA market and create new revenue opportunities for operators.

2.2
Tapping into the power of AI

There has been a wave of growing momentum behind AI in the last few years, with increasing investments into new AI capabilities and applications as well as debates on the responsible use of the technology. Amid these developments, it is clear that AI will have a profound impact on the way society operates in the coming years, as the emergence of new AI tools and use cases will accelerate the implementation of AI across various verticals and business processes.

Unsurprisingly, most AI developments are occurring in advanced markets in East Asia, Europe and North America. However, the technology can be utilised in any scenario where there is sufficient data to draw insights. As a result, a number of industry players are already taking steps to apply AI across a variety of use cases in Sub-Saharan Africa. Indeed, the potential benefit of AI in Sub-Saharan Africa and other emerging regions is significant, given that it can help offset the impact of limited resources and poor infrastructure in the delivery of many life-enhancing services, such as healthcare and education.

Google's AI projects in Africa

In June 2023, Google revealed six AI projects it is working on at the Google Labs in Accra, Ghana to support communities across Africa:

- **Mapping buildings:** Combining AI with satellite imagery to pinpoint the location of buildings, Google helps governments and nonprofit organisations to understand the needs of residents and to offer assistance.

- **Forecasting floods:** Google uses AI models to predict when and where riverine floods will occur in 80 countries worldwide, including 23 in Africa.

- **Predicting locusts:** Through collaborations with AI company InstaDeep and the Food and Agriculture Organization of the UN, Google uses AI tools to better detect locust outbreaks and enable farmers to implement control measures.

- **Improving maternal health outcomes with ultrasound:** Google is building AI models that can read ultrasound images and provide important information to healthcare workers.

- **Helping people with non-standard speech make their voices heard:** Google has built an AI tool that transcribes speech into text to help people with non-standard speech communicate more easily.

- **Teaching reading to children:** Read Along, Google's AI-based reading tutor app and website, is helping to increase child literacy. Diya, the in-app reading buddy, listens to the speaker reading aloud, offering support when they struggle and rewarding them when they do well.

Below are recent examples of the application of AI in various verticals in Sub-Saharan Africa:

- **Logistics in healthcare:** Viebeg Technologies, a venture capital–backed healthtech company, is helping to expand access to affordable healthcare in Central and East Africa by aiding healthcare facilities in procuring supplies in real time. It uses AI to manage supply-chain processes (including shipping, warehousing, distribution and inventory management) to ensure that healthcare facilities have the precise medical supplies in stock.

- **Personalised content creation for education:** Mtabe, a Tanzania-based educational-technology startup, uses AI to provide personalised learning to students. Mtabe's platform analyses each student's learning style and progress and then generates personalised learning content that is tailored to each student's individual needs.

- **Prediction analysis in agriculture:** The web-based Africa Agriculture Watch (AAgWa) platform, which combines remotely sensed data and machine-learning techniques to improve information for farmers and policymakers, is starting to incorporate the use of AI. AAgWa was launched by Akademiya2063, a pan-African nonprofit research organisation, and helps predict agricultural yields in 47 African countries.

The AI promise for mobile operators

Mobile operators in the region have employed AI at different levels, from improving network operations and customer services to achieving efficiencies and cost savings.[5] As a result, several network infrastructure vendors are creating new AI-enabled products to make the technology more accessible and to drive larger-scale deployments, such as the following examples:

- **MTN** will migrate to **Microsoft's Azure's** cloud computing platform to tap into machine-learning and AI to deliver operational efficiency across the operator's footprint, starting with Nigeria and South Africa.

- In December 2022, **MTN Benin** and **Ericsson** entered into a partnership to deploy AI and machine-learning solutions to address throughput degradation and, ultimately, provide improved customer satisfaction.

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5.   ChatGPT and other advanced AI for operators: smarter and more personalised customer experience, GSMA Intelligence, 2023

2.3
# Towards a circular life for mobile phones

Sub-Saharan Africa will have a combined 1 billion active feature phone and smartphone connections by the end of 2023. This number is set to increase, with the addition of more than 200 million new devices expected by the end of 2027.[6] The growing number of devices is a significant concern in terms of growing e-waste and the higher consumption of natural resources within the region. To address this,

device ecosystem players in Sub-Saharan Africa are leveraging the circular economy concept in device manufacturing. Phones with longer lifetimes are being produced, in addition to the use of recyclable and recycled materials and renewable energy in the process. As a result, fewer devices are going to waste, allowing the industry to make progress in sustainable transformation.

Figure 17

Number of mobile connections in Sub-Saharan Africa

Million

● Basic/feature phone connections   ● Smartphone connections
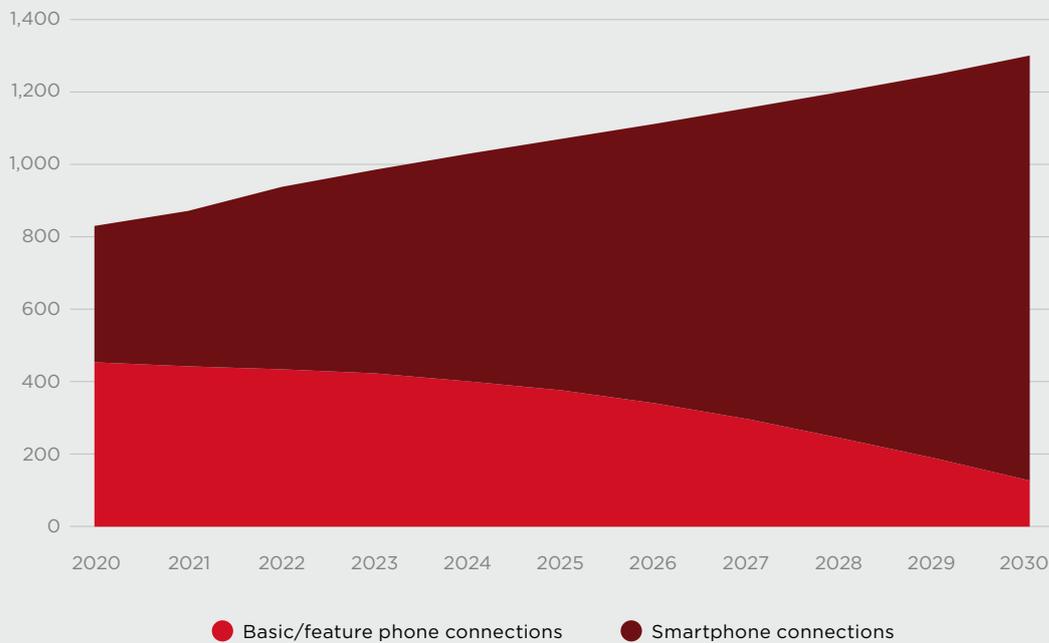
Note: Forecast for 2022 to 2030
Source: GSMA Intelligence

The technical lifespan of a mobile device is currently between four and seven years,[7] but the average use period of a mobile device is around three years.[8] This suggests that the biggest barrier to reducing waste is tied to consumer behaviour. As such, incentivising consumers will be crucial, though this could be complicated by a variety of factors affecting their choices, such as affordability, information availability, social norms and personal preferences.

Governments and industry players have a role to play here. For example, there is an opportunity to build new channels and suppliers to collect, refurbish and resell devices, as well as educate consumers and implement awareness campaigns on sustainability. Operators and other ecosystem players across Sub-Saharan Africa are already taking a lead in this regard, with initiatives to drive circularity in mobile phones and other digital devices.

6.   GSMA Intelligence
7.   Miliute-Plepiene, J. and Youhanan, L. (2019), E-waste and raw materials: from environmental issues to business models, IVL Swedish Environmental Research Institute.
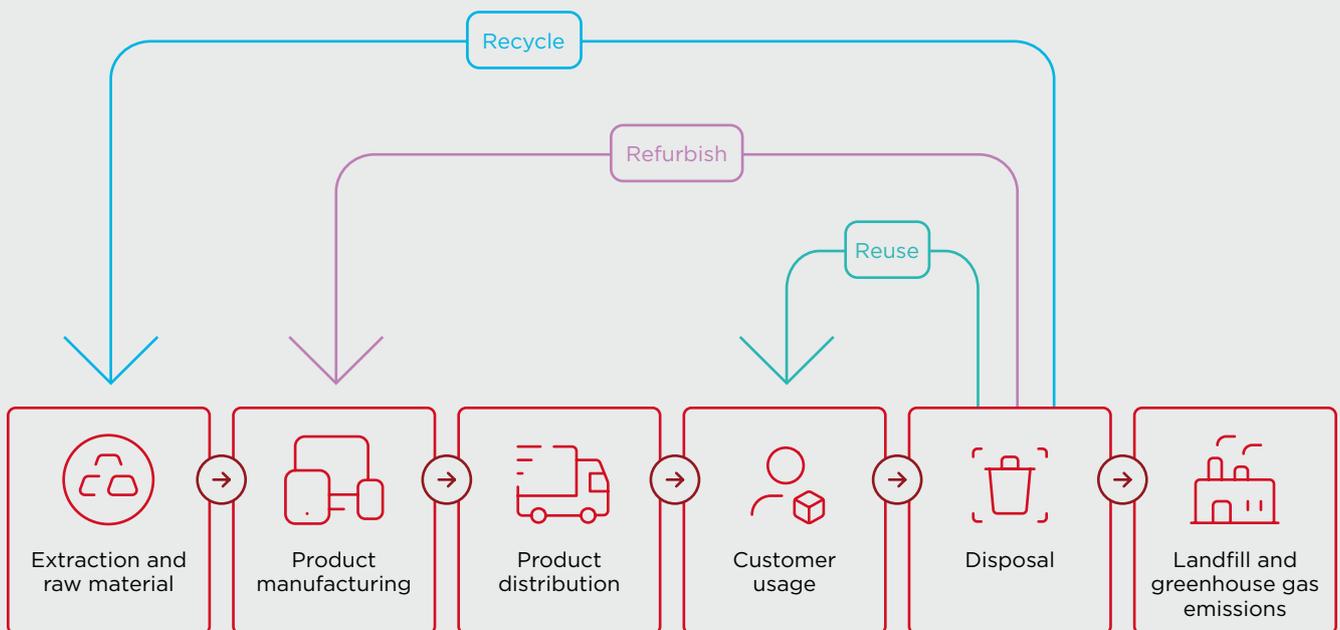8.   Statista

Potential for device reuse

Because of its accelerating rate of subscriber penetration compared to other regions, Sub-Saharan Africa is in a unique position and has greater potential when it comes to refurbishing used devices. Millions of unused devices can be refurbished and reused by those who cannot afford new handsets in the region. The affordability of phones, including smartphones, can simultaneously be addressed, improving the usage gap.

Figure 18

The concept of the circular economy

Recycle

Refurbish

Reuse

| Extraction and raw material | Product manufacturing | Product distribution | Customer usage | Disposal | Landfill and greenhouse gas emissions |

Source: GSMA

Initiatives to drive circularity

GSMA: tackling the problem of dormant phones in partnership with mobile operators

In June 2023, the GSMA teamed up with 12 mobile operators across the globe, including Safaricom, to take back and recycle or repair more than 5 billion unused mobile phones in an effort to tackle e-waste. The initiative builds on efforts by the mobile industry to move away from the traditional 'take-make-dispose' approach to the materials used in mobile phones and highlights the importance of working collectively to accelerate the transition to greater circularity.

In November 2022, the European Chemical Society identified 30 elements usually used in smartphones. Out of these, 11 were identified as elements with limited availability, which may cause risks to future supply, while the unsustainable usage of seven elements used in smartphones would pose a serious risk in the next 100 years. The GSMA estimates that a refurbished phone can have an 87% lower climate impact than a newly manufactured phone, and if properly recycled, 5 billion mobile phones could recover $8 billion worth of gold, palladium, silver, copper, rare earth elements and other critical minerals, and enough cobalt for 10 million electric car batteries.

Safaricom: over 10 years of experience in e-waste management

The e-waste management programme of Safaricom provides an end-of-life management solution for out-of-use devices, especially mobile phones. The allocated centre disassembles the gadgets by separating parts and recycles the locally recyclable materials. It sends the non-recyclable materials to partners outside of the country for safe end-of-life management. The programme was designed in partnership with the National Environment Management Authority and with endorsement of the Communication Authority of Kenya. The programme also aims to educate the public on the need for e-waste management and encourages wider participation from stakeholders in the e-waste management process.

Vodafone: a global partnership with the WWF supporting the goal to reach net zero

Vodafone recently announced a three-year programme to trade in, recycle, refurbish or repair smartphones across Europe and Africa while raising funds for the World Wide Fund for Nature (WWF). A £1 donation (or local equivalent) will be made to the WWF for each phone collected through the programme. Vodafone stated that the One Million Phones for the Planet programme will support the operator's goal to reduce its carbon emissions to net zero by 2040. Buying a refurbished smartphone could save roughly 50 kg of carbon dioxide equivalent (CO_2e), lowering the contribution to climate change by 87% over a newly manufactured device while also removing the need to extract 76.9 kg of raw materials. The scheme will help eliminate e-waste and create opportunities for the circular economy of mobile phones.

2.4
Addressing smartphone affordability

In Sub-Saharan Africa, around 60% of the population does not use mobile internet despite living in an area with coverage. Smartphone affordability is a key barrier to using mobile internet in the region. This is an area of growing concern, as reducing the internet usage gap is critical to closing the digital divide. For example, in Senegal, 61% of women and 46% of men who do not own a mobile phone reported that the lack of an affordable handset was the top reason.[9]

To help address the issue, operators and manufacturers have devised solutions targeting the cost of devices. The average selling price of smartphones has reduced significantly in recent years, with an influx of devices priced at under $100, mainly from Chinese brands, such as Tecno, Itel and Infinix. Alongside the availability of cheaper options, operators are increasingly partnering with device manufacturers to manage costs and offer financing plans to customers.

For example, European smartphone manufacturers, such as HMD Global, are attempting to grow their presence in Sub-Saharan Africa, as highlighted by recent moves to open assembly plants in the region. HMD Global, which uses the Nokia brand for its

devices, announced plans to assemble some of its phones in Kenya and plans to offer financing options for customers who want to buy the devices on credit with M-Kopa. In March 2023, HMD Global also launched the Nokia G60 5G, a mid-range 5G phone sold in partnership with Safaricom for KES53,000 ($397).

The challenge for manufacturers in Sub-Saharan Africa is to produce devices at a low enough price point to gain market share, particularly in the 5G and 4G markets, where devices remain prohibitively expensive for most regional consumers. Along with the manufacturing costs, other costs such as fees and taxation directly impact the final selling price. As per GSMA Intelligence research, taxation and duty fees add 10–30% to smartphone costs, depending on the country. To improve affordability, governments should reconsider these fees by offering tax exemptions on low-cost handsets, as is available in Rwanda. In addition to reducing the absolute cost of smartphones and supporting an individual's capacity to pay, providers also need to ensure that devices meet user's life needs and support users' willingness to pay.

> The challenge for manufacturers in Sub-Saharan Africa is to produce devices at a low enough price point to gain market share, particularly in the 5G and 4G markets, where devices remain prohibitively expensive for most regional consumers

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9. The Mobile Gender Gap Report 2023, GSMA 2023

Supply-and-demand factors

On the supply side, factors that impact costs include manufacturing, inbound and outbound supply chains, and business and manufacturer decisions about pricing. On the demand side, drivers include people's ability to pay and their value perception of the device to justify the expenditure, along with awareness levels, community norms and understanding of the total cost. Based on this, GSMA research identified three models for affordable smartphone ownership, as shown in Figure 19. Operators have been offering a range of initiatives across these three models, including launching device financing plans (subsidies, instalment payments), partnerships to improve access to smartphones (device and data plan schemes) and introducing entry-level smartphones.

For example, in July 2023, Bboxx, a data-driven super platform, and MTN Rwanda formed a strategic partnership to expand smartphone access and economic empowerment in Rwanda. Bboxx's pay-as-you-go service provides customers with a simpler and more accessible way to pay for their smartphones. It also provides financial education, helping users build credit worthiness. MTN Rwanda will provide SIM cards and starter data pack schemes along with smartphone access. The alliance leverages the operator's network and user base, while partners such as Bboxx support innovation and affordable smartphones to improve digital inclusion.

Mobile operators can continue to build such innovative partnerships to support industry efforts and design solutions to reduce one-off costs and provide instalment payment plans with third parties, especially for the population for whom smartphones are most unaffordable. At the same time, policymakers and regulators should continue to review and remove sector-specific taxes impacting costs and to consider subsidy programmes to help make handsets and data services more affordable.

Types of business models for affordable smartphone ownership

Asset financing models

Smartphones are made more affordable by spreading the total cost over time rather than one lump sum. Offered via finance from financial institutions, mobile operators or alternative credit providers.

Examples: Equitel Bank and Airtel in Kenya, Fenix and MTN in Uganda, and M-Kopa and operators in Tanzania, Uganda and Kenya.

Direct payment models

Total smartphone costs are lowered through highly efficient supply chains and/or device subsidies.

Examples: Phonetrader by Airtel in Kenya, Steppa by MTN in South Africa, Kilimall by Infinix and Safaricom in Kenya and Uganda, and Neon by Safaricom in Kenya.

Third-party payment models

The smartphone cost is subsidised or offset by a third party, such as governments, nonprofits or private companies.

Examples: Tigo and CELIAF's partnership to increase smartphone access for women.

Source: GSMA[10]

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10. [Webinar: Accelerating affordable smartphone ownership in emerging markets](), GSMA, 2019

2.5
Mobile connectivity propels the fintech industry

Sub-Saharan Africa's fintech industry has been bolstered by a surge in innovative solutions and growing funding and investments. Over 400 investors backed African fintech companies in the first three quarters of 2022.[11] With an influx of funding, increasing smartphone ownership, affordable connectivity and increasing supportive regulatory frameworks, the fintech market in Africa is set to grow exponentially.

The growth of fintech varies significantly across the region, with matured markets such as Kenya and South Africa leading the way, while countries such as Ghana and Nigeria have high potential.[12] With a rising shift towards digital lifestyles, regulatory initiatives continue to emerge in the region to support fintech solutions for financial inclusion. For example, Nigeria, Ghana and Uganda have introduced programmes to stimulate financial inclusion and increase digital cash transactions. The programme will encourage fintech stakeholders to innovate with new product offerings. Likewise, there are a number of regional initiatives, such as the Pan-African Payment and Settlement System, which supports instant cross-border payments in local currencies and expanded its operations in 2022. Such regional and national initiatives aid collaboration opportunities, encouraging the growth of digital payment networks. As a result, Africa's financial services market could grow by about 10% per annum until 2025, with payment and wallets among the fastest-growing products.

Opportunities for mobile operators

Beyond basic connectivity, mobile operators in the region have ventured into the fintech space by enhancing mobile money services, along with an increase in collaborations with fintech companies and financial institutions. For example, in early 2023, MTN and Mastercard announced a partnership to enable Mastercard's virtual cards to be linked with MTN's MoMo wallets. The partnership allows the expansion of their services by leveraging the networks of both companies. Similarly, in August 2023, Airtel Africa and Mastercard announced the launch of a new cross-border remittance service. The service will enable Airtel subscribers across 14 African markets to send and receive money safely and securely, with speed and certainty.

Digital payments remain the most widely available and adopted fintech service, driven by the demand for faster and lower-cost payment solutions from consumers and businesses. A range of digital payment solutions, including mobile wallets, app payment channels and QR codes, are becoming more prominent in the region. BNPL is another segment gaining traction. BNPL is a type of short-term financing that allows consumers to make purchases and pay for them in instalments, often interest-free, over a period. For example, Safaricom's Faraja in Kenya, launched in 2023, is a zero-interest credit service that allows its subscribers to pay later for in-store purchases for goods.

BNPL payments are also growing among startups and merchants. Faraja, for instance, enables business owners to grow their sales and businesses by allowing their customers to purchase at the point of need and then make payments later. Likewise, Spredda, a Nigerian online marketplace, offers its customers an option to pay in instalments after a 20% down payment. The BNPL model gives customers flexibility and more control over shopping and payments for online purchases. This translates to increased sales, lower cart abandonment rates and new customers for businesses.

The growing role of mobile financial services in Sub-Saharan Africa has been supported by an improved regulatory outlook, which is allowing further innovations. These regulatory developments have opened new avenues of growth for the fintech sector and present opportunities for mobile operators to expand services and generate additional revenue streams. By leveraging their existing infrastructure and customer data, operators can continue to create new value-added services for customers.

11. "Over 400 investors backed African FinTech companies in the first nine month of 2022", Fintech Global, December 2022
12. Fintech in Africa: The end of the beginning, McKinsey & Company, 2022

03

Mobile industry impact
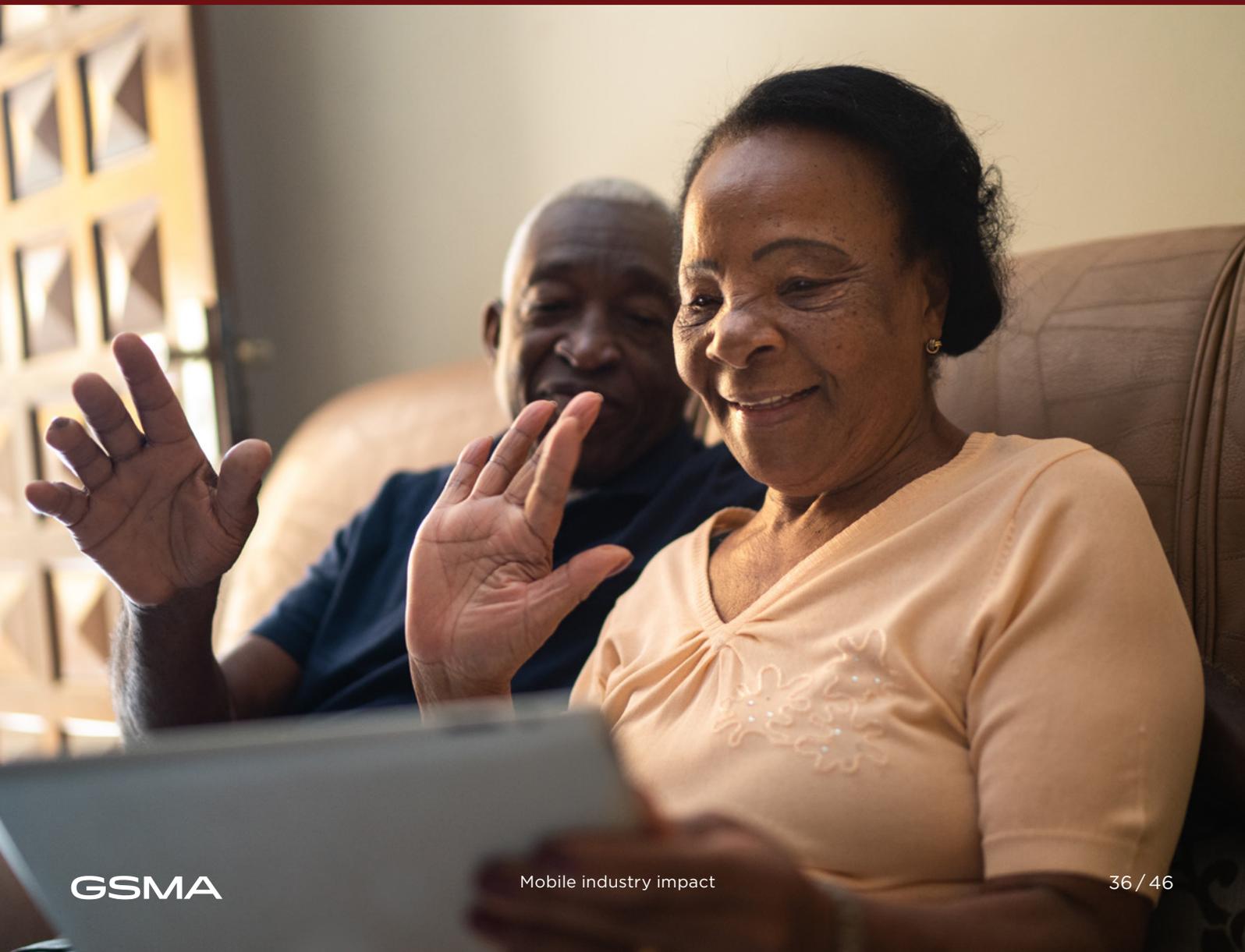
3.1
Operators explore new models to connect the unconnected

As of 2022, around 15% of the population in Sub-Saharan Africa is not covered by mobile broadband networks. Despite much progress, the coverage gap remains significant, especially in rural and remote areas. The lack of mobile broadband coverage in rural areas is primarily an economic challenge: costs can be prohibitive, revenues are lower and logistics are more complex. This has led operators to explore new infrastructure models through collaborations, such as MTN Uganda's turnkey solution with iSAT Africa under the GSMA Innovation Fund for Rural Connectivity. As part of the partnership, iSAT deployed five mobile network sites in rural areas of Uganda using concrete-less towers, solar power and an open radio access network (RAN) to provide 2G and 3G connectivity.[13] Such initiatives offer operators an opportunity to expand into uncovered areas while sharing the cost of infrastructure development, and the related responsibilities, and to utilise available resources.

Operators and infrastructure companies have also announced renewed commitments to improving connectivity in Sub-Saharan Africa. For example, Vodacom plans to invest $3.3 billion to upgrade network resilience, maintain connectivity and boost rural coverage in South Africa over the next five years (an increase of 20% on what it committed to in its last five-year plan in 2018). Meanwhile, Africa Mobile Networks revealed it has secured a $20 million loan package to build new base stations in rural areas.

Mobile operators have been innovating business models and improving coverage; however, the usage gap remains sizeable. More than half of the population in Sub-Saharan Africa do not utilise mobile internet despite living in an area with mobile internet coverage. The mobile industry has been taking steps to tackle the key issues restricting usage – specifically, lack of device affordability, digital skills and relevance, and safety concerns. This highlights the need for robust initiatives to improve coverage and for mobile adoption to close the digital divide.

Enhancing rural connectivity through collaboration

Solar-powered rural rollout in Benin

MTN Benin and Ericsson have teamed up to provide affordable and reliable mobile broadband services to remote rural areas in Benin that have limited or no connectivity. Ericsson will support the operator's planned rural coverage across 29 sites with its energy-efficient three-sector dual-band Radio 6626 and compact microwave radio MINI-LINK products. All the sites will run sustainably on 100% solar and battery power, reducing MTN's carbon footprint.

The partnership focuses on improving coverage while lowering carbon emissions and contributing to the digital economic development that will empower the local population in Benin.

Network-as-a-service (NaaS) model in Liberia

Orange and US-based RAN solutions provider Vanu will deploy 200 new sites in Liberia to improve rural coverage using an NaaS model. Vanu builds and maintain networks, and will build at least 200 2G, 3G and 4G towers for Orange Liberia. It will also deliver technology upgrades on behalf of operators as part of a revenue-sharing agreement.

Vanu has previously partnered with MTN in Sub-Saharan Africa. The partnership with Orange aligns with the operator's IDEAL programme, which aims to extend coverage to 20 million rural inhabitants in Africa through the construction of 5,000 sites by 2026.

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13. Accelerating Rural Connectivity: Insights from the GSMA Innovation Fund for Rural Connectivity, GSMA, 2022

3.2
Mobile's impact on the SDGs

In 2022, the mobile industry accelerated its impact on the Sustainable Development Goals (SDGs) in Sub-Saharan Africa, with improved mobile broadband and internet coverage and higher mobile penetration. The highest-scoring SDGs in the region were SDG 9: Industry, Innovation and Infrastructure,

SDG 11: Sustainable Cities and Communities and SDG 7: Affordable and Clean Energy. SDG 7 is also among the three most improved SDGs, alongside SDG 6: Clean Water and Sanitation and SDG 4: Quality Education.

Figure 20

Mobile's impact on the SDGs in Sub-Saharan Africa

Source: GSMA Intelligence

Digital advisory solutions accelerate transformation of the agriculture sector

Mobile technology contributes significantly to innovation and industrial development by serving as a critical infrastructure provider and increasing access to information. From the onset of the Covid-19 pandemic, digital agriculture tools have enabled smallholder farmers in Sub-Saharan Africa to continue receiving advisory services, acquire much-needed financing, receive farm inputs and identify new markets for their products. Since then, digital advisory solutions have provided smallholder farmers with the necessary information and are becoming a commonly accepted tool.

For example, Orange, in partnership with SNV (Netherlands Development Organisation), launched Garbal, a digital advisory service for pastoralists and smallholder farmers in Mali and Burkina Faso. Delivered through USSD and a call centre, the service provides instant access to reliable information on biomass availability and quality, surface water availability, herd concentration, and market prices for livestock and staple grains. Adoption of the digital-only service has continued to rise beyond the pandemic. Thus, the initiative is scaling up to build a viable bundled digital service in Mali based on the success of the last few years. This will involve geographic expansion and the launch of an online virtual market, which will increase access to agriculture and livestock inputs and include a digital inclusive finance solution.[14]

The transition to digital advisory solutions is likely to intensify as adoption grows in the agriculture sector and as new technologies are leveraged (such as sensors, mobile soil testing kits, drones and AI) to provide localised and tailored information.

Operators fuel smart city solutions

Mobile operators are enabling smart city solutions by providing connectivity and building new use cases through partnerships. The role of operators has evolved from being a connectivity and infrastructure provider to a smart city co-creator by utilising emerging technologies such as IoT, AI and cloud computing.

For example, Ethio Telecom, in partnership with the Addis Ababa city administration in Ethiopia, will install a wide area network (SD-WAN network) to interconnect different bureaus and service-rendering institutions of the city with the main data centre. The project will address the growing technology demands of digital transformation and data security concerns of the city administration, interconnecting the sub-cities and woredas (administrative divisions of Ethiopia) with higher-speed and greater-bandwidth optical services. This will strengthen administrative capacity to address the growing needs of its citizens.

While co-creating smart city solutions, mobile operators have been playing a pivotal role within the IoT ecosystem, contributing significantly to various applications in the utility sectors, including digital meters and monitoring and managing resources such as water and treatment plants. In Sub-Saharan Africa, smart utility IoT connections will increase almost sixfold between 2021 and 2030, as highlighted by GSMA research.[15] By 2030, utility solutions will account for nearly 30% of IoT connections in the region. Operators have been collaborating in trials using IoT solutions, with many leveraging the available low-power wide-area network (LPWA) networks.

In Kenya, for instance, Safaricom's NB-IoT network has been used for smart meter pilots in Kisumu, Embu and Eldoret, among other cities, and has led to an IoT product line for water. In addition, Safaricom has partnered with Kenya Water Institute to deploy a smart water system that uses IoT to manage production, distribution and consumption at the institute's campuses. The smart water system will be used to facilitate practical training and to co-create and run a smart water management curriculum for students at the institution.

Such partnerships encourage the use of technology and education to drive sustainable water practices and conservation and drives SDG 6, aiming for the provision of clean water and sanitation for all.

14. https://www.snv.org/project/stamp-building-success
15. IoT and Essential Utility Services: Opportunities in low- and middle income countries, GSMA, 2023

04

Policies for safe and inclusive digital development

The growing use of emerging technologies and accelerating digital transformation highlight the importance of digital technologies in everyday life. At the same time, the continued rollout of 4G and building momentum for 5G have enabled innovative solutions in the region, especially in essential areas such as healthcare, climate action and smart city infrastructure. To encourage these initiatives to drive socioeconomic growth, appropriate policy measures are required to support network investments for connectivity, consumer safety and the affordability of digital services.

4.1
Improving online safety

African economies have the potential for rapid growth and development due to increased consumption and adoption of digital services and the emergence of new technologies. However, Africa's rapid technological evolution makes the region an attractive target for fraud and cyberattacks. Understanding, mapping and mitigating these existing and upcoming security threats in an objective, speedy and effective manner have become essential.

As cybersecurity threats continue to grow in scale and scope, governments face increasing pressure to protect their citizens and critical infrastructure and to establish a framework for the mobile industry to mitigate the threat. Some countries already have comprehensive cybersecurity laws in place, including:

- **Eswatini** (Computer Crime and Cybercrime Act 2022)
- **Ghana** (Cybersecurity Act 2020)
- **South Africa** (Cybercrimes Act 19 of 2020)
- **Kenya** (Computer Misuse and Cybercrimes Act 2018).
- **Nigeria** (Cybercrime Act 2015)
- **Tanzania** (Cybercrimes Act 2015)
- **DRC** (Digital Code (which includes laws on data protection and cybersecurity))

A study by the ITU, conducted in 2020[16] through a survey of 54 African nations, found that:

- 35% (19 nations) have in place a reliable cybersecurity (incident and emergency) response team
- 54% (29 nations) have passed cybercrime legal frameworks.

Over the coming years, there will likely be an increased prevalence of legislative policies to promote cybersecurity related to critical infrastructure and supply chains. Similar activities are continuing at a pan-African level, with the African Union still aiming to deliver on a set of aspirations through its Agenda 2063.[17] In 2022, it published a data policy framework[18] examining international, regional and legislative trends and making recommendations on cybersecurity. The Convention on Cyber Security and Personal Data Protection[19] (the Malabo Convention) is the pan-African instrument for data protection and cybersecurity, adopted by the African Union in 2014. It sets out a comprehensive legal framework for data protection, cybercrime and cybersecurity. 15 African Union member states have ratified the Malabo Convention, which came into force in June 2023.

The ratification of the Malabo Convention and the transposition of its framework to national laws provide a structured and harmonised approach to addressing cybersecurity threats. It is necessary to reduce online trade barriers and accelerate digital trade implementation under the Africa Continental Free Trade Agreement. The Convention criminalises a wide range of cyber activities, including hacking, cyberfraud and identity theft. It also establishes procedures for investigating and prosecuting cybercrime and emphasises the need for international cooperation between African countries.

16. "Are African countries doing enough to ensure cybersecurity and Internet safety?", ITU, September 2021
17. https://au.int/agenda2063
18. AU Data Policy Framework, African Union, 2022
19. African Union Convention on Cyber Security and Personal Data Protection

The Budapest Convention on Cybercrime was the first international treaty on crimes committed via the internet and other computer networks, dealing with various crimes, including network security violations. However, various challenges in securing the mobile ecosystem still exist today. These include the wide range of security requirements, the risk of a fragmented ecosystem and isolated initiatives that introduce complexity and don't improve security. Consequently, Africa needs to pursue a common cybersecurity policy to protect society against cybercrime by adopting appropriate legislation and fostering international cooperation. South Africa was an original signatory to the Convention of Cybercrime in 2001, with subsequent ratifications from Cabo Verde, Ghana, Mauritius, Nigeria and Senegal.

Financial services and mobile money are at high risk of cyberthreats in the region. For example, Kenya (which is ranked 51 out of 182 countries on the UN ITU's Cybersecurity Commitment Index)[20] experienced a distributed denial-of-service cyberattack in July 2023.[21] Cyberattacks can target individuals as well as the technology infrastructure. These types of attacks, commonly known as 'social engineering', take advantage of a consumer's trust and their lack of awareness of cyberthreats. The GSMA's Mobile Telecommunications Security Landscape 2023 report[22] details the different types of security threats.

A separate GSMA cybersecurity report[23] explains why a holistic approach involving people, processes and technology is needed to address threats. There are also risk-based cybersecurity approaches that countries such as Kenya and Nigeria have implemented, showing that self-regulation through industry initiatives such as the Mobile Money Certification[24] are also an option to safeguard consumer trust.

Overall, cybercrime has become one of the greatest challenges of the digital age. The ubiquity of technology has intensified the risk of cyberattacks, and the rise of innovative and disruptive technologies in the digital economy has heightened the need for trust and stability. All over the world, policymakers, regulators and industry players are grappling with how to curb this growing risk. Addressing this requires a holistic approach covering people, processes and technology. Below are recommendations that should be put in place to maintain much-needed trust and confidence in the digital space:

- **Develop and review cybersecurity laws:** Governments should develop or continuously review existing laws that govern cybersecurity. At a national level, the adoption of appropriate legislation on the misuse of technology for criminal or other purposes, and activities intended to damage the integrity of critical national infrastructure, are vital. Legislation should also support the coordinated action of government authorities, the private sector and citizens to prevent, prepare for, respond to and recover from cybercrime incidents.

- **Create an independent cybersecurity authority:** An independent authority must be established to implement a structured framework for monitoring, detecting and responding to cybersecurity threats.

- **Build user awareness:** As more people access online services, it is essential to create awareness on safe behaviours online to build their confidence in the digital space.

- **Train cybersecurity experts:** Regular training for cybersecurity experts should be conducted to develop their skills and address the current skills gap, driven by the evolving nature of cybersecurity threats.

20. Global Cybersecurity Index 2020, ITU, 2023
21. "Kenya cyber-attack: Why is eCitizen down?", BBC, July 2023
22. Mobile Telecommunications Security Landscape 2023, GSMA, 2023
23. Cybersecurity: A governance framework for mobile money providers, GSMA, 2019
24. https://www.gsma.com/mobilefordevelopment/mobile-money/certification/

4.2
Spectrum policy for inclusive digital development

Spectrum availability and effective licensing continue to be important to improve connectivity. Governments and regulators in the region should therefore adopt forward-looking spectrum management policies.

Such policies include:

- creating a spectrum roadmap

- ensuring access to mid-band spectrum, in particular 3.5 GHz, given its importance to the future of 5G

- accelerating access to sub-1 GHz spectrum to provide widespread rural mobile broadband services.

Spectrum management

Effective spectrum licensing,[25] from roadmap to assignment, is 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. Spectrum policy also has an important role in the net-zero race.[26] Successful policies can help reduce carbon emissions from the mobile ecosystem and advance mobile connectivity, increasing the enabling effect on emission-saving use cases for other sectors.

At its core, a spectrum licensing framework should:

- ensure access to sufficient spectrum for operators

- provide predictability to support the new network investment needed

- provide clear procedures for spectrum renewals, well in advance of the end of the licence tenure

- avoid costly restrictions on the use of spectrum beyond those needed to manage interference.

Spectrum roadmaps

A spectrum roadmap[27] is essential to ensure there is enough spectrum to meet surging demand for mobile services in both the short and long terms. Roadmaps help governments forecast future trends and manage their work. For mobile operators, roadmaps mean increased certainty to invest based on the government's future allocation, renewal plans and radio spectrum management.

Key themes for a spectrum roadmap should include:

- identifying emerging opportunities and challenges to a radio spectrum framework at least three to five years in advance

- determining future technological trends and drivers, and assessing their impact on spectrum policy and planning

- planning spectrum management programmes to address challenges and maximise opportunities

- creating a plan to regularly review and update the roadmap, with an annual review recommended.

25. Best Practice in Mobile Spectrum Licensing, GSMA, 2022
26. Spectrum: the Climate Connection, GSMA, 2023
27. Roadmaps for 5G Spectrum: Sub-Saharan Africa, GSMA, 2021

Technology neutrality

Technology-neutral spectrum licensing is a key enabler of legacy network shutdowns and is widely recognised as best practice when assigning spectrum to mobile operators. It enables mobile operators to refarm spectrum used for 2G or 3G to 4G and 5G at a pace that is driven by market demand. Experience shows it is possible to 'gracefully refarm' bands without leaving any users behind.

Implementing technology-neutral spectrum licensing maximises spectral efficiency and allows users to benefit from faster rollouts of 4G and 5G. It can lead to the delivery of better mobile broadband coverage and higher data speeds by allowing operators to upgrade technologies promptly.

Spectrum pricing

High spectrum prices continue to hinder the rollout of mobile services. However, for countries willing to take a different approach, sufficient spectrum bandwidth assigned at reasonable prices is strongly linked to greater population coverage, better download speeds and increased service adoption. The main

goal of governments around the world should be to get the most out of mobile spectrum resources. The GSMA has developed 10 positions on the importance of fair spectrum pricing to support the effective management of spectrum resources.[28]

Low-band spectrum

Low-band spectrum is a driver of digital equality, helping to reduce the gap between urban and rural areas and delivering affordable connectivity. Without sufficient low-band spectrum, countries in Sub-Saharan Africa will struggle to address the digital divide and those living in rural areas may be excluded from the latest digital technologies. There are plenty of rewards for countries that prioritise access to more low-band spectrum for mobile. For example, adding 600 MHz to existing low bands raises download speeds by 30–50% in rural areas.[29]

There are also economic benefits. Through early adopters in the region, low-band 5G is expected to bring benefits of almost $3 billion to the economy of Sub-Saharan Africa, or around 0.08% of GDP in 2030.[30] While 5G penetration in the region is expected to continue to increase well into the 2030s, its relative impact will already be similar to the impact in Europe and North America by 2030, paving the way for Sub-Saharan Africa to realise even greater benefits from low-band 5G going into the next decade.

Low-band 5G applications will mostly benefit the mining and retail industries, reflecting the level of economic activity driven by these sectors. The wide area coverage enabled by low bands will be particularly important in driving the digital transformation of the agricultural sector, with IoT applications for smart farming and agriculture.

> Through early adopters in the region, low-band 5G is expected to bring benefits of almost $3 billion to the economy of Sub-Saharan Africa

28. Spectrum Pricing: GSMA Public Policy Position, GSMA 2021
29. Vision 2030: Low-Band Spectrum for 5G, GSMA 2022
30. The Socio-Economic Benefits of Low-Band 5G Spectrum, GSMA, 2023

Mid-band spectrum

Mid-band spectrum, particularly 3.5 GHz, is important for the future of 5G because it offers city-wide coverage and capacity. In the short term, operators should have access to 100 MHz of contiguous spectrum in this band.

Meeting long-term mid-band spectrum demand requires forward planning from policymakers. GSMA analysis shows that a total of 2 GHz of mid-band spectrum, on average, will be required to support the growth of 5G during the 2025–2030 time frame.[31] 5G growth in Sub-Saharan Africa is expected to develop rapidly in the second half of the decade and continue into the 2030s. The economic impact of mid-band 5G in the region will be around 0.4% of GDP in 2030, while the overall GDP impact of mid-band 5G in Sub-Saharan Africa in 2030 will be $13 billion.[32]

As policymakers look to the future, the 6 GHz band offers significant potential:[33]

- 6 GHz will be crucial in supporting the 2 GHz of mid-band spectrum required, on average, by 2030.

- 6 GHz capacity will be required to meet increasing customer demand at the required speeds of ITU IMT-2020.

- Mobile networks are already highly densified, but 6 GHz can enable the growth of sustainable 5G capacity on existing sites.

- Timely availability of 6 GHz, at reasonable conditions and price, will drive cost-efficient network deployment, help lower the broadband usage gap and support digital inclusion.

The 6 GHz band is already supported by the African Telecommunications Union (ATU) in the run-up to WRC-23. Discussions regarding the band's future need to focus on maximising speeds and increased service adoption.

WRC-23: mobile spectrum for Africa's future

WRC-23, held under the auspices of the ITU, is an opportunity to increase digital equality, widen harmonisation and provide a clear roadmap to address future spectrum capacity needs. The futures of low-band and mid-band spectrum are both on the agenda at WRC-23.

For mid-bands, there is an opportunity to expand the harmonisation of 3.3–3.8 GHz, 4.80–4.99 GHz and 6 GHz at WRC-23.

Access to more low-band spectrum (470–694 MHz) is on the WRC-23 agenda for countries in Europe, the Middle East and Africa, which can widen harmonisation of the existing equipment ecosystem. Because of Africa's high percentage of rural populations and vast geography, low bands form a critical part of the region's digital future and can ensure that 5G delivers benefits for all consumers.

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31. Vision 2030: Insights for Mid-band Spectrum Needs, GSMA, 2021
32. 5G gets boost in Kenya with successful spectrum assignment, GSMA, 2022
33. 6 GHz in the 5G Era, GSMA, 2022

GSMA Head Office
1 Angel Lane
London
EC4R 3AB
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601