GSMA Intelligence

5G FWA in Africa

Emerging trends and opportunities

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Executive summary

Countries in Africa have seen a significant rise in mobile internet connections over the last five years, driven by operator investment in mobile broadband (3G, 4G and 5G) networks and rising smartphone adoption. While mobile broadband connections have played an important role in connecting individuals, addressing the gap in last-mile fixed broadband connectivity is necessary to deliver enhanced connectivity services to households and enterprises.

5G FWA emerges as a credible alternative

Various technologies have been deployed to deliver broadband connectivity to households and businesses, including wired (FTTx, xDSL, copper) and satellite. However, many of these face challenges in terms of time to market and costs (for initial deployment and over their lifecycle). In recent years, 5G fixed wireless access (FWA) has emerged as a credible alternative to traditional fixed-line options to address the gap in last-mile connectivity for households and businesses.

As of September 2023, 116 operators in 57 markets had launched 5G FWA services. This indicates that around 40% of commercial 5G networks include an FWA offering. GSMA Intelligence data shows that global 5G FWA connections will reach nearly 80 million by 2030, while 5G FWA revenues will reach $44 billion, accounting for 3.5% of total mobile revenues.

For operators, 5G FWA has emerged as a crucial 5G use case. It offers opportunities to:

- drive revenue growth and serve new market segments
- better utilise existing network assets, including spectrum, towers and backhaul
- deliver high-speed broadband connectivity in a timely and cost-effective manner
- upgrade customers on older wireless broadband technologies, such as 4G FWA
- reduce churn.

The 5G FWA opportunity for operators in Africa is significant, considering the size of the addressable market for household broadband connectivity and the scale of the micro, small and medium-sized enterprise (MSME) market, which contributes around 50% to Africa's GDP. However, there are important considerations to take into account, especially in the Sub-Saharan Africa context. These include the cost of customer premises equipment (CPE) devices relative to local income levels, the backhaul requirements of increased data traffic, and the technical challenges associated with wireless networks.

The ecosystem can help realise the full potential of 5G FWA in Africa

Policymakers, operators and other ecosystem players can take steps to address the issues around 5G FWA deployment and adoption to realise the full potential of 5G FWA in the region:

Policymakers	• Provide spectrum for network deployment and wireless backhaul solutions • Implement policies to stimulate 5G network rollout and expansion • Reduce or eliminate taxes on CPE devices to improve affordability
Operators	• Prioritise FWA service to monetise 5G and improve the business case • Deploy 5G FWA in parallel with 5G mobile to gain early-mover advantage • Consider device-financing schemes to improve affordability
Other ecosystem players	• Innovate to help operators deliver compelling services and bring affordable CPE devices to market

1 The global outlook for FWA

Fixed wireless access (FWA) is a wireless technology that enables fixed broadband access using radio frequencies rather than cables. FWA can be used to connect homes and businesses to the internet and has gained significant attention as a viable solution for bridging the digital divide.[1] It serves as an alternative to wired broadband connections, such as DSL and fibre-to-the-home (FTTH), particularly where there is limited or no access to wired internet infrastructure.

As countries progress on their digital transformation journeys, demand for broadband connectivity is growing exponentially. This is especially true in the post-pandemic era, which has seen an acceleration of trends such as remote working and increased consumption of content via streaming platforms. Operators have invested heavily in building out their broadband infrastructure to pass more households and to boost capacity. However, progress has been limited for several reasons, bringing technologies such as FWA into focus as potential alternatives.

1 According to the OECD, the digital divide refers to "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities".

1.1 The rationale for 5G FWA

Various technologies have been deployed to deliver broadband connectivity to households and businesses, including wired (FTTx, xDSL, copper etc) and satellite. However, many of these face challenges, especially in terms of time to market and costs (for initial deployment and over their lifecycle). For example, covering the last mile via cable or fibre to the premises (FTTP) can be costly, with potential barriers such as the distance between the roads where the cabinets are located and users' premises, as well as red tape related to the civil works required. Satellite and xDSL alternatives can lag in terms of latency and speed, respectively.

FWA has emerged as a technology option for operators in certain market scenarios, especially those where traditional fixed broadband connections to the home or enterprise premises are low in number, based on legacy copper circuits, or both. The fundamental challenge for existing fixed broadband solutions has been reaching the last mile. As a result, many operators have long sought to leverage wireless technology to extend fixed broadband access to a larger percentage of the population.

Previous solutions based on WiMAX and 3G/4G FWA have seen limited uptake. However, 5G FWA provides an increase in speeds of more than 10× compared to 4G FWA, along with substantial improvements in capacity, due to a range of technological advancements. This enables FWA to target a broader market. The improvements have made 5G FWA a viable alternative to established fixed solutions. Furthermore, 5G FWA can be a primary 5G use case for enterprises of all sizes, given the potential challenges around access, cost and reliability for existing connectivity services, including fixed broadband and satellite. In this context, 5G FWA presents the opportunities outlined below for operators.

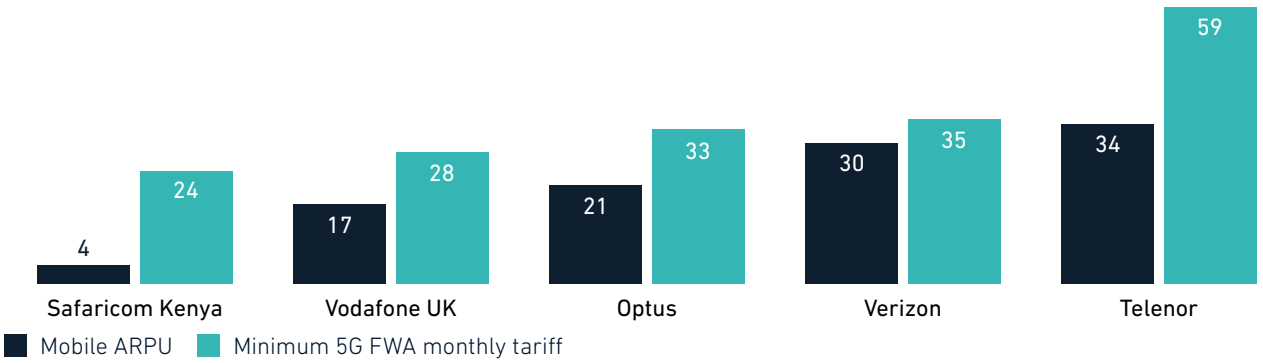
New revenues and customer growth

Operators are seeing strong revenue growth from mobile data services as consumers and businesses increasingly rely on connectivity for daily activities and operations. 5G FWA has the potential to drive revenue growth by delivering enhanced connectivity to customers, complementing their existing mobile broadband offering. For mobile operators deploying 5G, FWA is a cost-effective solution to compete in the fixed broadband market for both residential and enterprise customers, including MSMEs.

Some operators have achieved material revenue contributions from FWA (over 10% of service revenues is an indicative threshold). For example, in Poland around a third of fixed broadband revenue is attributed to FWA networks.[2] Analysis of operators' reported monthly mobile ARPU and minimum 5G FWA monthly tariffs shows a premium for the latter that could translate into significant revenue uplift as volumes rise (see Figure 1).

Figure 1

Monthly mobile ARPU versus minimum 5G FWA monthly tariff
$ per month



Note: pricing correct as of 27 September 2023. Prices do not include cost of equipment.
Source: operator websites, GSMA Intelligence

2 Report on the State of the Telecommunications Market in Poland in 2022, UKE, 2023

5G FWA can also provide a competitive advantage for operators by enabling them to reach new customers and serve new segments. This is especially true for customers that require constant connectivity for multiple devices, such as households, schools, hospitals and enterprises. For example, Verizon has successfully promoted 5G FWA as a fixed broadband alternative in the US. The operator added 384,000 FWA subscribers in the second quarter of 2023 and ended the quarter with nearly 2.3 million 5G FWA subscribers.

Resource utilisation

The main upfront costs for 5G FWA coverage typically relate to towers, shelters, backhaul and baseband. Operators with existing mobile network assets and excess capacity therefore have few additional costs when offering 5G FWA along with their mobile proposition. As such, 5G FWA provides a unique opportunity for them to maximise the utilisation and return on investment (RoI) on their 5G network assets.

In areas where smartphone traffic distribution on 5G networks is uneven, the majority of cell sites are likely to be underutilised and running significantly below full capacity. Operators could reuse cell-site resources and backhaul capacity for 5G FWA solutions. This allows network resources to be shared between mobile broadband and FWA services.

5G FWA also allows operators to plan for the broader 5G mobility market. 5G network deployment gives operators valuable learnings and insights into deploying and managing the new interface, spectrum, radio form factors, new antenna systems and new devices. FWA deployments will also provide insights into how to virtualise the core network and how to manage services, potentially through a network slice.

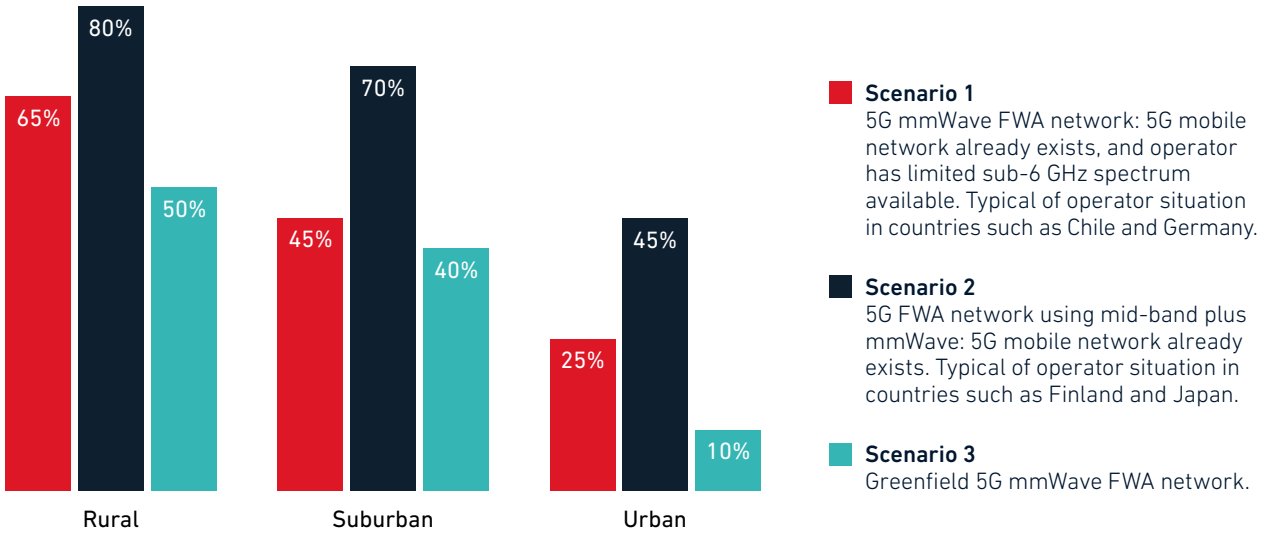
Cost savings

5G FWA provides an opportunity for operators to deliver high-speed broadband connectivity in a timely and cost-effective manner, relative to other technologies, across rural, urban and suburban areas. GSMA Intelligence research into 5G FWA deployment using spectrum in various bands in different geographies in Europe, Latin America and the US shows significant cost savings versus FTTH (see Figure 2).

The analysis estimates a cost saving of up to 80% with the deployment of 5G FWA compared to FTTH in rural settings, 70% in suburban settings and 45% in urban settings. This demonstrates potentially significant capex savings in absolute terms for operators with assets that can be used to support a 5G FWA network.

Figure 2

Cost savings (potential) achieved using 5G FWA versus FTTH



Source: GSMA Intelligence

An upgrade path for 4G FWA subscribers

4G FWA has been used in many countries to bridge the last mile. With 4G available on more frequencies, operators can dedicate some bandwidth to FWA service. As a logical evolution from 4G FWA, 5G FWA will benefit from existing network infrastructure and could improve the economics of connecting homes and businesses by enabling the network to accommodate more users per base station. For operators that have already deployed 4G FWA, upgrading users to 5G FWA provides an opportunity to deliver enhanced connectivity more efficiently.

With 5G services, subscribers can benefit from the higher bandwidth and innovations in 5G CPE. For the operator, upgrading users to 5G will help preserve revenue streams and ensure limited user churn. For example, to reduce user churn, Omantel offers 5G FWA with a cost advantage for first-time fixed broadband users in Oman, particularly in rural locations where conditions favour wireless connectivity over fibre densification. The service has been built on its 4G FWA service, which provides a strong foundation for growth.

Loyalty and cross-selling

Offering 5G FWA as part of a suite of services for customers can help operators improve customer loyalty. It creates new opportunities for cross-selling and fixed-mobile convergence, ultimately offering more value for customers and enhancing loyalty. There is also the potential to bundle additional services (such as online streaming packages) from third-party providers.

1.2 The global momentum behind FWA

Technological improvements have made 5G FWA a viable alternative to established fixed solutions. Four deployment scenarios have emerged for operators looking to realise the FWA opportunity (see Table 1).

Table 1

5G FWA deployment scenarios

Primary broadband	Targeting new fixed broadband users to drive first-time adoption, particularly in emerging markets such as in Africa, or first-time users in underserved/rural areas in mature markets such as the US and Australia. This can be cost effective compared to FTTx, particularly where new fibre infrastructure needs to be built.
Competing broadband	Targeting fixed broadband users looking for faster speeds and/or quicker installation. This occurs in markets where fibre infrastructure is concentrated in urban areas.
Complementary alternative	Complementing fibre offerings, generally in urban and suburban areas with difficult terrain and/or regulatory red tape, or areas with few fixed broadband alternatives.
Enterprise opportunity	Targeting enterprises in underserved areas or those with few alternatives. The embedded security, reliability and high capacity of 5G make for a valid value proposition for the enterprise segment. Other target segments include temporary work sites, such as construction zones, and large campuses that do not require permanent wiring.

Source: GSMA Intelligence

The renewed operator interest in delivering fixed wireless connectivity is reflected in the growing number of commercial 5G FWA deployments around the world. As of September 2023, 116 operators had launched commercial 5G-based FWA services across 57 markets (see Figure 3). This indicates that around 40% of 5G commercial networks worldwide include an FWA offering – a relatively high proportion at this early point in the generational cycle. This could rise further as operators take stock of pilots, demand and RoI.

Figure 3

5G FWA commercialisation around the world

Data correct to 30 September 2023
Source: GSMA Intelligence

5G FWA offers potential for operators in both advanced and emerging markets. The US is the largest 5G FWA market globally, with more than 5 million 5G FWA connections as of June 2023. Europe has the most operators offering 5G FWA services of any region; some 48 operators in Europe had launched commercial 5G FWA networks in 22 countries as of September 2023. Finland has been a pioneer in adopting and promoting 5G networks and services; 5G FWA is seen as a key enabler in expanding broadband access, with operators Telia and Elisa deploying 5G FWA to extend broadband services, especially in rural areas.

Meanwhile, 5G FWA is positioned as a niche solution in Japan, which has one of the highest fixed broadband penetration rates globally. Examples of recent 5G FWA announcements in other developed markets include the following:

- **Denmark** – Telia launched a 5G FWA service targeting urban areas, including Greater Copenhagen, Aarhus, Odense, Aalborg and Esbjerg.
- **Germany** – 1&1 launched 5G FWA services in Frankfurt and Karlsruhe, with plans to extend the service to other regions.
- **Italy** – TIM launched a 5G FWA service in the 26 GHz band (mmWave) for business customers, with download speeds of up to 1 Gbps and upload speeds of up to 200 Mbps.
- **Spain** – R plans to extend the 5G FWA service it launched in 2022 to around 300,000 homes in rural Galicia. The service is offered via a Wi-Fi 6 router at speeds of up to 150 Mbps in areas yet to be covered by the operator's fibre network.
- **US** – AT&T launched a new 5G FWA service in April 2023. This specifically targets DSL customers in locations where legacy copper networks are due to be deactivated.

In emerging markets, 5G FWA can help drive first-time adoption of broadband for consumers and businesses in urban and rural areas, with the potential to further reduce the digital divide. At least one operator in every country in Southeast Asia (except Vietnam and Brunei Darussalam) offers 5G FWA services. Large-scale 5G FWA networks have been deployed by operators across the GCC states, including Kuwait, Oman and Saudi Arabia, complementing existing footprints for DSL and fibre. Similar trends are emerging in Latin America, where 5G FWA is helping operators deliver high-speed broadband connectivity to homes and businesses for the first time. Examples of recent 5G FWA developments in emerging markets include the following:

- **India** – Reliance Jio and Bharti Airtel launched 5G FWA services in 2023. Given India's limited fixed broadband penetration, the operators could tap into a large addressable market. Jio expects to reach 200 million homes and premises over the next three years.
- **Brazil** – The Ministry of Communications has announced the launch of a project to study the feasibility of using 5G FWA in public schools. Meanwhile, mobile operator Claro launched its 5G FWA service in Sao Paulo, Campinas, Rio de Janeiro, Porto Alegre and Brasilia in August 2023, targeting consumers and SME customers.
- **Saudi Arabia** – Zain has deployed more than 5,000 5G towers across 53 cities and has put 5G FWA at the centre of its strategy, aiming to maximise the capacity of its 5G network.

FWA is not new in Africa

Operators in Africa are not entirely new to FWA services, as several already provide 4G FWA. For example, Telkom South Africa launched Huawei's WTTx solution in 2014, leveraging its extensive LTE network to reach customers in areas not covered by fixed broadband networks and to serve customers in lower-income segments. In March 2023, the operator reported that 57% of data traffic on its network is utilised for FWA services, compared to 39% for mobile data services.[3]

With the deployment of 5G networks in the region, operators have also begun rolling out 5G FWA services. For example, in October 2022, Telkom South Africa launched 5G FWA, in collaboration with Huawei, with 123 5G base stations in Gauteng, KwaZulu-Natal, Eastern Cape and Western Cape. As of September 2023, 14 operators in nine markets across Sub-Saharan Africa had launched commercial 5G FWA services. Recent launches include Airtel in Nigeria and Tanzania, and QCell in Gambia.

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

As more operators begin to deploy 5G networks, 5G FWA will be an important use case to both drive incremental revenue growth and meet the connectivity needs of homes and businesses, given the lack of fixed broadband infrastructure in most urban and rural locations across the region.

3 Telkom South Africa Group Annual Results, March 2023

1.3 FWA adoption and revenue forecasts

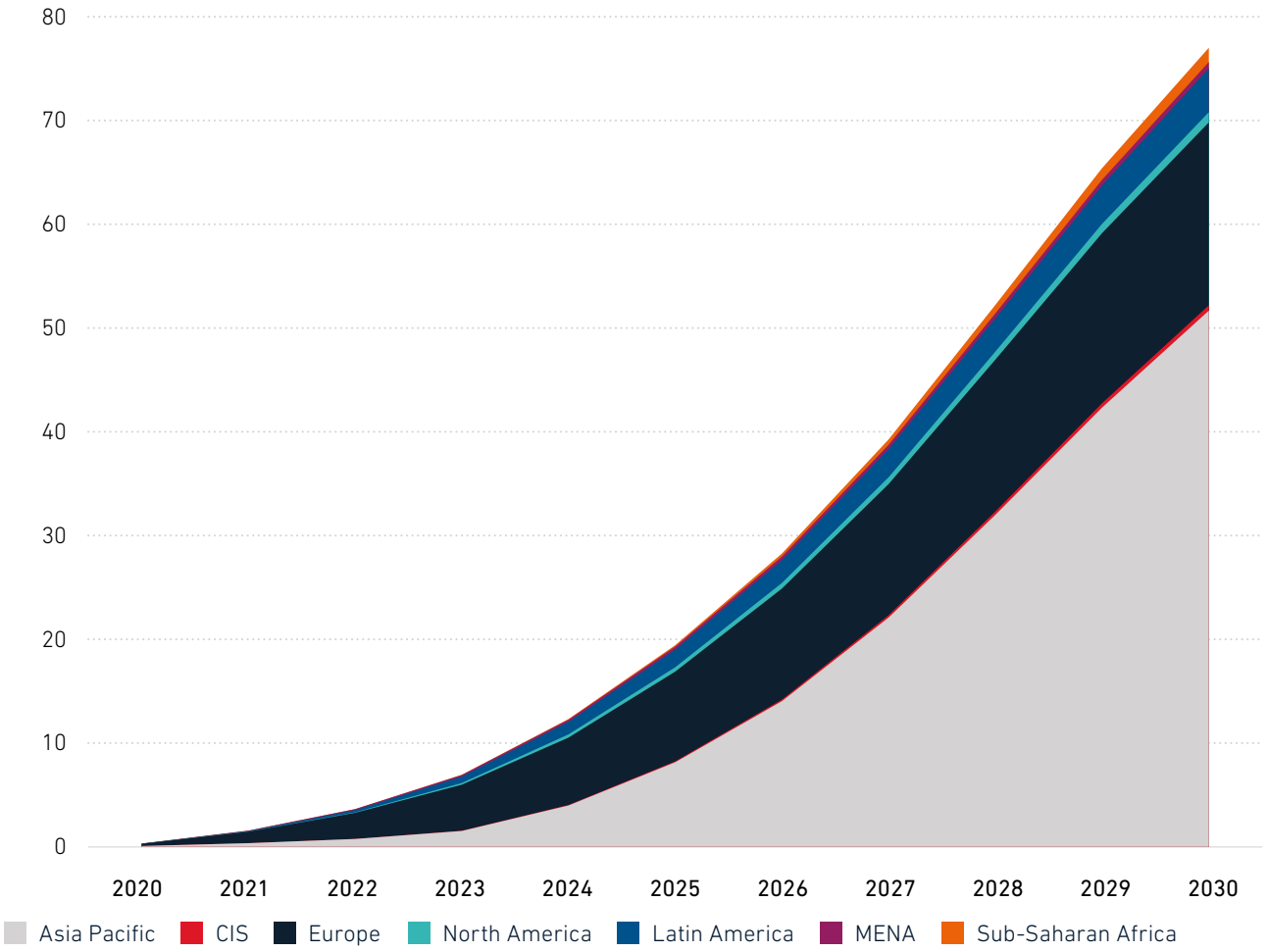
The momentum behind 5G deployments is matched by growing consumer uptake in most markets, driven by latent demand for enhanced connectivity and the increasing affordability of CPE devices.

Figure 4 shows that global 5G FWA connections will nearly reach 80 million by 2030. Asia Pacific and Europe will account for the largest shares – at 67% and 23%, respectively.

Figure 4

Global 5G FWA connections forecast

Million



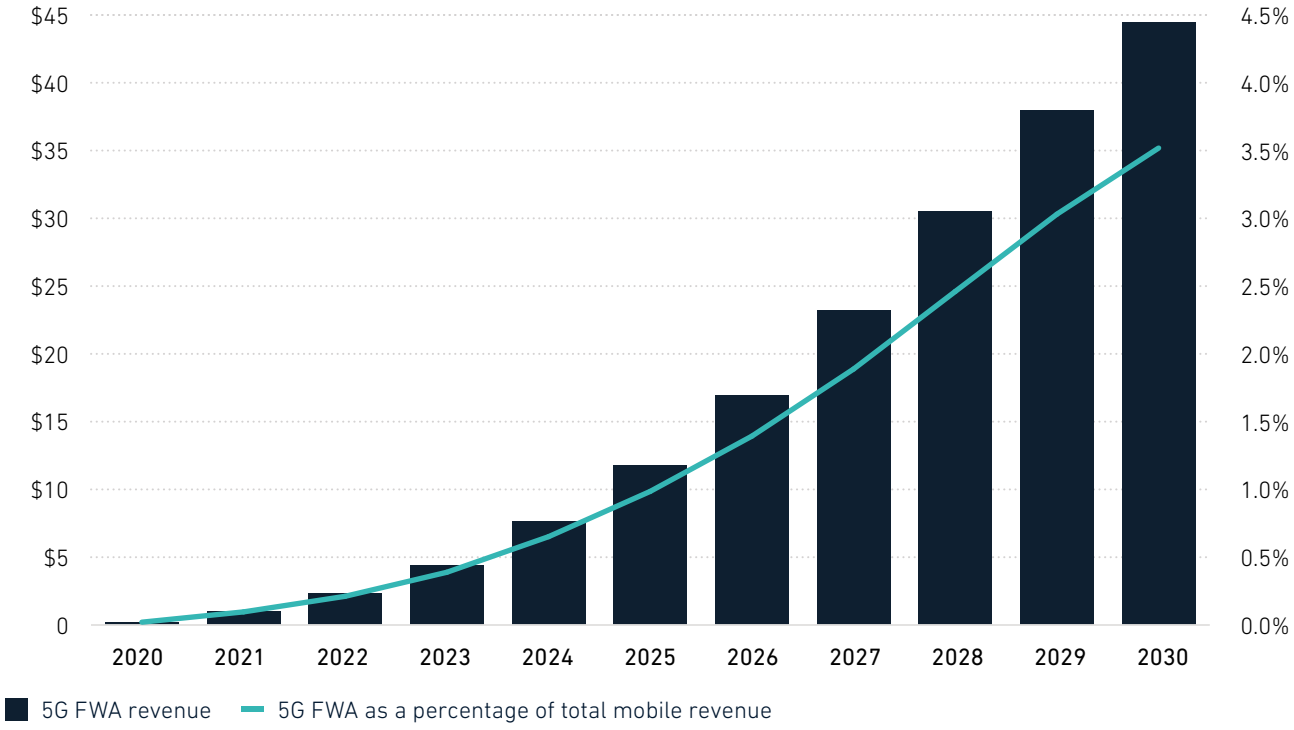
Source: GSMA Intelligence

Figure 5 shows that global 5G FWA revenues will reach around $44 billion by 2030, accounting for 3.5% of total mobile revenue. The revenue outlook highlights the size of the 5G FWA opportunity for mobile operators, especially those that do not currently have a significant presence in the fixed broadband market.

Figure 5

Global 5G FWA revenue forecast

Billion



Source: GSMA Intelligence

Consumer interest in 5G FWA

For the third year in a row, 5G FWA topped the list of 5G use cases that consumers find highly appealing in GSMA Intelligence's annual consumer survey. The 2022 survey results showed that 53% of consumers who have already upgraded to 5G or intend to upgrade to 5G find 5G-based home broadband an appealing proposition – a greater share than for any other 5G use case. Consumers increasingly see 5G FWA as a viable alternative to ageing xDSL and cable networks and as an appealing option for high-speed home broadband in hard-to-reach rural areas. Operators are strategically positioning FWA in response to the increasing consumer interest and growing viability of the technology.

2

5G FWA in Africa

In Africa, mobile internet penetration reached 28% at the end of 2022. However, ITU data shows that fixed broadband penetration was less than 2% on average, at that time. With connectivity becoming integral to the way people live and businesses operate, the need to increase broadband access for households and businesses, in addition to the personal connectivity provided by mobile broadband networks, has never been more urgent.

2.1 The last-mile connectivity challenge

Africa has seen a significant rise in mobile internet connections over the last five years, driven by operator investment in mobile broadband (3G, 4G and 5G) networks and rising smartphone adoption. While mobile broadband connections have played an important role in connecting people across the region, there is a need to address support for the increasing number of internet-enabled devices in households and enterprises. Various technologies have been deployed to deliver broadband connectivity, but many face challenges that limit their ability to scale up in the region. For example, FTTx and other wired technologies are limited by the following:

- significant investment requirements and, by extension, a challenging business case, given the low income levels of many households in Sub-Saharan Africa
- the cost and complexity of civil works for laying physical networks, and issues around obtaining the necessary right-of-way (RoW) permits
- the potentially lengthy time to deploy wired infrastructure, resulting in extended periods for RoI.

As an example, in South Africa, it cost around ZAR700 ($48) per metre of fibre for a trenched solution, according to 2015 estimates from local fibre providers.[4] This figure can rise sharply in sparsely populated areas, increasing the cost per active user for the service provider. To improve the business case for fibre rollout, some local providers plan to deploy aerial fibre,[5] but this comes with its own set of challenges around obtaining the right-of-way permits from local municipalities.

To address these and other challenges, some operators in the region have deployed FWA services to extend connectivity to the last mile. However, for FWA to be a competitive substitute to FTTx, it needs to provide fibre-like performance but at a lower cost. The advent of FWA solutions based on 3GPP radio technologies, such as 4G LTE and 5G new radio (NR), has significantly improved the outlook for FWA services. The advantages of 3GPP-based FWA solutions include the following:

- **Ecosystem support and maturity** – 3GPP radio technologies have wide industry support and a mature ecosystem of vendors and operators. Global adoption and open specification processes mean different companies and experts can drive the development of standards. Technologies such as WiMAX have failed to establish a similarly mature ecosystem.
- **Data throughput** – 3GPP radio technologies (starting from 4G) are optimised for broadband services and deliver hundreds of megabits per second. 3GPP technologies achieve higher throughput by using radio access technology to exploit high-band spectrum.
- **Cost** – LTE-A technologies,[6] such as massive MIMO, and the increasing optimisation of outdoor CPE and related technologies have significantly reduced the cost of 4G FWA relative to other fixed wireless technologies.
- **Spectrum efficiency** – Mobile operators may not always need to acquire additional spectrum for 3GPP-based FWA, as they can use the spectrum allocated for mobile broadband. This is possible because of the potential to optimise several parameters at the base station and CPE levels.

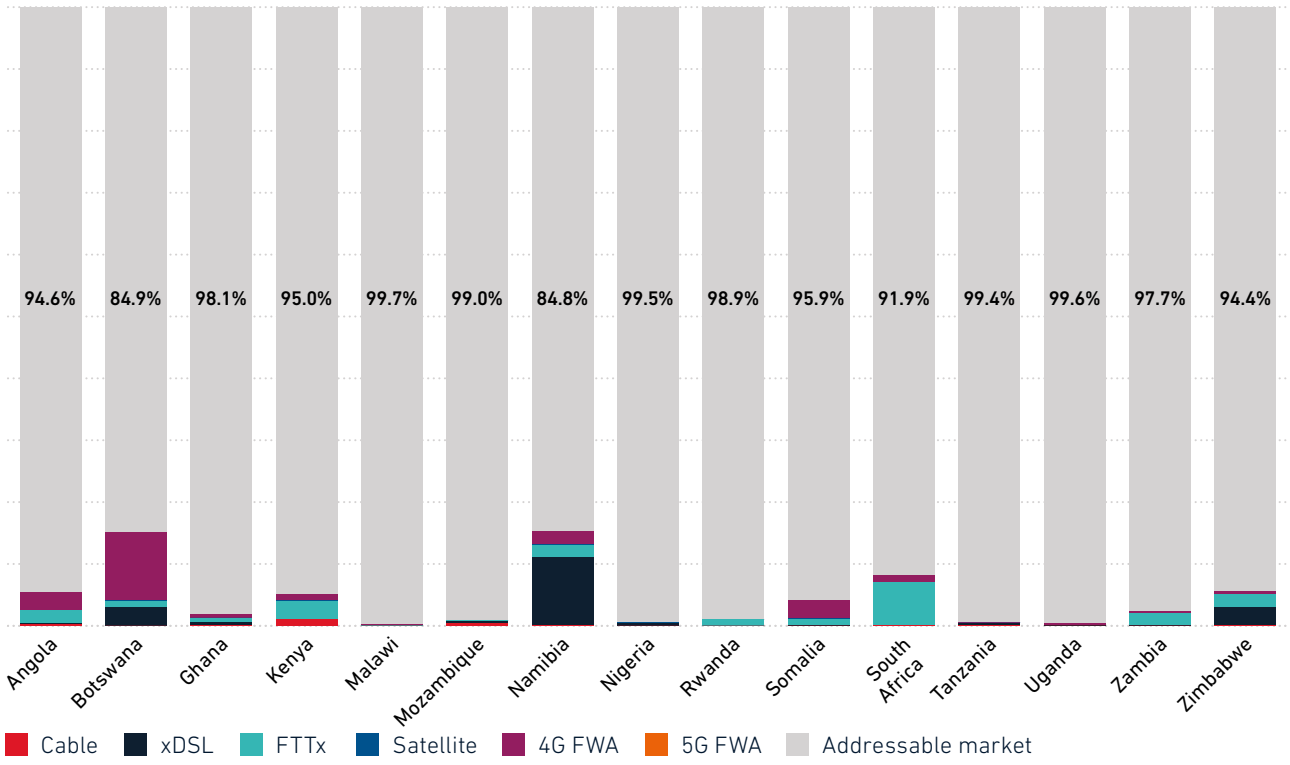
Figure 6 shows the household penetration levels of various fixed broadband services in selected countries in Africa. In every country except Botswana and Namibia, the addressable market for fixed broadband is above 90%. Even in Botswana and Namibia, the addressable market of approximately 85% is significantly larger than in most advanced countries. Given the challenge of extending fixed broadband to these households via traditional wired technologies, there is a significant opportunity for operators to leverage FWA solutions to close the gap in last-mile connectivity for broadband services in the region.

4 "How much FTTH really costs to roll out", MyBroadband, July 2015
5 Fibre cable installation on streetlight poles rather than in trenches
6 Long Term Evolution Advanced (LTE-A) is a cellular networking standard that offers higher throughput than its predecessor, the LTE standard. LTE-A networks can deliver up to 1 Gbps of data, compared to a maximum of 300 Mbps over LTE networks.

Figure 6

Penetration of fixed broadband connections

Percentage of households, 2022

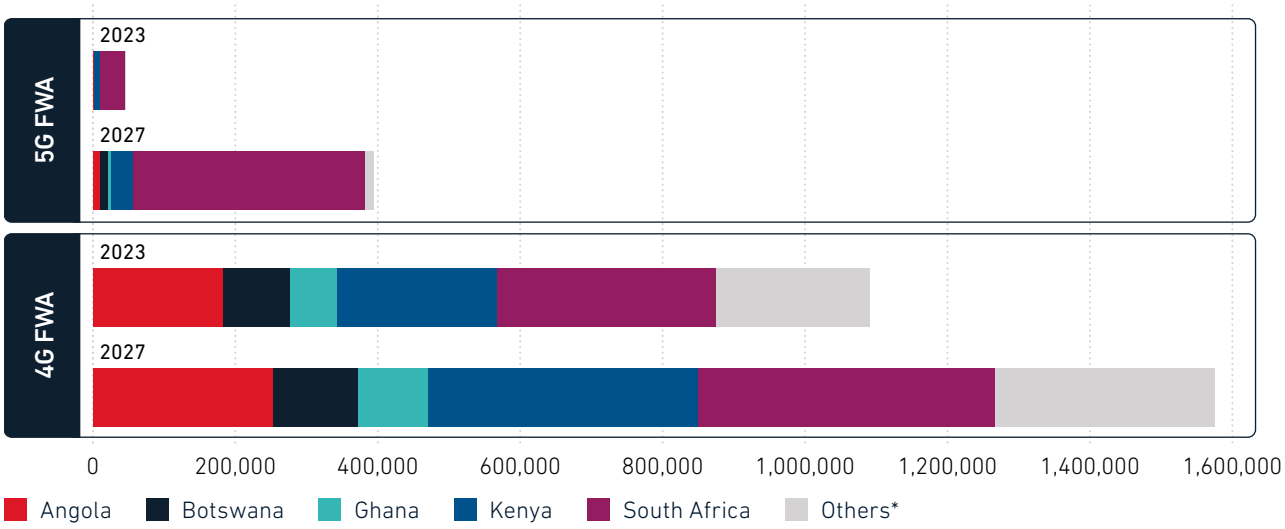


Source: GSMA Intelligence

GSMA Intelligence forecasts for 4G FWA project the total number of connections in the selected countries to rise from just under 1 million connections in 2022 to nearly 1.6 million by 2027. Within this aggregate figure, South Africa, Kenya and Angola are among the largest FWA markets, jointly accounting for two thirds of total connections in the selected countries by 2027 (see Figure 7).

Figure 7

FWA connections forecast for select countries in Africa



Note: others includes Malawi, Mozambique, Namibia, Nigeria, Rwanda, Somalia, Tanzania, Uganda, Zambia and Zimbabwe.
Source: GSMA Intelligence

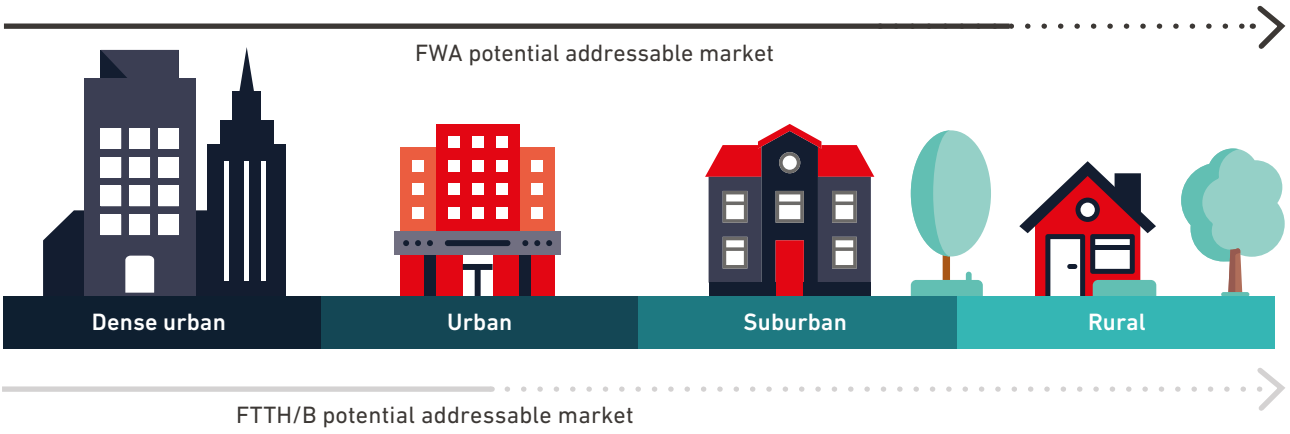
2.2 The 5G FWA opportunity and considerations

The opportunity

The deployment of 5G networks across Africa offers a way forward for operators to address the core challenges inhibiting adoption of fixed broadband services in the region. Given the limitations of FTTx and the size of the addressable market for fixed broadband, 5G FWA is well positioned to serve as a primary fixed broadband connectivity solution for households across urban, suburban and rural areas in the region, and cater to the connectivity needs of enterprises of all sizes.

Figure 8

5G FWA's potential to reach users across different geographical areas



*This is an indicative scenario showing the reach of fibre versus FWA services. This could be different in some countries, depending on the state of a particular country's telecoms market.
Source: Huawei, GSMA Intelligence

The low level of fixed broadband development in Africa means operators have the opportunity to deploy 5G FWA in multiple scenarios. Two of the four scenarios highlighted in Table 1 stand out: a primary broadband solution for households without access to fixed alternatives, and capturing the enterprise opportunity, particularly the MSME segment, which is responsible for more than 80% of Africa's employment and 50% of GDP, according to the World Economic Forum. Although 5G FWA in Sub-Saharan Africa is still nascent, early deployments are targeting first-time adopters and locations with a high concentration of MSMEs and large enterprises, including public institutions.

In the few cases where fixed infrastructure is relatively developed, such as in urban locations in South Africa, 5G FWA can be positioned as both a competing and complementary solution. For example, in 2019, Rain in South Africa launched commercial 5G FWA services in several urban and suburban areas with existing FTTx and xDSL infrastructure, including Johannesburg, Tshwane, Cape Town and Durban.

Table 2 highlights the 5G FWA activities of several operators in the region.

Table 2

Examples of 5G FWA developments in Africa

Operator	Details
Safaricom	In August 2022, Safaricom announced the completion of a 4G and 5G FWA network slicing pilot on its live commercial network, enabling it to support new types of enterprise network services, including fast-lane internet access and application slicing.
Rain	In 2019, Rain launched its FWA service in South Africa, starting in Johannesburg and extending to other major urban areas. In May 2023, it unveiled a fixed-mobile convergence (FMC) product, branded rainOne, following the launch of its 4G mobile network. Media reports have highlighted the growing popularity of the operator's FMC product among users.[7]
MTN	MTN plans to connect 10 million fixed broadband homes by 2025, mostly in South Africa and Nigeria. The plan involves providing mobile broadband modems for up to 30% of the households, FWA (based on 4G and 5G) for up to 10%, and fibre for up to 1%. In its FY 2022 report, MTN indicated that FWA is increasingly seen as a credible alternative to fibre, spurring new MTN Home subscribers across it key markets. In Nigeria, FWA data consumption per home reached 75 GB for the year.
Vodacom	Vodacom Tanzania's 5G FWA service targets homes and businesses. The operator intends to exploit the intersection of flexibility and fibre-like performance to deliver enhanced connectivity for fixed and temporary locations, and help businesses realise faster time-to-value than with other connectivity solutions.
Telkom South Africa	At its 5G network launch in October 2022, Telkom South Africa put 5G FWA at the heart of its strategy. It aims to build on the successes of its 4G FWA service. Telkom is shutting down its legacy copper network and views 5G FWA as a credible alternative to fibre in smaller towns that are often low priority for fibre rollouts, and a complement to fibre in urban areas with demand for connectivity.
Orange	In November 2022, Orange Botswana launched commercial 5G services, focusing heavily on 5G FWA as a way to expand broadband services to larger populations. Orange already offers 4G-based FWA in Botswana, where half of its 2 million broadband customers are connected wirelessly, with the other half connected by fibre.[8] The operator is targeting residential customers and MSMEs for its 5G FWA services.

7 "Rain says fixed-5G plan with free mobile data and minutes is going strong", MyBroadband, September 2023
8 "Orange turns on first African 5G network, prioritizing FWA", Rethink Research, November 2022

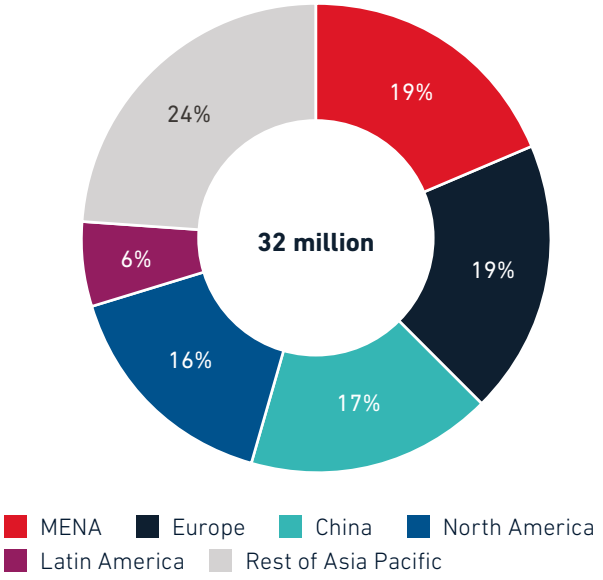
Considerations

CPE device trends

Given the higher costs associated with 5G modems, affordability of 5G FWA CPE has until recently been a major challenge hindering mass adoption globally. However, the growing supply of lower cost 5G FWA CPE is a change factor for 5G FWA compared to 4G FWA. According to the GSA, global shipments of 5G FWA CPE devices (among respondents in its annual survey) more than doubled in 2022, reaching 7.4 million in the first half of 2023, and are forecast to increase to 13.8 million by the end of the year.[9] Overall, 4G and 5G FWA CPE shipments in 2023 are expected to reach 32 million, with the Middle East and Africa accounting for nearly a fifth (see Figure 9).

Figure 9

Share of FWA CPE device shipments, 2023



Source: GSA

With increasing supply and lower cost components, the ex-factory costs of 5G CPE have reduced substantially in recent years to around $150 or less in many cases. Respondents to the GSA survey expect the prices of 5G CPE to reach the current levels of 4G CPE by 2025 – a situation that would help address the affordability challenge and drive 5G FWA adoption.

Backhaul transport

The average consumption of data for 5G FWA is usually higher than for a 5G mobile subscriber. Use within a household is spread across multiple people, devices and applications, many of which are data intensive (e.g. OTT streaming at home). Higher data consumption will mean a higher volume of traffic from the premises must be transported through the base station to the core network.

This connection ideally requires the capabilities that a fibre link can deliver. However, with limited fibre infrastructure in the region, operators rely on microwave solutions. Newer technology alternatives are emerging for backhaul, such as point-to-multipoint technologies deployed in the 60 GHz E-band; these have much higher capacity than traditional microwave and can act as an alternative to fibre.

Installation costs

While capex for FWA could be significantly lower than for fixed alternatives, operating costs such as spectrum fees, power and site rental, and outdoor CPE installation costs could quickly add up. For this reason, operators are attempting to minimise costs by sharing network capacity between mobile broadband and FWA services. In the US, for example, Verizon has focused primarily on areas where it has adequate 5G mobile coverage and sufficient spectrum. Furthermore, existing or already planned RAN infrastructure in a specific area can include 5G FWA deployment to save on costs.

Operators also incur opex when they need to do a truck roll for installation. A truck roll refers to the operator sending out a technician or team to the customer's site, incurring an operating cost. Operators such as Verizon, T-Mobile and Telstra have all selected CPE with self-install capabilities to minimise the need for truck rolls and save on installation costs. There is also growing momentum behind indoor CPE devices that do not require specialist installation.

9 Fixed Wireless Access CPE Vendor Survey 2023, GSA, 2023

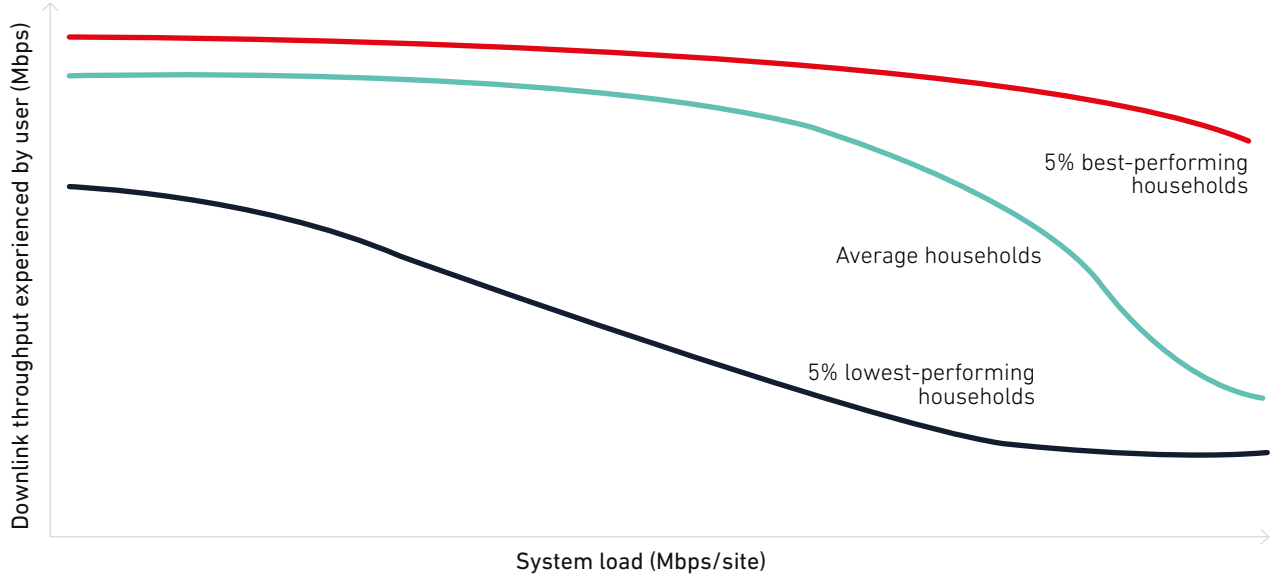
Interference and path loss

Operators will have to manage how to separate mobile and FWA traffic. This will not be an issue in the early days of 5G deployments when the network is not fully loaded. However, the available bandwidth will become challenged with more subscribers connecting to an individual base station. With higher range frequencies, such as mmWave, there are additional interference and path loss challenges. Weaker signal strength means mmWave signals tend to fade, particularly indoors.

FWA radio signal propagation is susceptible to path loss from adverse weather and difficult terrain, such as mountainous regions and locations with heavy foliage. There is also a risk of signal degradation during peak consumption hours, as shown in research conducted by Ericsson (see Figure 10). Newer technologies and CPE that utilise high-gain antenna systems can help address some of these challenges. CPE with an outdoor antenna, which can be placed at higher levels, could also help minimise interference and path loss.

Figure 10

The risk of signal degradation increases during peak hours for FWA



Source: representation of trends in "Leveraging LTE and 5G NR networks for fixed wireless access", Ericsson Technology Review, 2018

Range/distance to CPE

5G connectivity can be achieved over several radio frequency bands, though most deployments have focused on sub-6 GHz, typically 3.5 GHz. Operators face a difficult trade-off: while higher frequency bands can offer much larger channels and greater bandwidth, they suffer from weaker propagation characteristics. As such, operators will need to plan their networks with the right cell density to cope with the available spectrum and usage characteristics.

In several instances, mmWave provides an opportunity for operators that are constrained in their mid-band holdings to deploy 5G FWA. The deployment of a large-scale mmWave network is not without its challenges. As the size of a mmWave cell, depending on propagation characteristics, is expected to be in the order of 200 to 1,000 metres outdoors and tens of metres indoors, achieving nationwide coverage would be prohibitively expensive. However, vendors are increasingly developing solutions to address such shortcomings. In February 2022, Qualcomm announced new features and capabilities supporting 5G mmWave for its Qualcomm 5G FWA Platform, which services more than 40 OEMs and 125 FWA designs.

2.3 5G FWA market readiness in Africa

The FWA opportunity depends on a combination of factors supporting its adoption. These cut across demand, supply and regulatory imperatives. Understanding these and how they impact the deployment and adoption of 5G FWA services is an important first step to assessing a market's readiness for 5G FWA.

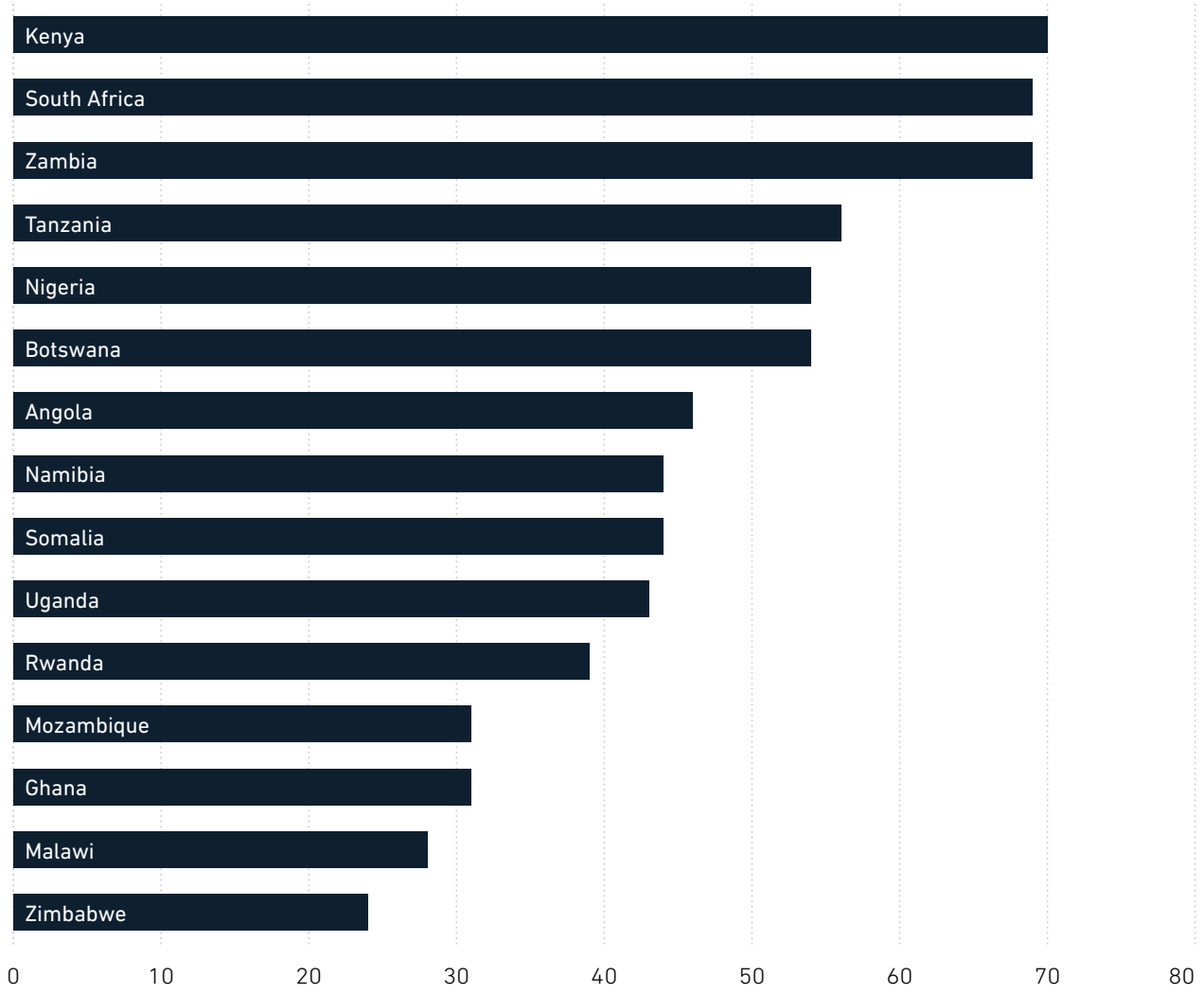
- **Spectrum availability** – the assignment of 5G spectrum for the development of 5G FWA.
- **4G FWA availability** – the availability of 4G FWA, providing a stronger base from which to develop 5G FWA.
- **CPE device affordability** – the availability of affordable devices, relative to income levels.
- **Technology-neutral spectrum licensing** – allowing operators to refarm legacy network spectrum used for 4G/5G.
- **5G network coverage** – the addressable market for 5G FWA services.

Using the above factors, GSMA Intelligence developed a 5G Readiness Index for selected countries. Kenya, South Africa and Zambia top the list, scoring well across all five factors (see Figure 11).

Figure 11

5G FWA readiness for selected countries in Africa

Index score of 1–100



Source: GSMA Intelligence

Spectrum availability

FWA services can use spectrum in different bands, depending on demand and location. Available bandwidth is also critical to ensuring fibre-like performance and facilitating high-bandwidth and low-latency services. Most 5G FWA deployments are currently in the 3.5–3.8 GHz frequency band. However, 2.3 GHz and 2.6 GHz are also major 5G frequency bands and can carry 5G mobile and FWA services.

In addition, RF modules in 2.3/2.6 GHz spectrum can support 4G and 5G at the same time, and devices are well prepared for this. This can meet the requirements of African operators looking to run 4G and 5G service simultaneously. Spectrum availability at 2.3, 2.6 and 3.5 GHz is therefore critical to the development of 5G FWA in Africa. Of the 15 selected countries, eight have allocated 5G spectrum as of October 2023.

Table 3

Spectrum availability

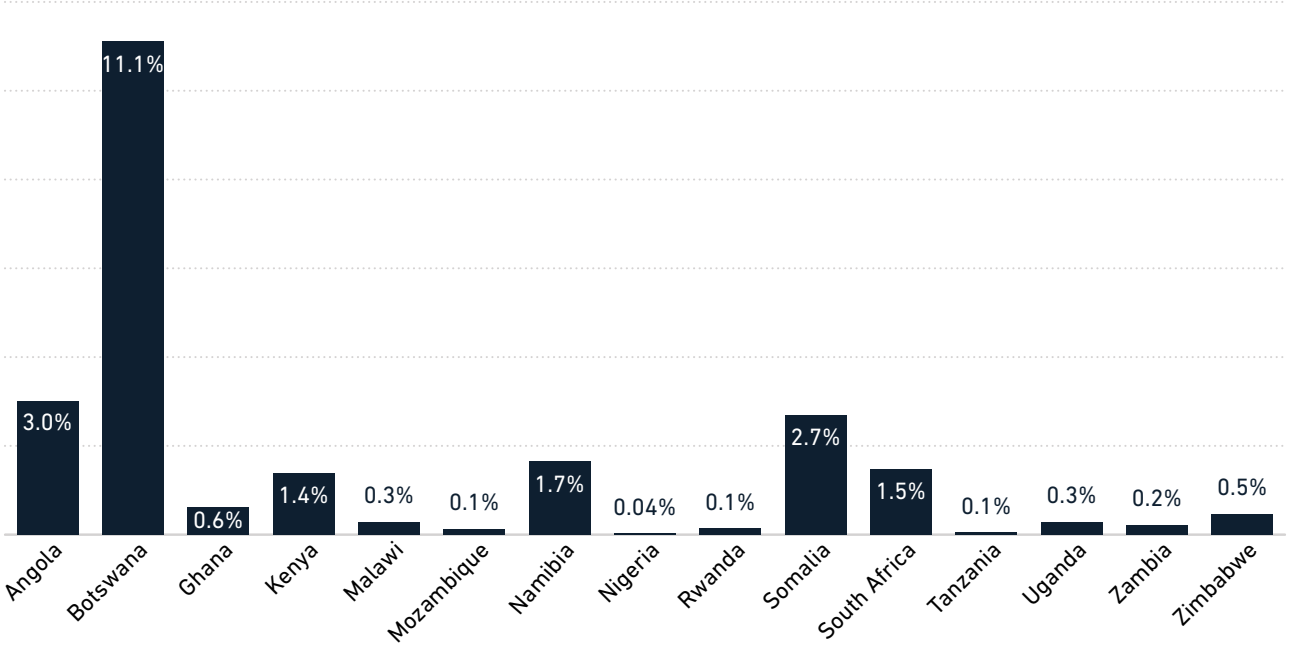
Angola	In December 2021, the Angolan Communications Institute (INACOM) granted 5G licences to Africell, Movicel and Unitel, with an allocation of spectrum in the 3.3–3.7 GHz band. The licence allows the operators to carry out tests for a period of two years, during which they are exempt from paying fees for the use of the spectrum. In the subsequent stage, the operators will be assigned definite licences, for which they will pay for the use of the designated spectrum.
Kenya	In May 2022, the Communications Authority of Kenya (CA) allocated 60 MHz of spectrum in the 2.6 GHz band to Safaricom for 5G services. In July, Airtel acquired 60 MHz of spectrum in the 2.6 GHz band for $40 million. The CA noted that the 3.5 GHz band, within which most WiMAX networks were deployed in Kenya, would be refarmed for 5G technology from 30 June 2022.
Namibia	In October 2023, The Communications Regulatory Authority of Namibia (CRAN) awarded 5G licences to Loc8 Mobile, Telecom Namibia Limited and Mobile Telecommunications Limited. The licensees will make use of the assigned frequencies at 703–788 MHz and 790–862 MHz.
Nigeria	In December 2021, MTN and Mafab Communications each won 100 MHz of spectrum in the 3.5 GHz band for 5G services. In December 2022, Airtel secured 100 MHz of spectrum in the 3.5 GHz band, in an auction carried out by the NCC. It was the sole bidder. In January 2023, the operator secured a further 2×10 MHz in the 2.6 GHz band.
South Africa	In March 2022, South Africa's mobile network operators Vodacom, MTN, Rain, Telkom, Cell C and Liquid Telecom all obtained spectrum licences. These were sold in the 700 MHz, 800 MHz, 2.3 GHz, 2.6 GHz and 3.5 GHz bands.
Tanzania	In October 2022, Tanzania Communications Regulatory Authority (TCRA) completed its auction of additional frequencies in the 700 MHz, 2.3 GHz, 2.6 GHz and 3.5 GHz bands. The winners were Vodacom, Airtel, Millicom and Viettel.
Uganda	In June 2023, the Uganda Communications Commission (UCC) awarded spectrum to MTN and Airtel in the 700 MHz, 800 MHz, 2.3 GHz, 2.6 GHz and 3.5 GHz bands, reaching at least 100 MHz per operator in the mid-bands for 5G.
Zambia	In August 2022, the Zambia Information and Communications Technology Authority (ZICTA) revised its 5G Spectrum Roadmap. This included timelines for the assignment of spectrum in the 700 MHz, 2.6 GHz, 3.3 GHz, 3.5 GHz and 26 GHz bands between Q3 2022 and 2024.

4G FWA availability

4G FWA provides a foundation on which to build 5G FWA. Operators can build on the experience of providing 4G FWA to develop their 5G FWA service offering and prepare the user base to be upgraded when service becomes available. All 15 countries have launched 4G FWA services, but the rate of adoption remains low (see Figure 12). Botswana is a clear leader, with 4G FWA household penetration in double digits.

Figure 12

4G FWA connections penetration (percentage of households), 2022



Source: GSMA Intelligence

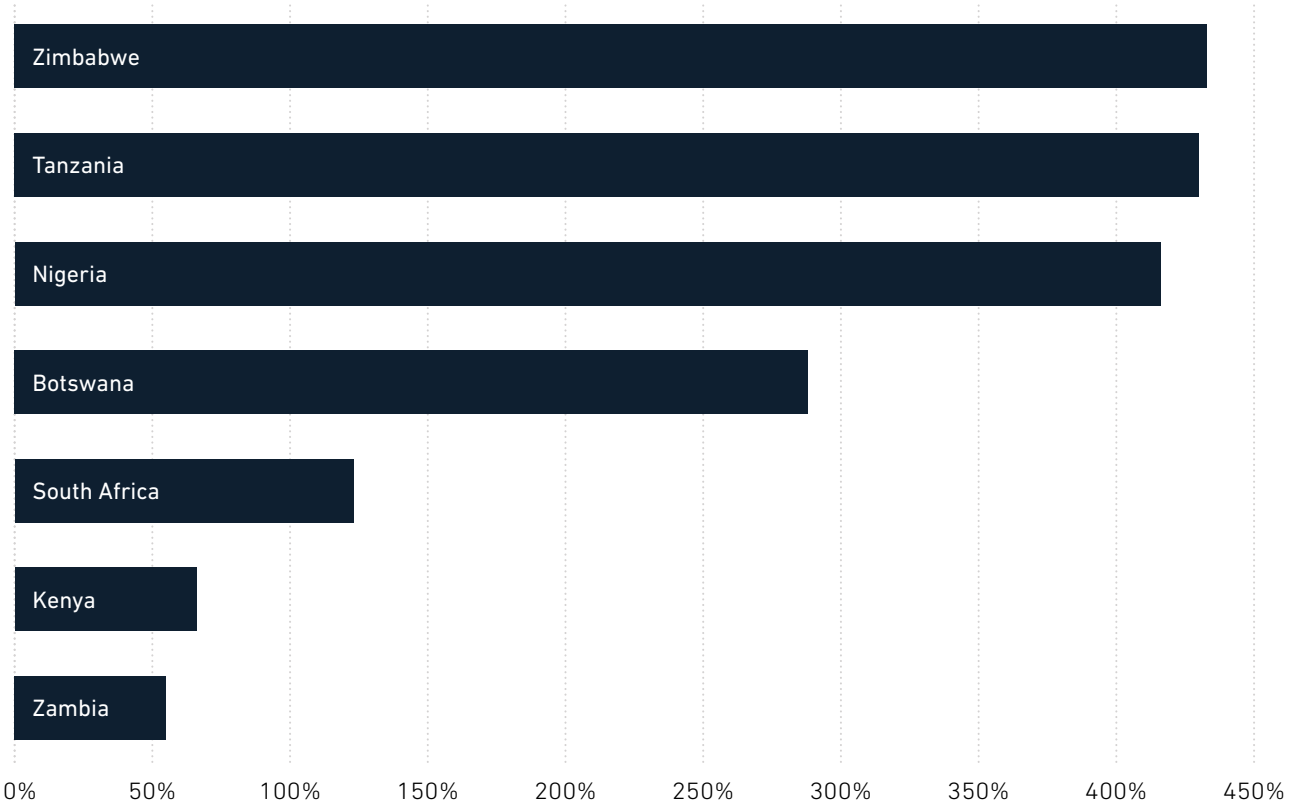
FWA CPE device affordability

The availability of affordable CPE devices is a key enabler of 5G FWA uptake. Currently, retail prices of CPE devices (4G and 5G) vary considerably across markets in the region in absolute terms – a reflection of factors such as government taxes, operator subsidies and distribution costs. For example, basic 4G Mi-Fi devices are available for around $30 in Somalia, while 5G routers cost more than $600 in Zimbabwe. On average, 4G CPE devices cost around 50% less than 5G CPE devices in most of the selected markets.

To ascertain the affordability of devices for local customers, GSMA Intelligence analysed the indoor 5G CPE device costs relative to the minimum monthly wages of consumers in the selected countries. The vast majority of deployments are planned to be indoors, which allows operators to keep costs in check. Figure 13 shows the 5G CPE costs in markets where data is available as a percentage of the minimum monthly wage. Zambia and Kenya have the most affordable 5G CPE device costs, at just over 50% of minimum monthly income. In Nigeria, Tanzania and Zimbabwe, this figure is more than 400%.

Figure 13

5G CPE costs as a percentage of minimum monthly wage



Note: data correct as of 30 September 2023
Source: company websites and announcements, GSMA Intelligence

For comparison, 5G CPE devices generally cost less than 30% of the minimum monthly wage in most advanced markets. However, in these markets, operators usually bundle the device costs with data tariffs in a postpaid contract over a set period. Operators in Africa are increasingly adopting a similar model, particularly in countries such as Kenya and South Africa.

Technology-neutral spectrum licensing

Given its performance capabilities, 5G has brought a new dimension to the spectrum refarming space. While the majority of 5G deployments to date have been in new mobile broadband frequency bands, notably 3.5 GHz, it is essential that mobile operators have the freedom to refarm existing spectrum assignments, particularly to meet the requirements of the 5G coverage layer, which benefits from the propagation capabilities of sub-1 GHz spectrum (600, 700, 800, 850 and 900 MHz). Some of these have been licensed as 2G, 3G or 4G technology-specific spectrum but will be useful as a 5G coverage layer.

As new 5G spectrum has yet to be assigned in many markets, mobile operators are utilising spectrum refarming in some legacy bands to support 5G deployments, such as the 1800, 2100 and 2600 MHz bands. Technology neutrality is also necessary for dynamic spectrum sharing (DSS), which allows mobile operators to use the same spectrum band for different radio access technologies such as 4G and 5G, in the absence of new 5G spectrum. It works by allocating spectrum to different technologies in real time, based on demand. In Africa, MTN has deployed the technology in South Africa, in partnership with Huawei, using DSS in the 2100 MHz frequency band to upgrade existing 4G base stations to 5G without changing antennas and radio units.

In the 15 countries studied, full technology neutrality is available in 10: Angola, Botswana, Kenya, Nigeria, Rwanda, Somalia, South Africa, Tanzania, Uganda and Zambia. Across the wider region, 28 countries are yet to fully implement technology-neutral spectrum licensing, limiting the ability of operators to refarm spectrum used for legacy networks for 4G and 5G upgrades.

5G network coverage

The launch of commercial 5G services is a first step towards realising the potential of 5G FWA. At the end of September 2023, 27 operators in 16 markets in Africa had launched commercial 5G services. Almost 10 different operators in the region now provide 5G FWA services across various countries, including eight of the 15 selected countries (Angola, Botswana, Kenya, Nigeria, South Africa, Tanzania, Zambia and Zimbabwe).

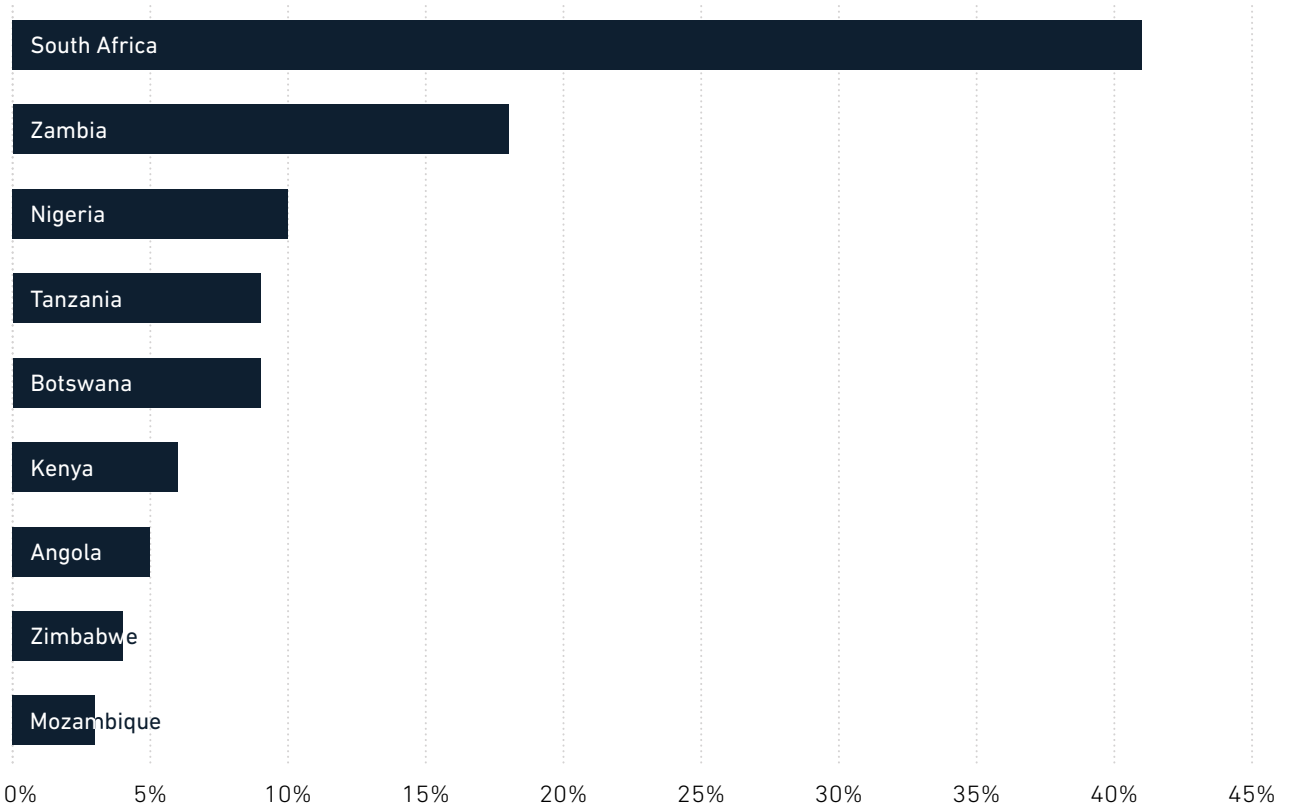
In these countries, 5G coverage is growing rapidly. In South Africa, for example, 5G coverage reached 41% of the population as of September 2023 (see Figure 14).

For countries that have not deployed 5G, 4G is the dominant network. Most African countries now have widespread 4G coverage, and 4G FWA has already been deployed and can grow further. Developing 4G FWA in such markets can help to cultivate habits and lay the foundation for 5G development.

Figure 14

5G coverage

Percentage of population



Note: data correct as of 30 September 2023
Source: GSMA Intelligence

5G FWA LESSONS FROM OTHER REGIONS

Zain Saudi Arabia
5G FWA at the centre of its business strategy

Zain's 5G FWA offering, 5G Home, was launched in October 2019 as part of the operator's 5G launch. The service is offered over the same network grid as Zain's 5G mobile service, allowing it to target households in urban, suburban and rural areas. Zain's 5G FWA effort is part of the wider progress with FWA in Saudi Arabia; FWA has helped drive fixed broadband household penetration from 30% in 2015 to around 90% as of Q3 2022. 5G FWA also supports Zain's objective to transform into a fixed-mobile convergence (FMC) player by bundling FWA with mobile services.

Zain's pricing highlights the opportunity for operators to achieve material revenue contributions from FWA. Zain's most affordable 5G FWA plan is SAR289 ($77) per month, which is more than double its mobile ARPU. Zain's 5G FWA tariffs also show how it is targeting indirect revenue growth by bundling content add-ons.

Zain Saudi Arabia reported that its 5G FWA connections grew by 12× between 2019 (the launch year of its 5G FWA service in Saudi Arabia) and 2021, implying strong customer interest in 5G FWA services.

Government support has been crucial to the development of 5G FWA in Saudi Arabia. The government established a National 5G Task Force to increase regulatory certainty and the timely availability of 5G spectrum. This enabled Zain to use the 2.6 GHz band as the coverage layer for its FWA deployments, with spectrum in the 3.5 GHz band used to provide additional capacity. Zain also deployed further sites and upgraded its backhaul network to cope with additional data traffic and to ensure it could meet its download speed guarantees.

5G FWA LESSONS FROM OTHER REGIONS

Telenor Norway
Complementing fibre with 5G FWA

Telenor launched 5G home broadband services in Finland in 2019, followed by a launch in Norway in 2020. Telenor Norway's fixed broadband strategy is centred on its fibre and wireless (4G and 5G) assets. The operator decommissioned its copper network in December 2022 and migrated 95% of the users (and 70% of revenue) to fibre or FWA.

Fibre is pitched as the fastest option available to customers, best suited for those with high-bandwidth requirements. All fibre plans above 300 Mbps are priced more attractively than their FWA equivalent plans. 5G FWA is positioned as the alternative for those living outside of fibre's reach. 5G is expected to be available nationwide by the end of 2024. In 2022, Telenor added 27,000 FWA customers. This compares with 33,000 fibre customers and implies strong FWA growth.

Government initiatives are helping to support FWA rollout. Telenor Norway was one of three operators that agreed to extend broadband coverage to rural areas in exchange for a discount on the price of spectrum. In early 2023, the government announced a new set of subsidies to ensure that all Norwegian households have access to fixed broadband services with download speeds of 100 Mbps or more by the end of 2025.

3 Implications and imperatives for stakeholders

Connectivity is essential to building Africa's digital economy. While mobile broadband connections have played an important role in connecting people across the region, addressing the gap in last-mile fixed broadband connectivity is necessary to deliver enhanced connectivity services to households and enterprises. 5G FWA is well-placed to play this role, offering policymakers and operators the opportunity to overcome many of the limitations of other fixed broadband services, including cost, complexity and time to market.

To take advantage of these opportunities, stakeholders will need to take steps to facilitate the deployment of 5G FWA networks and stimulate adoption among households and enterprises.

3.1 Governments and policymakers

An important first step for governments is to acknowledge the role that 5G FWA can play in the realisation of national broadband and digitalisation plans. This will stimulate the right policy response across all levels of government to create an enabling environment for investment in 5G FWA networks and the adoption of services by citizens and businesses.

Facilitate access to spectrum for network deployment

Mid-band spectrum is a good fit for 5G FWA in population clusters such as towns and smaller urban areas, in most cases with a single base station. This is especially true where other options are expensive or unavailable.

Low-, mid- and high-band spectrum all have roles to play as 5G FWA connectivity expands. Lower bands (e.g. sub-1 GHz) are useful for rural and remote areas, where populations are more spread out, while mmWave can provide access in more densely populated areas, with the fastest 5G speeds. As successful 5G networks and services depend on a significant amount of spectrum across all three bands, ensuring the timely availability of spectrum in these bands and on the right terms should be prioritised by authorities.

Refarming 2G, 3G and 4G bands can contribute to meeting 5G spectrum requirements. To this end, regulators and authorities should implement technology neutrality for all mobile operators where it does not yet exist, and avoid delaying the refarming of spectrum through technology-specific licensing or other forms of restrictions. Regulators should also consider 5G backhaul needs, including making additional bands available and supporting wider bandwidths in existing bands. In the near term, the E-band (70–80 GHz) will be most important, especially to support initial 5G growth, but the W-band (92–114 GHz) and D-band (130–175 GHz) will be vital to increase capacity in subsequent years.

Implement policies to stimulate network investments

5G network deployment is capital intensive for operators. As such, additional burdens on rollout projects, such as complex planning procedures, can significantly delay 5G deployment. Policymakers are encouraged to simplify planning procedures and regulations for site acquisition, co-location and base station upgrades, and provide operators access and rights of way to public/government facilities for antenna siting and fibre deployment on reasonable terms and conditions.

Reduce or eliminate taxes on CPE to improve affordability

CPE device affordability is a key factor in the adoption of FWA services. With technological advancements and growing competition among vendors, the ex-factory cost of CPE devices is trending downwards. However, they largely remain unaffordable for most users in Africa. According to GSMA research, post-production costs, such as shipping, customs and tariffs, local taxes and retail channel costs account for a significant proportion of the retail price of connectivity devices, including CPE.

Revenue authorities should reduce or eliminate import and excise duties on CPE devices to increase uptake and, by extension, close the digital divide. By aligning tax policies with governments' digital transformation objectives, policymakers can bring sustained long-term social and economic benefits through the positive impact of greater connectivity across society. In addition, governments can consider other financial incentives to stimulate adoption, such as subsidies for the most vulnerable users.

3.2 Service providers

5G service providers, including mobile operators and other fixed wireless licensees, are at the forefront of delivering enhanced connectivity to users. Despite the lower deployment cost relative to fibre technology, the business case for 5G FWA will likely remain challenging in low-ARPU markets (monthly mobile ARPU in Sub-Saharan Africa is now below $3, on average) and in areas with insufficient demand for home broadband connectivity.

Prioritise FWA service to monetise 5G

FWA has emerged as a key 5G use case. As such, operators should define their 5G FWA strategy from the outset, based on the competitive dynamics of the local market. This could involve deployment and pricing strategies to maximise the opportunity in the home fixed broadband and MSME market segments. It could also involve cross-selling strategies, with mobile, entertainment and streaming service bundles, as well as other device bundles such as those including tablets and TVs.

Deploy 5G FWA in parallel with 5G mobile

Mobile operators should consider deploying 5G FWA in parallel with 5G mobile services to gain early-mover advantage and create opportunities for FMC and other product-bundling opportunities. For operators, it is essential to realise the incremental revenue opportunity from 5G FWA from the start of their 5G journeys, leveraging strong consumer interest in the service as well as the large addressable market for fixed broadband connectivity to homes and enterprises.

Consider device-financing initiatives

While governments have a role to play in easing the fiscal burden on device costs, operators should consider measures to make these devices affordable for users. This includes device-financing schemes to improve affordability and boost adoption. Across the world and increasingly in Africa, device-financing schemes, such as subsidies and rentals, paying in instalments and tariff bundling, help offset the impact of prohibitive upfront costs.

3.3 Ecosystem players

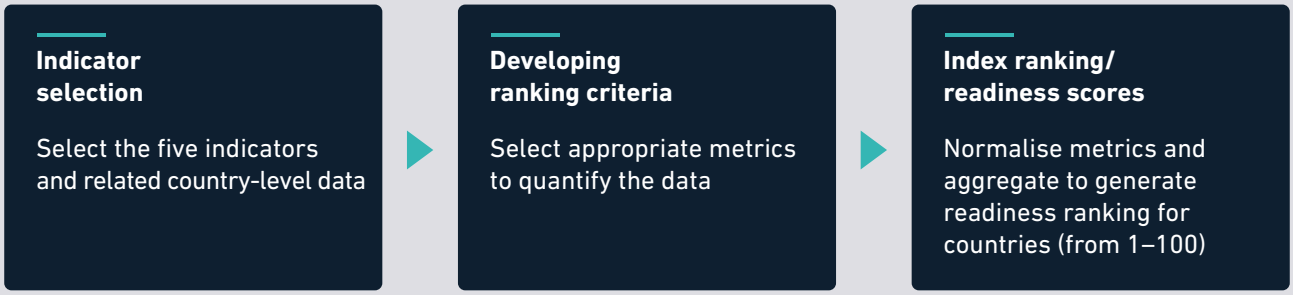
5G FWA presents long-term growth potential for operators in Africa, given the scale of the addressable market for fixed broadband services. Ecosystem players, including network equipment and device vendors, have a role to play in helping operators realise this potential. FWA network and equipment innovations can help operators deliver compelling services (access and beyond), while affordable CPE devices can help accelerate adoption among users.

Appendix
5G FWA Readiness Index methodology

For each of the five selected indicators, a readiness score is calculated out of 100 to rank the 15 countries. A score of 1 means the country is least ready for 5G FWA, while a score of 100 means the readiness of the country is highest, considering the selected indicators. The methodology used to construct the readiness scores is carried out in three steps.

Figure A1

Methodology steps used for readiness scores



Source: GSMA Intelligence

Indicator selection and ranking criteria

To realise the potential of 5G FWA in Africa, a combination of factors that support the adoption of the technology are considered. These factors cut across demand, supply and regulatory imperatives. Having considered these imperatives and how they impact the deployment and adoption of 5G FWA services, we selected five indicators. Quantifiable metrics and ranking criteria were then developed to assess the level of readiness for each country.

Table A1

Indicators and criteria

Indicator	Description
Spectrum	Spectrum availability and spectrum assigned in the 3.5 GHz band Source: GSMA Intelligence
FWA services	Availability of commercial FWA services (4G and 5G) in the country Source: GSMA Intelligence
CPE device affordability	Ratio of the cheapest CPE device cost and national minimum wage Source: operator websites and government data on minimum wage
Technology-neutral licences	Technology-neutral spectrum licensing availability for refarming Source: GSMA Intelligence
Coverage	Percentage of the population covered by 5G Source: GSMA Intelligence

Source: GSMA Intelligence

Normalise metric and aggregate for readiness score

Metrics are standardised on a 0–100 scale to ensure comparability. This is based on a maximum and minimum value, where 100 represents the best performance. In some cases, metric values are bounded or put in a range (e.g. between 0 and 100% for 4G and 5G coverage), in which case there is an obvious maximum and minimum to use. Where this does not apply, we use the actual maximum and minimum values. For example, if the spectrum is available, the country gets a higher score compared to the country in which spectrum is in the planning stage or not available. For device affordability, the cost of the cheapest available CPE devices in the country (4G and 5G) is compared to the national minimum wage.

The readiness score is obtained by averaging the underlying metric scores after standardisation. The scores reflect current 5G FWA readiness of the selected countries.

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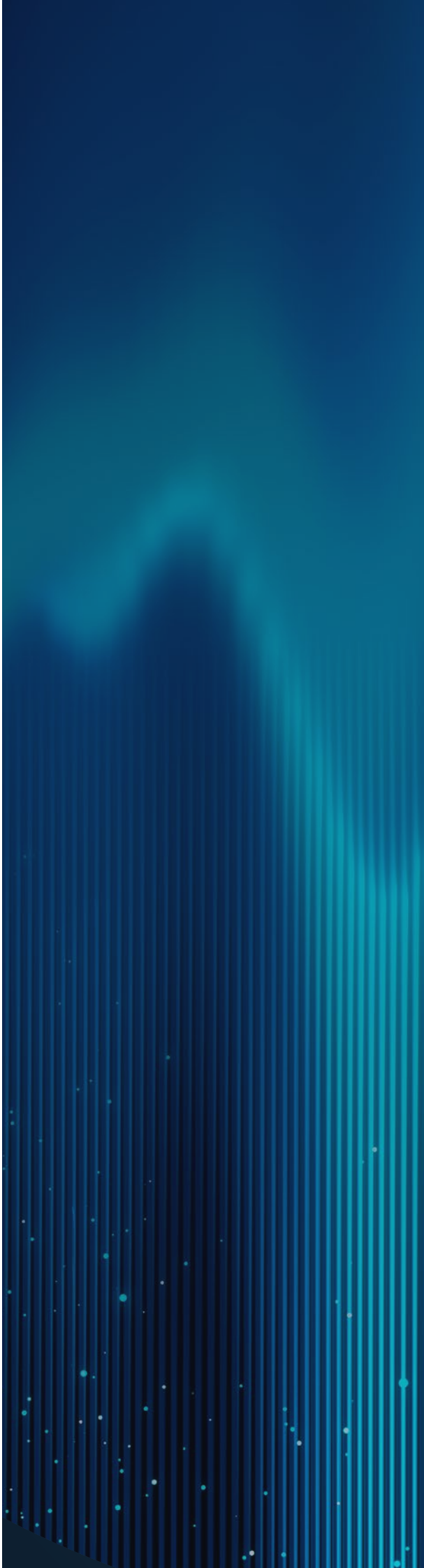

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