chapter 1 State of the Market

The cloud of uncertainty that covered Africa's telecom space as result of the Covid-19 pandemic, along with other ongoing political situations, left the continent in a state of flux over the past 18 months. Now, as we (hopefully) begin to emerge from the other side, analysts, researchers and other writers have compiled a raft of content that updates us on the current state of the market.

The International Telecommunication Union (ITU) is the United Nations specialised agency for information and communication technologies – ICTs.

It prides itself on a commitment to connecting all the world's people – wherever they live and whatever their means. Through our work, we protect and support everyone's right to communicate.

ITU Regional Office for Africa frequently publishes reports on the region - two of which we have sampled below.

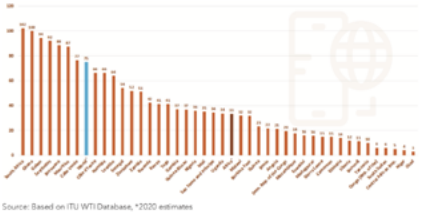
Digital trends in Africa 2021

Mobile market developments

The African mobile market is very diverse, with mobile cellular subscriptions far in excess of 100 per 100 inhabitants in 12 out of 44 countries, namely Seychelles, South Africa, Botswana, Mauritius, Côte d'Ivoire, Gambia, Gabon, Ghana, Mali, Namibia, Senegal, Cabo Verde and Kenya. Twenty countries have subscription rates per 100 inhabitants below the African average of 82.3, while 12 other countries have less than 50 subscriptions per 100 inhabitants (Figure 4). In

Source: Based on the ITU WTI Database, December 2020 edition

Figure 4: Mobile cellular subscriptions, African countries, 2019 and CAGR (%), 2015-2019



Source: Based on ITU WTI Database, *2020 estimates

Figure 5: Active mobile broadband subscriptions per 100 inhabitants, 42 African countries, 2019

most countries, mobile cellular subscription rates have increased over the time-period 2015-2019 (see CAGR in Figure 4).

African active mobile broadband subscriptions per 100 inhabitants reached 33.1 in 2019, trailing far behind the world average of 75 per 100 inhabitants. While just over one sixth of countries in the Africa region, including South Africa, Ghana, Gabon, Seychelles, Botswana, Mauritius and Cabo Verde, had active mobile broadband subscription rates per 100 inhabitants above the world average, almost half of all countries for which data were available had subscription rates below the African average of 33.1 per 100 inhabitants (Figure 5).

Fixed broadband market

Compared with other regions, Africa has one of the lowest fixed broadband subscription rates, given the absence of legacy infrastructure and the relatively lower costs of deploying wireless broadband infrastructure. ITU estimated a fixed broadband subscription rate of 0.5 per 100 inhabitants for Africa in 2020, a figure that is well below the global average of 15.2 subscriptions per 100 inhabitants. Yet fixed broadband subscriptions per 100 inhabitants have increased across most countries for which data were available. Within the region, two-thirds of the countries slightly increased their fixed broadband subscription rates in the period 2018-2019. Just under one-third of countries show declining subscription rates for the same period. Seychelles and Mauritius are two significant outliers, with fixed broadband subscription rates per 100 inhabitants well above the world average, recording sizable increases for the period 2018-2019 (Figure 6).

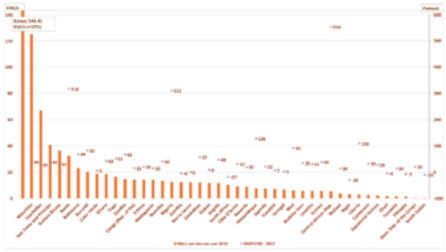
The availability of international bandwidth continues to be an important area for policy and investment, especially given the rising amount of data-intensive applications, cloud-based services and the increasing numbers of Internet users desiring better international connectivity. The Africa region is lagging far behind other regions with regard to international bandwidth at the aggregate and individual levels. Although the total international bandwidth across the region has more than doubled over the last four years from 5 Tbit/s in 2017 to 11 Tbit/s in 2020, it represents only 1.5% of the total world international bandwidth. At the individual user level, there were 30.8 kbit/s per Internet user in the Africa region in 2019, compared with 131.3 kbit/s per Internet user globally (see Box 1 for an overview of international capacity in the Africa region).

At the country level, international bandwidth per Internet user has increased across almost all the countries in the region, where data were available. Kenya had the highest international bandwidth per Internet user, with 566.41 kbit/s and a CAGR of 52% for the period 2015- 2019. Just over one-third of the countries shown in Figure 7 had CAGRs in excess of 40%, including Sao Tome and Principe, Benin, Botswana, Burundi, Ghana, Togo, Zambia, Namibia, Nigeria, Zimbabwe, Angola, Mozambique, Mali, the Central African Republic and Liberia.

Over the same period, just under one-third of countries grew their international bandwidth per

Source: ITU, based on ITU WTI Database

Figure 6: Fixed broadband subscriptions per 100 inhabitants, Africa region, 2019



Source: ITU, based on the ITU WTI Database

Figure 7: International bandwidth in selected African countries in kbit/s per Internet user, 2019 and CAGR (%) for the period 2015-2019

Internet user between 20 and 40%. Few countries, including South Sudan, Ethiopia, Niger, Senegal, Eswatini, South Africa, Gabon, Sierra Leone, Gambia and Cabo Verde (Figure 7) experienced small or no growth (CAGR below 10% or negative).

International capacity in the Africa region

To ensure that the Africa region, as one of the most important future global growth markets, is embracing digital transformation and that it has adequate connectivity, expanding international connectivity via submarine cables, international fibre and satellite is key. The figure below shows that by the end of 2019, 28 African ITU Member States had, at least, one submarine cable landing(1). Fifteen ITU Member States in the region are landlocked and have to rely on either satellite or international fibre link capacity. The figure also shows that approximately 45% of Africa's population is more than 10 km away from fibre network infrastructure.(2)

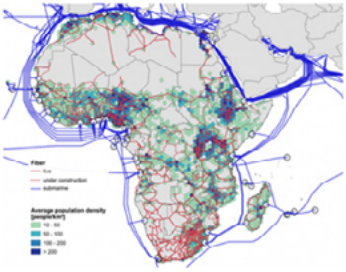
Satellite broadband connectivity offers a good alternative, with the possibility to provide coverage everywhere, including the remote parts of the region. It therefore may offer an effective means to close the digital divide and address remaining connectivity gaps. While progress has been made, challenges persist with regard to the cost of infrastructure.(3) ITU data for satellite broadband subscriptions (4) were only available for 19 countries, with the biggest markets including Tanzania, Zimbabwe, Nigeria, South Africa and Kenya.

Internet access, use, skills and gender

ITU estimated that 14.3% of households in the Africa region had Internet access in 2019, compared with 57.4% globally. The proportion of individuals using the Internet in 2019 totalled 28.6% in Africa10 and 51.4% globally (Figure 8), highlighting the need to bring more people in Africa online.

ITU data show that the%age of individuals using the Internet greatly varies across the Africa region (Figure 9). In four countries, namely Mauritius, Cabo Verde, Seychelles and South Africa, the proportion of individual Internet users (for the most recent year) was above the world average of 51.4%. In most countries, individual Internet use is below 30 per cent (Figure 9).

According to GSMA, lack of infrastructure is not the main reason for the relatively low numbers of individuals using the Internet. The much bigger



1 submarine cable	2 submarine cables	3 submarine cables	4 submarine cables	5 submarine cables	6 submarine cables	11 submarine cables
Republic of Congo	Benin	Cape Verde	Angola	Ghana	Nigeria	South Africa
Togo	Equatorial Guinea	Libya	Senegal		Kenya	
Liberia	Gabon	Tanzania	Côte d'Ivoire		Cameroon	
Sierra Leone	Dem. Rep. of the Congo		Mauritius			
Guinea	Namibia		Madagascar			
Guinea-Bissau	Mozambique					
Gambia	Seychelles					
Sao Tome and Principe	Comoros					

gap is associated with individuals living in areas covered by a mobile network, but not using the Internet. At the end of 2019, 272 million people were connected to the mobile Internet across sub-Saharan Africa, while 800 million were still offline, mainly because of the high cost of smartphones, relative to average income levels, and limited digital skills among rural and less literate populations.(11) In addition, the Alliance of Affordable Internet (A4AI) has identified lack of quality of access, which it has termed "meaningful connectivity" (12), as one key reason why people are not using the Internet. While the GSMA Mobile Connectivity Index shows that infrastructure has seen the biggest improvement in sub-Saharan Africa, alongside modest increases across all other categories over the period 2016-2019 (Figure 10), more needs to be done to ensure that access to meaningful connectivity can be achieved to close the usage gap.

Michael Minges,
ITU expert

Connectivity in the Least Developed Countries: Status report 2021

Mobile phones and rapid Covid-19 surveys

National household surveys in most LDCs are generally carried out face-to-face. Covid-19 has had a major impact on household and individual surveys, due to the need to socially distance and self-quarantine. Many development partners want to know about the impact of Covid-19 and the kinds of emergency interventions that might be needed. Most developed countries use telephone surveys, due to the prevalence of mobile phones. This has now spread to developing nations, given that many have reached a high level of cellphone ownership. Rapid surveys using calls

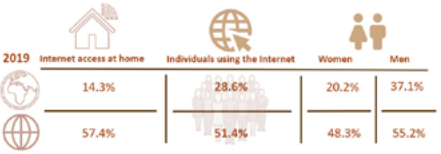


Figure 8: Household access, individuals using the Internet, total and by gender, Africa region and the world

to respondents with mobile telephones have emerged to meet this need. Rapid surveys have been carried out in LDCs such as Afghanistan and Myanmar (World Bank, 2020). A roster of mobile telephone numbers in the country is used, with random calls made to a subset of the numbers. One drawback is that, while mobile telephone ownership may be high, it is not universal, and therefore some people will be left out. These are likely the most vulnerable, lacking the income to own and pay for mobile services, or out of 2G coverage range. However, the rapid surveys do not adjust for this or indicate what proportion of the population they believe they are covering.

Basic mobile networks have enhanced economic and social welfare in LDCs in many areas, particularly banking, agriculture and health. Mobile money reduces transaction costs, increases privacy and reduces the risk of theft, among other benefits (Hamdan, 2019). Financial inclusion has expanded among many LDCs, due to mobile money. According to the World Bank's Financial Inclusion (Findex) survey, the LDC country average of those 15 years of age and older with a mobile money account almost tripled between 2011 and 2017 (the last available survey), from 7% to 19%. Mobile money transactions have expanded rapidly due to Covid-19. For instance, in Rwanda, mobile money transactions increased by 85% in 2020, due to measures taken to encourage digital payments and slow down progression of the Covid-19 pandemic (MTN Rwanda, 2021). Mobile money

PROVIDING
HIGH QUALITY BROADCAST, TELECOMMUNICATION AND TELEPORT SERVICES

With expanded capacity at MENA hotspot of 25.5°E/26°E, state-of-the-art Teleport, and a wide network connectivity, Es'hailSat supports broadcast and telecommunications services across the Middle East, North Africa and beyond

Es'hailSat سهيل سات
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

Space to deliver your vision

www.eshailsat.qa

services have additionally opened up innovative ways to transfer cash and pay for products. Development agencies can make conditional cash transfers to mobile money accounts, saving costs and increasing security (Aker and others, 2016). Mobile money is also facilitating the deployment of off-grid solar energy, by allowing users to make micropayments for repaying the solar panel (McKibben, 2017).

In agriculture, mobile phones have had an impact in LDCs by reducing information asymmetries. For instance, in Niger, grain traders use them to check price information, improving consumer and trader welfare (Aker, 2010). An SMS alert system in Bangladesh has reduced diseases among poultry farmers (FAO, 2017).

Health is another area where mobile services have had a significant development impact, notably during the Covid-19 pandemic, where many telecom operators have waived fees for access to health information, and health officials have used mobile networks to spread safety messages (WHO, 2020). Mobile networks are also being used to remind people to take medication, such as in Senegal, where people with diabetes are sent text messages (Wargny and others, 2018). Mobile call records can be aggregated to estimate the spread of diseases and identify population movement after natural disasters such as earthquakes. This helps with relief efforts and distribution of cash to affected populations. Call records have been used in Haiti and the Republic of Nepal to follow population movement during earthquakes, and in Sierra Leone during the Ebola outbreak (Maxmen, 2019).

What the most successful mobile services and applications have in common is that they are basic, often using voice or SMS services, affordable, easy to use, require little bandwidth, and work with feature phones and over the 2G network. Although the Internet can be accessed over 2G networks, it is at narrowband speeds (less than 256 kbps). It also requires an Internet-enabled phone. However – given the relatively high coverage of 2G networks and fairly widespread diffusion of basic mobile phones, combined with useful services, ranging from mobile money to health – many people in LDCs may not feel a critical need to move to broadband services.

Percentage of households with a mobile telephone

Country	Survey	Total	Urban	Rural	Location Parity Index score
Afghanistan	2015 DHS	87	94	85	0.91
Angola	2015-2016 DHS	63	83	31	0.38
Bangladesh	2017-2018 DHS	94	97	94	0.97
Benin	2017-2018 DHS	84	89	80	0.90
Bhutan	2017 Census	97			
Burkina Faso	2017-2018 MIS	94	99	92	0.93
Burundi	2016-2017 DHS	47	83	43	0.51
Cambodia	2019-2020 CSES	93	95	91	0.96
Central African Rep.	2019 MICS	36	74	18	0.24
Chad	2019 MICS	71	89	67	0.75
Dem. Rep. of the Congo	2018 MICS	52	84	30	0.35
Ethiopia	2019 DHS	68	87	59	0.68
Gambia	2018 MICS	98	99	97	0.97
Guinea	2018 DHS	89	97	85	0.87
Guinea-Bissau	2018-2019 MICS	94	98	92	0.94
Haiti	2016-2017 DHS	76	90	67	0.74
Kiribati	2021 MICS	73	85	62	0.73
Lao P.D.R.	2017 LSIS	92	98	89	0.91
Lesotho	2018 MICS	92	97	88	0.90
Liberia	2019-2020 DHS	70	84	50	0.59
Madagascar	2016 MIS	34	73	29	0.40
Malawi	2017 DHS	51	84	44	0.52
Mali	2018 DHS	89	96	87	0.90
Mozambique	2018 MIS	63	84	53	0.63
Myanmar	2017 MLCS	82	93	77	0.82
Nepal (Republic of)	2020 MICS	96	97	94	0.97
Niger	2018 ENTIC	79			
Rwanda	2017 MIS	63	88	56	0.64
Sao Tome and Principe	2019 MICS	87	89	83	0.93
Senegal	2019 DHS	97	99	95	0.96
Sierra Leone	2019 DHS	73	93	58	0.62
Tanzania	2017 MIS	82	93	76	0.81
Timor-Leste	2016 DHS	84	96	81	0.84
Togo	2017 MIS	84	95	76	0.80
Uganda	2018-2019 MIS	77	90	72	0.80
Zambia	2018 DHS	74	90	62	0.69
Average		**78**	**91**	**70**	**0.76**
Median		**82**	**92**	**76**	**0.81**

Note: Location Parity Index = Rural households with a mobile phone/urban households with a mobile phone. CSES= Cambodia Socio-Economic Survey, LSIS = Lao Social Indicator Survey, MLCS= Myanmar Living Conditions Survey, MIS = Malaria Indicator Survey and ENTIC = Enquête Nationale sur L'accès et L'utilisation des TIC.
Source: DHS, MICS and national surveys.

Alan Hadden,
Telecoms consultant

Approximately every 10 years a new mobile technology is introduced. The first generation (1G) comprised several incompatible analogue systems for voice. 2G marked a step change with the commercial introduction of GSM from 1991, a digital system developed as a harmonised mobile voice and messaging system in a common spectrum band (900 MHz) initially for Europe's "single market". Its attractive features, performance and scale subsequently led to mass adoption by markets globally.

Global systems need global standards. Cooperation across industry intensified to bring together regional and national standards bodies and stakeholders in major market sectors under the umbrella of a newly formed cooperative organisation, 3GPP. Each generation of mobile technology represents an evolutionary step. 3GPP took over maintenance of the 2G/GSM specifications that formed the basis for 3G development. 3G (WCDMA·HSPA) from the early 2000s brought new features and capabilities including enhanced data rates that built on, and were backwards-compatible with, earlier 2G/GSM systems. 3GPP later instigated development of specifications for the 4th generation of mobile, specifying LTE and LTE-Advanced systems, followed by 5G.

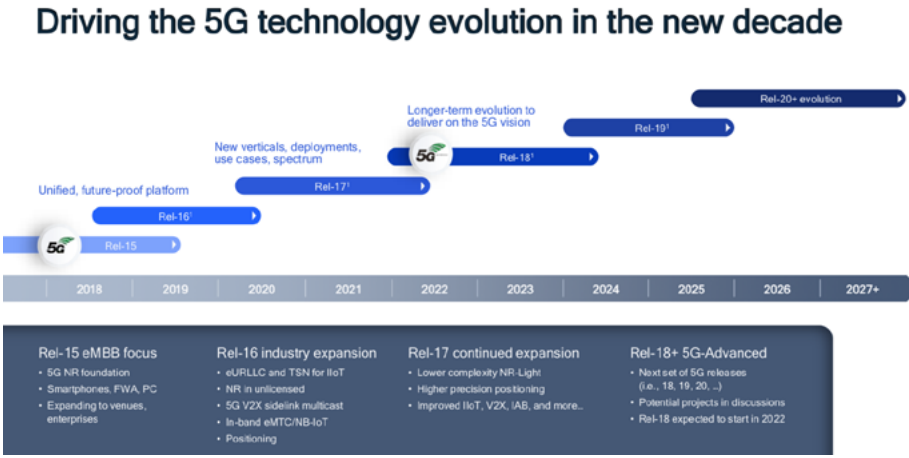
4G/Long Term evolution (and LTE-Advanced) is an evolution of 3G systems, 5G is an evolution from 4G, and so on. Each generation delivers increased scale, capabilities, economies, efficiencies, potential for enhanced and new services, and revenue growth. 5G will achieve the same, critically addressing new markets with new service and business models, not only for consumers but increasingly to support the needs of enterprises and business users in new vertical industries. This harmonized and evolutionary approach to mobile systems development is as important for operators in Africa as elsewhere, who benefit from massive global economies of scale, vast technology developments and service experiences, multi-vendor sourcing programs, global ecosystems, and more. It also means operators can deploy 4G/LTE systems and expand coverage, obtain spectrum etc. knowing that investments are safe and future proof as the basis for introducing 5G systems when the timing and conditions are right for them in their market.

Looking to the future, and following this well-proven model, detailed discussions have begun on "6G" in anticipation of its market introduction in the 2030s. Operators and other stakeholders in Africa should follow and participate in the international discussions about 6G to ensure the specifications are fully inclusive of their needs.

The results of 3GPP's work are submitted for review and adoption to the ITU, which plays a leading international role in managing radio spectrum and developing standards for mobile cellular systems, to ensure stable international regulations, sufficient and harmonized spectrum availability, as well as internationally agreed Sustainable Development Goals.

Currently 4G/LTE (including LTE-Advanced) is the key cellular platform globally for data and broadband connectivity, revenues and growth. Many 3G systems and some 2G/GSM systems in all regions are being retired and their spectrum refarmed for use by more efficient and feature-rich 4G and early 5G systems.

The International Telecommunication Union (ITU) defines the following main usage scenarios for 5G systems:



Source: Qualcomm

- Enhanced Mobile Broadband (eMBB) to deliver vastly increased data rates, high user density and very high traffic capacity for hotspot scenarios as well as seamless coverage and high mobility scenarios with still improved used data rates
- Massive Machine-type Communications (mMTC) for the IoT, requiring low power consumption and low data rates for very large numbers of connected devices
- Ultra-reliable and low latency communications (URLLC) for safety-critical and mission-critical applications

5G provides the opportunity to boost the current broadband and services experience, particularly when using increasingly media-rich mobile apps, across the whole network including at the cell edge. 5G can also enhance the video experience to support HD, 4K, 8K, 3D and 360 degrees content. Advanced gaming enabled by streaming over 5G direct to mobile terminals represents an exciting opportunity for new services and revenue growth. Higher capacity enabled by 5G networks supports many more users – even when in crowded places. Thinking about advanced technological synergies, AR and VR glasses can be paired with 5G terminals for a truly immersive experience for the mobile user.

For the fixed wireless customer today using 3G or 4G networks, 5G delivers a fiber-like performance, which is particularly appropriate to deploy in difficult-to-serve rural areas where FTTH and FTTP costs are prohibitive.

New spectrum is needed to secure the full potential for 5G. Key outcomes from WRC-19 included identification of significant extra spectrum for 5G. High capacity spectrum in millimeter bands in the 26 GHz, 40 GHz and 60 GHz ranges was also successfully identified.

Many of today's 5G systems are deployed within the C band, particularly in the range 3.3 – 4.2 GHz, and future international discussions including at WRC-23 will aim to secure yet more of this mid-band spectrum for mobile systems. Availability of more spectrum below 1 GHz would also greatly help in addressing rural 5G coverage. However the 6GHz band may become the next spectrum 'battleground' within the ITU forum as a number of different technologies and users seek access to this range. The challenge will be keeping the balance of 5G, WiFi users and existing services in the band. Some initial

positions have emerged. For example, North America supports unlicensed use for the whole band, Europe seeks unlicensed use in the lower part only, while China seeks the whole 6GHz band exclusively for licensed 5G systems.

The transition to 5G is mainstream and global. According to my independent research (July 2021) 461 network operators are investing in 5G technology in 147 countries/territories. Investments embrace, technology studies, testing, license submissions, trials, network deployments or commercial launches.

Within these totals, 174 network operators launched 5G commercial service in 71 countries (end 2020: 156 operators in 65 countries) offering eMBB and/or fixed wireless access (FWA) services. Private 5G networks are excluded. 5G service areas vary significantly; some operators offer broad, even nationwide 5G coverage, others have a limited footprint.

The majority of the initial systems were deployed in the Non-Standalone (NSA) configuration. NSA and "Standalone" (SA) are the standardised paths for operators in transitioning from 4G/LTE to 5G. The first deployments broadly were in NSA mode and focused on the eMBB use case for mobile and/or fixed users. It means the 5G radio (New Radio i.e. NR) is supported by the 4G/LTE network infrastructure. Note that 5G use cases needing URLLC and much higher capacity only become feasible with SA 5G NR and 5G core network architecture, independent of the 4G/LTE network anchor.

"According to my independent research (July 2021) 461 network operators are investing in 5G technology in 147 countries/territories. Investments embrace, technology studies, testing, license submissions, trials, network deployments or commercial launches"

Operators can choose a fast start into 5G by deploying new 5G radio on existing 4G architecture (i.e. NSA). But operators who go directly to the standalone model can test or offer solution for many new cases which may be of special interest for enterprises, e.g. to enable smart factories. Private networks represent an exciting new opportunity; dozens of networks are deployed or planned, encompassing - but not limited - to car manufacturers, consumer electronics and other manufacturing plants, ports, airports, mining and process industries, offshore and power utilities, etc. which is driving Industry 4.0 and the digital transformation of numerous industrial sectors and practices. 5G SA is essential for supporting advanced "network-slicing" capabilities. Operators can set out the precise characteristics of a slice including speed, latency, reliability, and security, and delivered in service level agreements agreed with individual enterprise customers.

Interest is now high in Standalone (5G SA). Referring again to my research, 87 operators are evolving their 5G networks to the 5G SA configuration. At least 12 have commercially launched 5G SA services, including in South Africa.

5G will continue to evolve, as we saw with all previous technology generations. 5G, AI, VR, edge and cloud computing technologies are synergistic; each reinforces the impact of the other to propel 5G into new markets and settings. 3GPP will start detailed work on specifications for the next step i.e. "5G Advanced" (3GPP Release 18 and beyond) from Q2 2022 and is expected to be finalised by December 2023. ■

Witney Schneidman,
non-residential fellow Brookings Institution – global economy and development, Africa Growth Initiative

Continuing troubles in the Tigray region of Ethiopia are occupying the thoughts of President Biden's administration, with a call to end "large-scale human rights abuses" and for the withdrawal of Eritrean and Amarah forces from Tigray.

Biden's administration is in the tough position of considering sanctions that would cut off funding from the US and its allies with potential to further destabilise Ethiopia.

Nonetheless, imposing visa restrictions on Ethiopian and Eritrean officials who are responsible for the atrocities in Tigray is an appropriate action, and a watershed given Ethiopia's long-standing role as a key regional ally. There is clearly scope for ratcheting up sanctions if Prime Minister Abiy Ahmed, who won the Nobel Peace prize in 2019, doesn't deescalate conflict and follow through on his commitments to senior American officials, including Senator Chris Coons and Special Envoy Jeffery Feltman.

"The principal dilemma for the Biden administration is how to mobilise pressure on prime minister Abiy Ahmed to induce him to end the conflict and the suffering without turning Ethiopia—the largest recipient of American development assistance in sub-Saharan Africa—into a pariah nation"

A next step could be along the lines recently advocated during Congressional testimony by John Prendergast, the human rights activist and co-founder of the Sentry, in which he called for carefully targeted Magnitsky sanctions. Such sanctions would include asset freezes on Ethiopian and Eritrean officials and their national and international networks through which they perpetuate the conflict and benefit personally.

A pariah nation?

The principal dilemma for the Biden administration is how to mobilise pressure on Prime Minister Abiy Ahmed to induce him to end the conflict and the suffering without turning Ethiopia—the largest recipient of American development assistance in sub-Saharan Africa—into a pariah nation.

In addition to visa sanctions, the administration has shown a willingness to progress a diplomatic path of pressuring the Ahmed government, reportedly imposing cuts in security and economic assistance and extending US$350 million in food aid in hopes of fending off starvation in Tigray.

Perhaps the most difficult decision facing the administration is whether it should cancel a US$500 million investment that the board of the US Development Finance Corporation (USDFC) approved in January that enabled the Vodafone Group Plc. to win a new mobile-phone license issued by the Ethiopian government last month. It would be a mistake for the Biden administration to cancel this financing.

The award of the first telecoms license for US$850m is the largest direct foreign investment in the country's history, according to a tweet by prime minister Abiy Ahmed. The winning

consortium, led by Kenya's Safaricom along with Vodafone and South Africa's Vodacom, plans to invest US$8.5bn in its network over 10years. They have also committed to creating 1.1 million jobs in the same period and covering the country with a 4G service by 2023. The UK development finance institution CDC and Sumitomo Corporation will also provide financial support, in addition to the USDFC.

A bid of US$600 million for a second telecoms license was rejected by the Ethiopian government for being too low. This bid was made by the MTN Group Ltd. of South Africa and a Chinese state investment group, the Silk Road Fund. Apparently, the license will be retendered. The government also plans to privatise 45% of state monopoly, Ethio Telecom.

Opening of the economy

A key question surrounding the tender of the licenses was whether the government would permit the cellphone companies to offer mobile money services. The state-owned Commercial Bank of Ethiopia controls about half of the country's banking sector, which limits the prospect for the development of mobile financial services. This would obviously impact the commercial viability of the investment. Mobile services are projected to contribute to nearly 10% of Africa's GDP by 2023. Mobile will inevitably be a growth sector in Ethiopia's economy. Another uncertainty was whether the cell companies could build their own infrastructure or whether they would be required to lease it from Ethio Telecom. On both issues, the consortium apparently received assurances that gave them confidence to move forward.

"In addition to driving skills development and job creation among Ethiopia's large youth population, the internet will be a vital tool for enhancing transparency and accountability, especially as it concerns elections and human rights"

Internet access will be another spinoff of the successful tender. Even though the country is the second-most populous in Africa, its 110 million people are among the most digitally isolated on the continent. The country's internet penetration of 18% is just below Guinea and above the Democratic Republic of the Congo—a remarkable contrast to neighbouring Kenya where the internet penetration rate is 85% and in Nigeria, where it is 73%.

In addition to driving skills development and job creation among Ethiopia's large youth population, the internet will be a vital tool for enhancing transparency and accountability, especially as it concerns elections and human rights. Recent instances where the Ethiopian government has tried to block internet usage, not only related to violence in Tigray but also in 2020 after the killing of the activist singer Hachalu Hundessa and in 2019 following an alleged coup attempt in the Amhara region, underscore importance of networks not being state controlled.

The region saw the downsides of such control earlier this month when, after Twitter took down a tweet of President Buhari, the government suspended the company in response. Activists and civil society members continued to use virtual private networks to circumvent restrictions in an effort to make the government accountable, as they previously did during the EndSARS campaign.

Biden's administration should stay fully engaged in Ethiopia not only to end the conflict in Tigray but to help the country recover from the pandemic and to ensure that Ethiopia's June 21 elections will be as successful as possible. There's a role for both American pressure and investment in ensuring that the Ethiopian government meets its many challenges. ■

The following information and data was sourced from GSMA'S The Mobile Economy sub-Saharan Africa 2021 report

The mobile industry in sub-Saharan Africa continues to play a crucial role in the response to Covid-19. Mobile operators have implemented measures to support vulnerable communities including offering discounts to mobile tariffs and providing digital content and tools to help people and businesses get online.

By the end of 2020, 495 million people subscribed to mobile services in sub-Saharan Africa, representing 46% of the region's population – an increase of almost 20 million on 2019. With more than 40% of the region's population under the age of 15, young consumers owning a mobile phone for the first time will remain, for the foreseeable future, the primary source of growth.

Over the period to 2025, 4G adoption in sub-Saharan Africa will double to 28%, compared to a global average of 57%. We are still in the early stages of the journey to 5G in sub-Saharan Africa; as of June 2021, there were seven commercial 5G networks in five markets across the region. By the end of 2025, 5G will account for 3% of total mobile connections in the region.

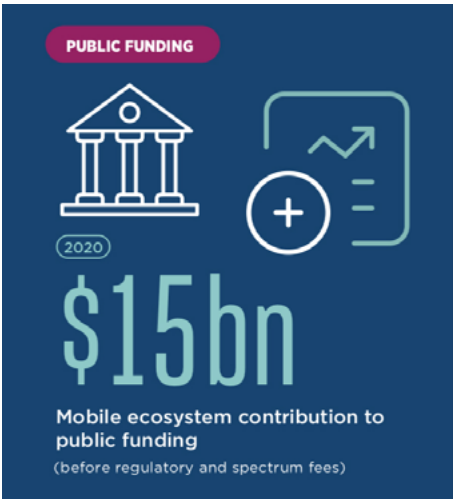
As economies recover and restrictions ease, mobile technology will be even more integral to how people live and how businesses operate. It will enable new digital solutions for small and large enterprises and support the growing use of online channels by consumers. Strong investor confidence and consumer interest in digital platforms point to a digital-centric future for sub-Saharan Africa, with mobile at the centre of the creation and consumption of innovative solutions.

Policies should look to engender inclusive digital development

The pandemic has highlighted the increasing importance of digital technology to responding effectively to crises and planning for recovery. At the same time, the crisis has the potential to accelerate the continent's digital transformation and create resilient digital jobs in sub-Saharan Africa. The continued rollout of 4G and the first stages of the move to 5G open up opportunities in areas such as healthcare, digital commerce, industrial automation and smart city infrastructure.

Realising this potential requires policy measures to support network investments and improve the affordability of digital services for consumers. Governments and regulators in the region should therefore adopt forward-looking spectrum management and fiscal policies, including the following:

- Creating a spectrum roadmap to ensure there is enough spectrum to meet surging demand for mobile services in both the short and long term.
- In particular ensuring access to mid-band spectrum 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.
- Applying best-practice principles of taxation as recommended by international organisations such as the World Bank and the International Monetary Fund.



Revenue growth remains strong in the pandemic

Revenue growth is benefitting from the recovery of economic activities, following disruptions caused by the pandemic in 2020. Data and mobile money remain the prime revenue growth drivers, with adoption and use of both services continuing to rise rapidly. Beyond this, operators are seeing strong demand for a wider range of digital services, reflecting a shift in consumer behaviour triggered by the pandemic.

The pandemic has underscored the value of mobile networks, which remain the only form of internet access for many in sub-Saharan Africa. Mobile networks have remained resilient as operators implemented various measures, including investments in network capacity, to cope with the surge in data traffic. With the use of digital services likely to continue rising, operators' investments will only become more important. 5G will be a major part of this investment as commercial services are deployed in new parts of the region.

Also in its report, under the sub-heading Telco of the future: open RAN gains ground, GSMA made the following prediction:

The mobile industry is experiencing a paradigm shift in network infrastructure models, with operators large and small increasingly considering open RAN solutions for network deployment and operation. Although open RAN is still in its infancy, with vendors competing to build out their solutions, operator commitments, trials and deployments indicate growing momentum behind the technology. As of July 2021, 38 countries around the world had active open RAN trials, deployments or commitments.

Open RAN has become the native approach to 5G networks for a number of high-profile operators, notably Rakuten in Japan and Dish in the US. Meanwhile, operators are taking a collaborative approach to the development of open RAN technology. In May 2021, Deutsche Telekom, Orange, Telefónica, TIM and Vodafone issued a white paper outlining their technical requirements for the open, disaggregated RAN products they want to roll out in significant deployments from 2022. In July 2021, Etisalat Group, Mobily, STC, Zain Group and du signed an MoU to progress the implementation of open RAN solutions across their footprints.

Every new technology faces challenges to its deployment and adoption; open RAN is no different. GSMA Intelligence research, based on a survey of 100 operators globally, revealed that the top challenges include uncertainty around internal ownership, the integration of solutions in a multi-vendor scenario and limitations in terms of supplier diversity. Vendors should seek to address these challenges to drive greater scale of open RAN deployments. ■

Nathaniel Allen,
assistant professor with the Africa Center for Strategic Studies at National Defense University and a term member of the Council on Foreign Relations

The rapid spread of the internet across the African continent has been heralded as a key driver of prosperity and a sign of the continent's technological coming of age. Today, at least a quarter of the population has internet access, a nearly fifty-fold increase in internet usage since the turn of the millennium. By 2030, the continent could achieve rough parity with the rest of the world when three quarters of Africans are projected to become internet users. The economic potential is enormous: mobile technologies alone have already generated 1.7 million jobs and contribute US$144bn to the continent's economy, or roughly 8.5% of GDP.

Some African countries have taken advantage of rapid increases in internet penetration to make concrete improvements in the lives of citizens. Led by the rise of platforms such as Kenya's M-PESA, Africa has leapt ahead of other regions to become a centre of mobile, peer-to-peer finance. The continent registers close to half of the world's mobile money accounts. Sierra Leone, one of the world's poorest countries, recently established a Directorate of Science, Innovation and Technology (DST). Its initiatives include a "national financial data architecture with embedded automated financial tools" intended to improve service delivery and reduce corruption. These are just two examples of how digitization can provide a cheap, secure source of finance to populations in need and improve government transparency in countries where official graft is a universal concern.

Nevertheless, the rapid spread of the internet across Africa has downsides. For one, without affordable internet and reliable power, broadband internet access will remain out of reach for many low-income Africans living in rural areas. The relationship between internet access and household welfare in Africa is strong: One study from Senegal associated 3G internet coverage with a 14% increase in consumption and a 10% decline in poverty. Thus, countries that do not address internet access issues risk limiting the opportunities of their citizens, exacerbating already-substantial inequality, and inflaming regional, political, and ethnic divides.

More broadly, digitization brings with it vulnerabilities that expose countries to cyber espionage, critical infrastructure sabotage, and crime. Until recently, Africa was responsible for such a negligible portion of overall internet traffic that its systems were not particularly vulnerable to sophisticated cyberattacks. That could change in the coming decade, as African states, criminal enterprises, and threat groups become increasingly prominent cyber actors. Four African states with comparatively high levels of internet penetration—Algeria, Morocco, Kenya, and Nigeria—already rank among the top ten countries by share of users attacked by mobile malware.

Covid-19 and its aftermath

The effect of the Covid-19 pandemic is likely to act as an accelerant for the spread of emerging technology. The pandemic has already led to remarkable innovation. According to a study by the World Health Organization, 13% of all new or modified technology developed to respond to Covid-19 is African. In Ghana, authorities launched a Covid-19 tracker app, citizens invented solar-powered hand-washing stations, and private sector Zipline drones delivered tests. In Tunisia, the Interior Ministry deployed a robot to help enforce a lockdown. When confronted by a man attempting to buy cigarettes, the robot relents: "OK buy your tobacco, but be quick and go home."

But as life has moved increasingly online, opportunities for malicious actors to exploit digital technology have grown. Cyberattacks in countries across Africa have risen, with threat actors adopting techniques designed to exploit shifts to less secure home office work environments and other Covid-related fears. In Zimbabwe, cyberattacks increased by as much as fivefold during the pandemic, driven by phishing attacks that impersonate organizations working on pandemic response or use Covid as a lure to get unwitting individuals to download malicious software.

Moreover, Africa's economies are expected to take significant time to recover from a pandemic-induced shock, leading to increases in poverty and declines in GDP that stand in sharp contrast to the first two decades of the twentieth century. As connectivity continues to rise, increases in poverty and inequality could herald an increase in the growth of cybercrime, as tech-savvy and college-educated Africans find opportunities for legitimate forms of employment limited. For example, SilverTerrier, a major cybercriminal actor based in Nigeria, is made up of individuals in their late teens through to early forties, based in urban areas, and possessing some level of post-secondary education, according to a study of the group.

The economic, political and technological shocks of Covid-19 could also accelerate unsettling trends of digital repression and conflict. Prior to the pandemic, conflict in Africa was already on the rise and democracy in retreat. Facing declining revenues and rising social unrest, it is probable that regimes will double down on surveillance, censorship, and disinformation rather than compromise or address the grievances of disaffected groups. In Uganda's recent election, authorities hacked the encrypted communications of opposition leader Bobi Wine, ran a sophisticated online influence operation, and shut down the internet, efforts that helped to elect incumbent Yoweri Museveni to a sixth term.

A protean legacy

Most likely, African governments will continue to exhibit tremendous variation in their ability to adapt to this period of geopolitical uncertainty and technological change. Some of the more innovative countries may surf the spread of digital technology to prosperity and stability. Mauritius, Rwanda, and Kenya, for example, possess dynamic, tech-driven economies and are the only African countries to rank in the top 50 of the International Telecommunications Union's global cybersecurity commitment index.

More countries, however, risk being destabilised or limited in their ability to harvest the fruits of the digital revolution. Nigeria has more tech hubs than any other country in Africa, but has also become a global centre for cybercrime. Libya's information environment experienced a brief renaissance in the aftermath of the fall of Muammar Ghaddafi in 2011, but has since become a "fragmented vacuum," controlled largely by armed groups and foreign actors. Internet connectivity is a basic prerequisite for technology-driven growth and innovation, yet in fifteen countries, penetration rates are 10% or less.

For Africa's digital revolution to yield peace and prosperity, it is not enough for African countries to focus on the rapid, and often reactive, adoption of emerging technology. It is equally crucial to consider risks and externalities. Increasing internet connectivity should be prioritized, but so should affordability, cybersecurity, and equitable access. Drones and artificial intelligence offer African countries profound opportunities to innovate, but could be destabilizing without strategies, policies and legal frameworks to govern their use. And, driven in part by the pressures of the Covid-19 pandemic, the question of what African governments should do to respond to the proliferation of emerging technology is no longer a theoretical one, It is urgent.

The signs of Africa's digital revolution are impossible to miss. The destination? Impossible to know. ■


RSCC
Russian Satellite
Communications Company
TV
SATELLITES
FOR DIGITAL
ECONOMY
rscc.ru

Keoikantse Marungwana,
senior research manager, IDC

Many think Africa's telecoms/ICT landscape experienced a cautiously optimistic phase. Economies reeled from pandemic lockdowns yet digital transformation, specifically, ICT and telecoms demonstrated themselves as critical enablers to achieving countries national development imperatives. Regulators and policymakers across Africa, for good reasons, have been actively involved in initiatives and developments impacting market outlook of the digital landscape.

There's still excitement around 5G deployments and developments, with South African operators leading 5G deployments. The Independent Communications Authority of South Africa (ICASA) was Court instructed to review 5G spectrum allocation plans and licensing of wholesale mobile network operators, or WOAN (Wholesale Open Access Network). This might delay the market by at least a year from seeing new allocations of highly contested International Mobile Telecommunications ("IMT") spectrum, also called high-demand spectrum ("HDS"). Regulator promises to expedite spectrum allocation, with possible auction in March 2022.

Ethiopian market experienced development with award to Safaricom consortium of first mobile networks operator's telecoms license. Tendering started for second license, which includes mobile financial services, to liberalise the economy. There's also a plan to sell 40% of state-owned incumbent.

Kenya's regulator published Frequency Spectrum Management Guidelines and kicked off 5G network trials with Safaricom. The government published National Broadband Strategy (2018-2023) to accelerate 5G developments.

Regulator, Nigerian Communications Commission (NCC), fast tracked 5G roadmap

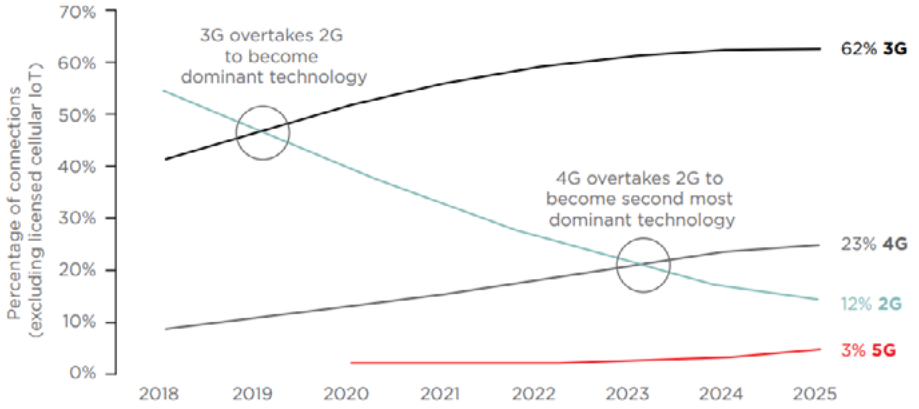


Figure 1: African Mobile Broadband Connections Forecast. Source: GSMA, 2021

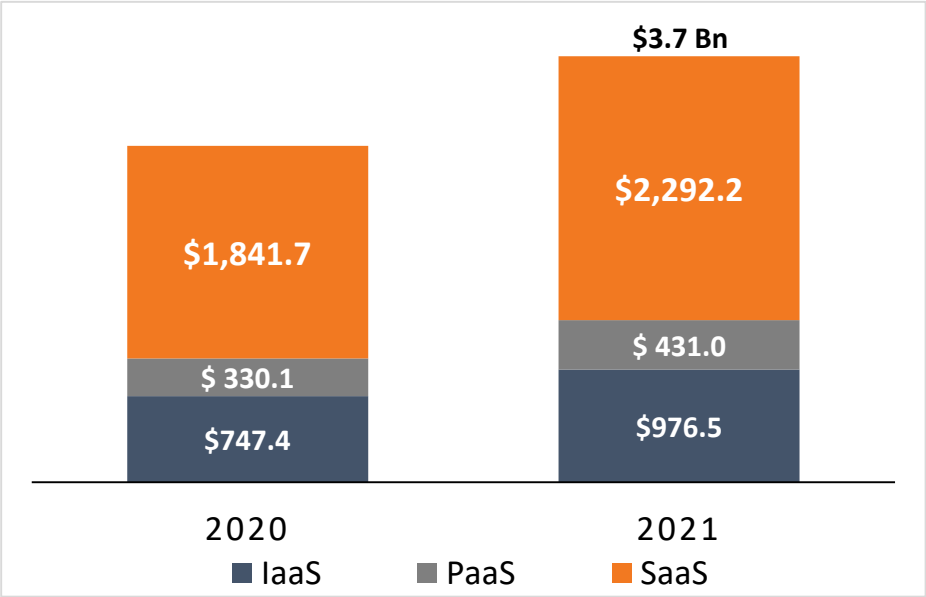


Figure 2: Public Cloud growth momentum to continue beyond 2021 (YoY Growth) – Source: IDC 2020

through a MoU with holder of IMT spectrum, Nigerian Communications Satellite Limited (NigComSat), relocating the NG-1R satellite of NigComSat from previous 400MHz band (3.5GHz – 3.9GHz) to standard C-band 300MHz (3.9GHz – 4.2GHz). NCC set 13 December for Africa's first 5G spectrum auction (two 100MHz blocks in 3.5GHz – 3.6GHz and 3.7GHz – 3.8GHz).

Mauritius, to accelerate 5G deployments, allocated IMT spectrum without auction, allocating three blocks of 100MHz in 2.6GHz and 3.5GHz bands. In lockstep, MyT Mobile, Mauritius Telecom's mobile network, launched 5G services in limited areas.

Increasing number of governments are grappling with managing or keeping up with rapid advancement of digital technologies, particularly over-the-top (OTT) services and emerging technologies outpacing regulations. Some governments apply a strong approach in managing regulatory or policy gaps exposed by democratisation and globalization of digital services. Social media services are hosted anywhere around the world; and ensuring that OTT providers operate within legal and regulation frameworks for data, financial etc. challenges local regulators. 2021 saw government shutdowns of Internet and social media, while attempts to create or enforce local tax regulations on global OTT players had mixed results.

Cybersecurity breaches haven't abated, banks and government entities experienced incidents. Increased reliance on digital services and global march to 4IR technologies sector demands increased

focus and cybersecurity investment. The 2020 IDC MEA Security Survey showed that data sovereignty, data leakage and non-compliance of local regulations were top concerns for 50% META (Middle East, Turkey, and Africa) organizations.

To assist African governments and regulators move swiftly on 5G, GSMA published "Roadmaps for 5G Spectrum: Sub-Saharan Africa (2021)" with a roadmap to enable 5G in a structured and efficient manner. This should inform and accelerate 5G spectrum release, and perhaps encourage spectrum harmonization, enabling continent wide, mass and rapid 5G deployments, particularly rural communities.

GSMA expects 5G to comprise 3% of 1 billion connections by 2025. Ther's need for rapid 5G spectrum allocation otherwise, 5G promise for Africa, at 3% in 2025, and likely only accessible in major cities mostly by enterprise customers, will be a dream for most of Africa's population.

Recently African Peer Review Mechanism's conference on, The Future of Governance in the 4IR. highlighted importance of technology developments, digital transformation, and direct impact on continent's progress across all developmental themes of democratic, economic, socio-economic, and corporate governance.

Many African countries have published ICT broadband strategies and updated regulations to encourage digital transformation of economies, Africa will need deliberate and active involvement by governments, policymakers, and regulators to drive transformation and realise 4IR. potential.

Emerging technologies landscape has been very active, many organisations embraced digital transformation because of Covid-19. Organisations resumed or plan cloud investment, IoT and AI solutions for use cases in healthcare, education, mining, manufacturing, security, and retail sectors. IDC predicts by 2024, 28% of IT services opportunities in META region will be digital transformation related.

Many use cases were fast-tracked by learnings from the pandemic. Video analytics solutions using AI for image recognition, a feature used for temperature screening and face mask detection, are becoming standard feature in various surveillance solutions, in malls, airports or in streets. The CCTV surveillance network being rolled out in Johannesburg with number plate and facial recognition capabilities is an interesting use case of the confluence of high-speed networks, IoT and AI.

Cloud is going mainstream, while Africa accounts for less than 1% of global data centre market, Africa's data centre landscape has been hive of activity. Hyper-scalers and local incumbents have doubled down on expansion plans. Global players entering market through acquisitions and partnerships with local players.

Teraco raised R2.5 billion (US$170 million million) for construction of 38 MW hyper-scale facility in South Africa, JB4, scheduled completion in Q1 2022. Africa Data Centres (ADC), Liquid Telecom's data storage arm, raised US$300 million from US International Development Finance Corporation. The company plans to build hyper-scale data centres in ten African countries. Dimension Data's new JHB1 facility will come online early 2022.

Nigerian data centre market, with challenges of reliable electricity, is

expected to grow at a 17% CAGR through 2021-2026. Huawei is driving a trend of modular data centres. These developments might assist in reducing country's challenge where an estimated 90% of its data is hosted externaly.

Telecom infrastructure investments and holdings have also raised interest. IHS Towers (29% owned by MTN) operates in some African countries has announced plans to list on New York Stock Exchange, to unlock value for shareholders. Telkom announced plans to list its masts and towers business, Gyro, on JSE in March 2022. Mobile operators are emphasizing new identities of being digital or technology companies more than infrastructure companies. This strategic objective is also being realised on financial statements, with revenue contribution from digital services growing faster than traditional services.

This dynamic continues to create clear distinction between tower infrastructure providers and telecom companies, a move that should create new opportunities for innovation and new tower company business models. A nationwide infrastructure asset with miniature data centres at the base of mobile network RANs can be useful for various reasons, all sorts of edge cases, however remote or latent.

African telecoms landscape has been buzzing, and while there are some missteps on the regulatory front, when it comes to ecosystem enablement, there's an enormous opportunity for rapid advancement of the landscape by regulators and governments.

High-speed broadband connectivity continues as operators push for more coverage and ROI on 4G. Deployment targets 5G for specific segments and use cases and expands fibre and 'AirFibre' or 'wireless Fibre' into rural markets. Satellite internet services market will play a key role with Starlink having opened customer applications for African consumers, promising very high internet speeds at competitive prices. ■

Looking ahead: A very positive market outlook due to abundance of compute and storage capacity because of hyper-scale data centres, maturing IoT and AI solutions landscape, emergence of edge computing, and increasing focus by telcos on digital services like financial services.

The opportunity landscape is wide open for all ecosystem players. For telecom operators, opportunities range from new market expansions, optimisation opportunities in their core and access networks, new propositions in managed cloud and edge services, and launching new digital services. SMMEs with specialised ICT skills in emerging technology (cloud, AI, IoT and RPA), and with industry insights on specific verticals, now have access to unlimited compute, storage, and bandwidth to develop innovative scalable vertical-specific solutions without need for expensive infrastructure investments.

African business and consumer markets, opportunity for increased productivity, and access to services from virtually anywhere, will continue to fuel new ways of working, learning and playing. Cloud-native business models will emerge from all business sectors. 2021 has seen new online-only formal and accredited educational institutions being launched at both high-school and tertiary levels, signaling maturity of the online learning opportunity beyond the typical MOOCs that led this revolution.

Karim Yaici,
senior analyst and lead analyst for Analysys Mason's The Middle East and Africa regional research programme

We close this section with a report from leading TMT management consulting firm, Analysys Mason.

The company provides detailed 5-year forecasts of the fixed and mobile telecoms market. Its forecasts take into consideration the likely range of economic impacts that the Covid-19 pandemic may have on operators' telecoms service revenue worldwide.

This report, Sub-Saharan Africa telecoms market: trends and forecasts 2020–2025, focuses on operators' core telecoms services in sub- Saharan Africa. It includes discussion of IoT, pay-TV and operator business services. These services are discussed in detail in our other research programmes.

Analysys Mason says its forecasts are informed by on-the-ground, regional market experts from our topic-led research programmes and our consulting division, as well as external interviews. In addition to its robust set of historical data, its forecasts draw on "a unique and in-house modelling tool", which applies a rigorous procedure (reconciling different sources, standard definitions, top-down and bottom-up modelling).

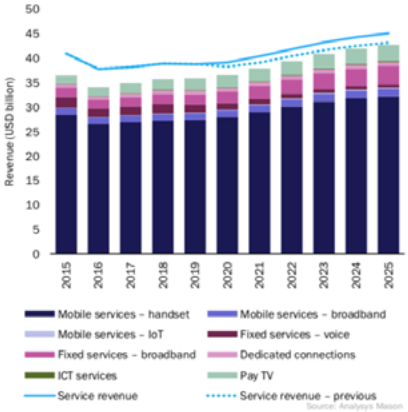
The Sub-Saharan Africa telecoms market: trends and forecasts 2020–2025 was produced by a team* lead by Karim Yaici, senior analyst and lead analyst for Analysys Mason's The Middle East and Africa regional research programme.

REPORT COVERAGE

Geographical	Key performance indicators (around 200)	
Region modelled	**Connections**	**Revenue/ARPU/ASPU**
• Sub-Saharan Africa (SSA)	Mobile	Mobile
Countries modelled individually	• Handset, mobile broadband,[2] IoT[3]	• Service,[4] retail, wholesale
• Cameroon	• Prepaid, contract	• Handset, mobile broadband,[2] IoT[3]
• Côte d'Ivoire	• 2G, 3G, 4G, 5G	• Handset voice, messaging, data
• Ghana	• Smartphone, non-smartphone	• Prepaid, contract
• Kenya	Fixed	• 2G, 3G, 4G, 5G
• Nigeria	• Voice, broadband	Fixed
• Rwanda	• Narrowband voice, VoBB	• Service,[4] retail, wholesale
• South Africa	• DSL, FTTP/B, cable, FWA, 5G, other	• Voice, broadband, dedicated connections
• Sudan	Pay TV	• DSL, FTTP/B, cable, FWA, 5G, other
• Tanzania	**Traffic**	ICT services
• Uganda	Fixed and mobile	Pay TV
• Zambia	• Outgoing voice minutes, MoU	
	Mobile data traffic	

Telecoms revenue in Sub-Saharan Africa will grow in the long term, despite the temporary decline due to the Covid-19 outbreak in 2020

Figure 1: Telecoms and pay-TV retail revenue by type and total service revenue, Sub-Saharan Africa, 2015–2025



The Covid-19 outbreak limited telecoms revenue growth in sub-Saharan Africa (SSA) in 2020.

We estimate that total telecoms and pay-TV service revenue in Sub-Saharan Africa grew by just 1.0% year-on-year in 2020 due to the impact of the Covid-19 pandemic in the region. The lockdown measures had an immediate effect on revenue, and many countries are also beset by macroeconomic difficulties; strong inflation and currency devaluations are common.

We expect that the conditions will start to improve from 2021 thanks to economic

recovery. Nominal GDP for the region is expected to grow at a CAGR of 8.3% during 2020–2025, supported by a 13.3% net expansion in population.

Total telecoms and pay-TV service revenue will grow at a CAGR of 2.9% between 2020 and 2025.

Telecoms markets will also slowly start to recover from 2021. The rising demand for mobile telecoms services will drive most of the growth in telecoms revenue. MNOs will expand and upgrade their mobile networks. This will allow them to reach new customers in unserved areas and to convert non-data users into active data users. The availability of affordable handsets and discounted tariffs for first-time 4G users as well as the launch of new IP- based applications will drive the migration of customers to 4G and result in strong data revenue growth.

Mobile: the mobile SIM population penetration will grow notably, thanks to operators' network expansions and the increasing take-up of mobile data plans

There are opportunities for mobile network operators (MNOs) in the region to grow their subscriber bases.

The mobile SIM population penetration in SSA was 81.6% in 2020. However, multi-SIM usage is very common, so there is still potential for unique subscriber population penetration growth.

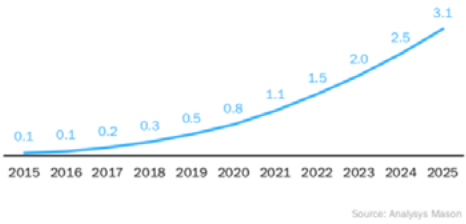
The number of mobile connections in the region is expected to grow by 21% between 2020 and 2025 to reach 1.14 billion. Strong population growth and MNOs' efforts to expand their networks into rural areas will underpin much of this expansion. However, we expect that regulatory interventions on illegal or unregistered SIMs may act to limit the pace of this growth in some countries (such as Ghana, Kenya and Uganda).

The shift towards a data-centric model will accelerate during the forecast period.

The regional average cellular data traffic per handset connection will grow from 0.5GB to over 3.2GB during the forecast period. The lack of fixed infrastructure will enable MNOs to capitalise on consumers' growing appetite for online services. The availability of new feature phones and low-cost smartphones will also drive the take-up of data plans. MNOs are promoting plans with larger data allowances and introducing applications for messaging, music, social media and video services.

Figure 7: Mobile connections by plan and 5G connections, Sub-Saharan Africa (billion), 2015–2025

Figure 8: Cellular data traffic per handset connection, Sub-Saharan Africa (GB per month), 2015–2025



*Alex Boisot (analyst), Ameer Gaili, Charlie Westphal, Emma Brown, Felix Hall and Noor Mohammed Khan (research analysts). ■

YOUR SIGNAL STARTS HERE.®

TOWER OWNERSHIP

LEASING

SITE MANAGEMENT

Our clients depend on SBA to provide the essential wireless infrastructure that allows them to transmit the signal to their customers. As a preferred provider for mobile network operators throughout Africa, we are continuously setting the standard for customer satisfaction by **"Building Better Wireless".**

We are proud to announce two market changes for SBA:

Atlas Towers (Pty) Ltd. (South Africa) is now doing business as **SBA South Africa**.

Minara Tanzania is our branded solution for the Tanzania market.

sbasite.com

SBA®

minara TANZANIA

SBA SOUTH AFRICA