


# Market assessment

Connectivity solutions for schools in Eastern,  
Western and Southern Africa



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# Table of contents

- 1 Executive summary**  
Overview of main insights
- 2 Overarching insights**  
Barriers, market shortcomings & recommended actions
- 3 Country-level insights**  
Market assessment





1

# Executive summary

Overview of main insights





# Executive Summary

To support Giga with positively influencing the school connectivity market in Africa, a market assessment has been conducted in 9 focus countries in Eastern, Western and Southern Africa

## Introduction

- “**Giga**” is an initiative from UNICEF and the International Telecommunication Union (ITU), which has the aim to **connect all schools in the world to the internet** by 2030
- To achieve this objective, Giga **designs and recommends interventions** to positively influence the market and improve access to affordable and quality school connectivity
- To support Giga with **positively influencing the market** for school connectivity in **Eastern, Western and Southern Africa**, a **market assessment** is conducted
- The **scope** of the market assessment is focused on **9 focus countries**<sup>1</sup>, on the **last-mile connectivity market** and on the **fiber, wireless and satellite connectivity** market segments

## Approach

- The market assessment is based on **desk research** and **interviews with connectivity suppliers** and **subject matter experts** (e.g. from UNICEF, ITU, Deloitte). Furthermore, an **industry consultation** has been conducted at **Africa Tech Festival** (November 2023) to discuss and validate the main findings
- The market assessment is built bottom-up from a **country-level** assessment of the connectivity market in the **9 focus countries**, which is brought together in a **regional synthesis** for each of the three regions (EAC, ECOWAS and SADC<sup>2</sup>) as well as an **overarching overview** of the identified barriers, root causes and recommended actions
- In each of the 9 focus countries, the market assessment provides insights into the **broader context** (e.g. connectivity status, access to electricity), **the fiber, wireless & satellite market segments** (e.g. market players, pricing, trends) and the **enabling environment** (e.g. regulations, access to finance)
- Subsequently, the **market health** is assessed based on **UNICEF’s 7 market dimensions**<sup>3</sup> resulting in an overview of the identified **market shortcomings** and their **root causes**
- **Recommended actions** for Giga on how to positively influence the market by addressing the identified root causes are provided **on a regional level** (in the regional syntheses), and are linked to **UNICEF’s 4 market-shaping levers**<sup>4</sup>

## General market characteristics

- Overall, in the school connectivity markets across the 9 focus countries, it has been found that the **availability of connectivity solutions** as well as the **experienced barriers to school connectivity differ** for **urban, semi-urban and rural areas**
- In **urban areas**, the **fiber** backbone extends to all main urban areas across the country, and **mobile** (mostly 4G) connectivity is also available. Because of high population density and high level of commercial activity, **profitability of suppliers** in urban areas is **generally high**, which **facilitates the provision of school connectivity**. However, in some countries (e.g. Malawi, Sierra Leone, Zimbabwe), also in urban areas there are significant barriers to school connectivity such as the affordability of connectivity and a lack of access to electricity

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Notes: 1) Kenya, Rwanda, Nigeria, Sierra Leone, Benin, South Africa, Botswana, Malawi, Zimbabwe; 2) the East African Community (EAC) assessment covers Kenya and Rwanda, the Economic Community of West African States (ECOWAS) assessment covers Nigeria, Sierra Leone and Benin, and the Southern African Development Community (SADC) assessment covers South Africa, Botswana, Malawi and Zimbabwe; 3) Acceptability, affordability, availability, competition, delivery, funding security and quality; 4) Increase market information, reduce transaction costs, balance supplier & buyer risks and improve access to finance & technology

# Executive Summary

The school connectivity market varies between urban and rural areas, with large MNOs driving the market and new technologies emerging in the market (e.g. LEO satellite internet)

## General market characteristics *(continued)*

- In **semi-urban / semi-rural areas**, deploying fiber often is a challenge given the larger distances between customers and the scaling of deployment costs, but there is often **mobile coverage (3G/4G) and Fixed Wireless Access (FWA)**. However, the lower density of population, businesses and schools **reduce the profitability of suppliers** and their economic incentive to invest in deploying infrastructure. Besides the fact that the barriers of affordability and access to electricity are more severe further away from the main urban areas, there are also additional barriers such as higher cost of providing maintenance & after-sales support and access to finance for infrastructure investments
- Lastly, in each of the 9 focus countries, there are **rural & remote areas** where there is often **no fiber or mobile network available** and **satellite internet is perceived as the most viable connectivity option**. In these deep rural areas, **connecting schools** in the 9 focus countries is considered **difficult**, given that the high **fragmentation of demand** and **challenging natural environment** results in **low revenue density** and **high investment & operating costs for suppliers**. As for satellite connectivity, affordability of connectivity, providing maintenance & after-sales and security of equipment are considered significant challenges

## Market players

- The **connectivity market** in the 9 focus countries is largely concentrated in the **mobile segment of the market (3G/4G)**. Fiber internet connectivity only covers a small percentage of the overall connectivity market. The satellite internet market is emerging in most countries, and the entrance of LEO satellite internet (e.g. Starlink, Eutelsat OneWeb, Amazon Project Kuiper) could provide a competitive new connectivity solution
- In most focus countries, the **connectivity market** is mostly driven by **2 or 3 Mobile Network Operators (MNOs)** and in **some countries** there is a **one dominant MNO** with a **>60% market share** (e.g. Safaricom in Kenya, MTN in Rwanda, Econet in Zimbabwe)
- Besides the MNOs, there are often a **significant number of Internet Service Providers (ISPs)** offering fiber, mobile or satellite connectivity directly to customers, but most ISPs are small and operate locally

## Market trends

- Overall, across the focus countries the **affordability of connectivity is increasing** when considering the price of connectivity as percentage of Global Net Income (GNI) per capita, with the price of **mobile connectivity nearing Broadband Commission's target** of 2% of GNI per capita in many countries. However, in some countries (e.g. Malawi, Zimbabwe) this target is still far away
- The entrance of **LEO satellite internet** is considered a promising trend in the connectivity market, given that it can provide a **competitive solution particularly in (semi-)rural areas** and that it will increase the **level of competition** in the market
- Other **technology trends** include the **roll-out of 5G** by the main MNOs as well as more **niche connectivity solutions** such as **community networks** and Fixed Wireless Access (FWA) using **unlicensed frequencies** (e.g. TV White Space) which could serve as a **low-cost connectivity solution for underserved areas**

Note: 1) Increase market information, reduce transaction costs, balance supplier & buyer risks and improve access to finance & technology



# Executive Summary

Barriers to school connectivity range from digital literacy to affordability of connectivity and access to finance, and a total of 37 root causes underlying these barriers have been identified

## Barriers to school connectivity

- A distinction is made between **usage gap** (i.e., percentage of schools which are covered by a good-quality internet network (>3G) but are not connected) and **coverage gap** (i.e., percentage of schools which are not covered by a good-quality internet network (>3G))
- In **6 of the 9 focus countries** (Kenya, Rwanda, Nigeria, Benin, South Africa and Botswana), the **coverage gap is relatively small** (<20% of schools) and the **key barriers exist in closing the usage gap**
- In **3 of the 9 focus countries** (Sierra Leone, Malawi, Zimbabwe) on the other hand, there are not only key barriers in the usage gap for schools that are covered by a good-quality network but **also significant barriers to increase network coverage and close the coverage gap**
- To overcome the **usage gap, access to electricity, affordability of connectivity & devices, security of connectivity equipment & devices** and **providing maintenance & after-sales support** are considered some of the main barriers for school connectivity across the 9 focus countries, and these are particularly severe in **rural areas**
- To overcome the **coverage gap**, a lack of **business viability** for suppliers to invest in infrastructure and **access to finance** are considered some of the main barriers

## Market shortcomings & root causes

- A **variety of market shortcomings** and a **total of 37 root causes** have been identified across the 9 focus countries, which can be addressed by Giga to positively influence the market and help suppliers provide more connectivity to schools
- **Examples** of identified root causes include a **high cost of wholesale internet prices** (e.g. because of countries being landlocked or limited competition in the middle-mile market), **high cost of networking equipment** (e.g. because of import duties, inflation, lack of foreign currency/unfavorable exchange rates), and a **lack of access to finance for smaller players** (e.g. because of difficulty to access Universal Service Fund (USF) funding, development aid or private sector financing)
- In the **EAC region**, some important root causes include the **perceived hesitance from schools & teachers to transition to digital learning as experienced by suppliers**, the **lack of electricity infrastructure, limited competition in the mobile market** and **theft or vandalism** of equipment, devices & energy infrastructure
- In the **ECOWAS region**, root causes of market shortcomings revolve around a **high price of connectivity** due to **high inflation, limited competition in the first-mile** and **high cost for maintenance & after-sales support** to customers. Furthermore, root causes underlying the **difficulty of expanding network coverage** include the **lack of access to affordable finance** and the **low business viability to expand to rural areas** for suppliers given the low population density, low disposal income per capita and challenging natural environment

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Note: 1) Increase market information, reduce transaction costs, balance supplier & buyer risks and improve access to finance & technology

# Executive Summary

A total of 30 recommended actions are provided to address the root causes and positively influence the market

## Market shortcomings & root causes *(continued)*

- In the **SADC region**, there are **major differences** in the market shortcomings and root causes experienced across countries. In **South Africa**, the **low reliability of electricity infrastructure** and **theft & vandalism** are some of the main root causes for the remaining usage gap. In **Botswana**, the **high price of connectivity** given that the country is **landlocked** and **high cost for infrastructure development & maintenance** are some of the main challenges. In **Malawi and Zimbabwe**, important root causes include the **high inflation** and the **lack of access to foreign currencies** (e.g. US dollars), which is **reflected in the high cost of importing equipment, lack of electricity and lack of access to affordable finance**

## Recommended actions

- A variety of possible solutions have been identified resulting in a **total of 30 recommended actions for Giga**
- **Examples** of recommended actions (for each of UNICEF's 4 market-shaping levers<sup>1</sup>) include:
  - **Increase market information:** for example, include the proximity of other potential customers (town hall, health clinic, etc.) and proximity of existing infrastructure/electricity in Giga's connectivity map of schools, or create a dashboard with prices for school procurement contracts to help governments benchmark what an appropriate price is
  - **Reduce transaction costs:** for example, look for opportunities for (cross country) pooled procurement of last-mile school connectivity and devices to bring down prices
  - **Balance supplier & buyer risk:** for example, establish long-term agreements (5-10 years) with Internet Service Providers (ISPs) to reduce their risk and ensure return on investment
  - **Improve access to finance & technology:** for example, create more operational expenditure (OPEX)-oriented financing vehicles to cover the recurring costs of connectivity (e.g. to accommodate for satellite connectivity)

## Potential next steps

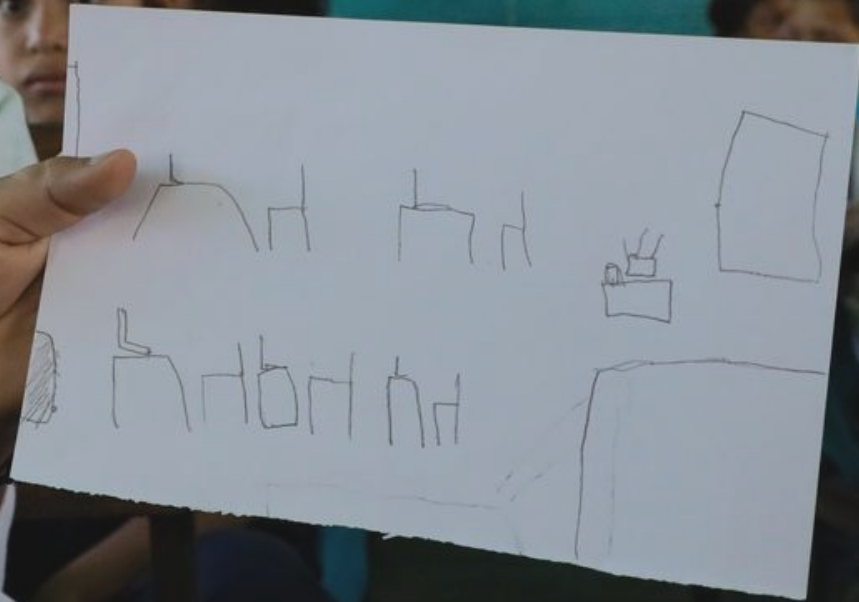
- A '**catalogue of recommended actions**' has been developed, covering all 30 identified recommended actions, for consideration by the Giga team. This catalogue can serve as a **starting point**, from which the Giga team should assess which of the proposed actions will be pursued and when
- After **prioritizing** the **market-influencing actions**, a **roadmap** should be defined to plan the activities in time (from short-term to long-term)
- Lastly, the Giga team is encouraged to leverage the **relationships with suppliers** as developed during the market assessment (through interviews and industry consultation), and to **continue strengthening the collaboration** among governments, market players and other relevant organizations to further capitalize on the recommendations

Note: 1) Increase market information, reduce transaction costs, balance supplier & buyer risks and improve access to finance & technology



## 2 Overarching insights from assessment

Barriers, market shortcomings & recommended actions



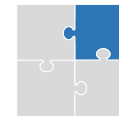
# Definitions | Market dimensions & market levers

The market assessment is based on UNICEF’s approach to influencing markets, where markets are assessed on 7 market dimensions and can be influenced through 4 market-shaping levers

## UNICEF’s 7 Market Dimensions

<i>Dimension</i>	<i>Desired situation</i>
<b>Acceptability</b>	Products are culturally appropriate and well-adapted for low-income settings
<b>Affordability</b>	Prices are low enough to meet government’s ability & willingness to pay
<b>Availability</b>	Sufficient volumes of appropriate connectivity solutions are available and easily accessible
<b>Competition</b>	There is a competitive and reliable supplier base (e.g. no monopoly and low barriers to entry)
<b>Delivery</b>	Products & services are delivered reliably, cost effectively and on time
<b>Funding security</b>	Market players have sufficient access to finance
<b>Quality</b>	Products meet quality standards

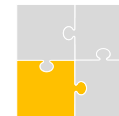
## UNICEF’s 4 Market-shaping Levers



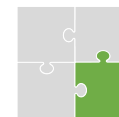
**Increase market information:** helping businesses assess the market potential and identify market opportunities, through demand forecasting and information communication



**Reduce transaction costs:** lowering the cost of delivering products & services through pooled procurement (resulting in greater economies of scale), variant optimization (resulting in streamlined demand) and/or harmonizing quality standards (lowering barriers to entry)



**Balance supplier & buyer risks:** making contracts more attractive or feasible through special contracts with non-standard terms (e.g., financing structures)

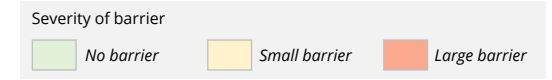


**Improve access to finance & technology:** supporting suppliers with gaining access to finance & technology through local industry engagement and supplier financing



# Barriers to school connectivity

The availability of connectivity solutions and the barriers to school connectivity<sup>1</sup> vary across the 9 focus countries and differ for urban, semi-urban and rural areas



	Urban	Semi-urban / semi-rural	Rural & remote
<b>General characteristics</b>			
• Availability of connectivity solutions	Across the 9 focus countries, the <b>fiber</b> backbone extends to all main urban areas across the country; <b>mobile</b> (mostly 4G) connectivity is also available	In semi-urban & semi-rural areas in the 9 focus countries, there is often no middle-mile fiber available, but there is <b>mobile</b> coverage (3G/4G) and Fixed Wireless Access ( <b>FWA</b> )	In each of the 9 focus countries, there are rural areas where there is often no fiber or mobile network available and <b>satellite</b> internet is perceived as the most viable connectivity option
• Market characteristics	Densely populated area and high level of commercial activity, resulting in <b>high profitability</b> of connectivity suppliers	Lower density of population, commercial activity and schools, but <b>manageable</b> required investment costs for connectivity	High fragmentation of demand as well as a challenging natural environment results in low revenue density and high investment & operating costs, thus <b>low profitability</b> of suppliers
<b>Usage gap barriers<sup>2</sup></b>			
• Digital literacy	<span style="background-color: yellow;">■</span> Digital illiteracy is a <b>challenge</b> in all countries except South Africa and Botswana	<span style="background-color: yellow;">■</span> The issue of digital illiteracy <b>increases</b> further away from the main urban areas	<span style="background-color: yellow;">■</span> <b>Particularly in rural &amp; remote areas</b> , digital illiteracy hampers uptake of connectivity solutions
• Affordability of connectivity	<span style="background-color: yellow;">■</span> <b>Affordability of fiber is a challenge</b> , particularly in Malawi and Sierra Leone. Wireless connectivity provides a lower-cost alternative and affordability is generally good, with some exceptions (e.g. Zimbabwe, Malawi and Benin)	<span style="background-color: yellow;">■</span> <b>Affordability of wireless connectivity is generally good</b> , with some exceptions (e.g. Zimbabwe, Malawi and Benin)	<span style="background-color: orange;">■</span> <b>Affordability of satellite internet is a challenge</b> in rural & remote areas, given the relatively high price of satellite internet and low purchasing power in rural areas; however, prices of satellite internet are decreasing
• Affordability of devices	<span style="background-color: yellow;">■</span> Devices (phones, tablets) are a <b>large cost component in the overall digitalization</b> of a school, and affordability is a challenge	<span style="background-color: yellow;">■</span> <b>Similar to urban areas</b> , but prices of devices may be higher because of distribution cost	<span style="background-color: yellow;">■</span> <b>Similar to urban areas</b> , but prices of devices may be higher because of distribution cost
• Access to electricity	<span style="background-color: yellow;">■</span> Access to electricity is <b>relatively good in urban areas</b> , except in Benin, Sierra Leone, and Malawi	<span style="background-color: orange;">■</span> Access to electricity <b>deteriorates</b> further away from the main urban areas	<span style="background-color: orange;">■</span> In rural areas, access to electricity is a <b>major challenge</b> , with the exception of South Africa and to a lesser extent Kenya
• Security (vandalism & theft)	<span style="background-color: yellow;">■</span> Vandalism & theft of equipment and devices <b>pose a barrier</b> for the uptake of connectivity	<span style="background-color: yellow;">■</span> Security concerns are <b>higher in more remote areas</b> , and mobile tower infrastructure might get targeted	<span style="background-color: orange;">■</span> Vandalism & theft of equipment, devices and power infrastructure is a <b>larger issue in rural areas</b>
• Maintenance & after-sales	<span style="background-color: green;">■</span> Maintenance & after-sales can be provided <b>efficiently</b> in urban areas	<span style="background-color: yellow;">■</span> Maintenance & after-sales support becomes <b>more challenging</b> as distance from support centers increases	<span style="background-color: orange;">■</span> In rural & remote areas, maintenance & after-sales is a <b>significant challenge</b> given the large distance from suppliers
• Quality	<span style="background-color: green;">■</span> Generally, quality is <b>not considered a major barrier</b> , especially in urban areas with access to fiber & 4G	<span style="background-color: green;">■</span> Quality will depend on the strength of the wireless network but generally is <b>not considered a major barrier</b>	<span style="background-color: yellow;">■</span> Quality of GEO satellite internet <b>might not suffice</b> for certain functions (e.g. videoconferencing due to high latency)
<b>Coverage gap barriers<sup>3</sup></b>			
• Business viability	<span style="background-color: green;">■</span> N/A	<span style="background-color: yellow;">■</span> <b>Expanding fiber</b> to semi-urban areas is considered <b>not economically viable</b> (e.g. large upfront investment costs, fragmentation of demand)	<span style="background-color: orange;">■</span> <b>Expanding fiber or 4G</b> to rural & remote areas is considered <b>not economically viable</b> (e.g. low population density/fragmentation of demand). For <b>satellite</b> internet, providing <b>maintenance &amp; after-sales</b> support is the <b>main challenge</b> for the business viability
• Funding security	<span style="background-color: green;">■</span> N/A	<span style="background-color: yellow;">■</span> <b>Smaller ISPs lack access to finance</b> (e.g. from Universal Service Fund (USF)) to expand their coverage	<span style="background-color: orange;">■</span> <b>MNOs have difficulty to gain funding</b> for expanding to rural & remote areas (e.g. high interest rate, inadequate USF implementation, inflation & foreign currency shortages)

Notes: 1) The barriers have been identified in the context of school connectivity, but may also be applicable to other segments of the connectivity market in the 9 focus countries; 2) Usage gap barriers refer to the barriers to connectivity which are experienced in areas where there is coverage of (fiber/mobile (>3G)) internet; 3) Coverage gap barriers refer to the barriers for expanding coverage of fiber/mobile (>3G) to underserved areas;

Sources: Interviews, Deloitte analysis

# Market shortcomings & root causes

A variety of market shortcomings and root causes have been identified across the 9 countries, which can be addressed by Giga to improve the market

## Overview of identified market shortcomings & root causes<sup>1</sup> (1/2)

Barrier	Market shortcoming	Root causes	Applicable countries <sup>3</sup>			
<i>Usage gap barriers<sup>2</sup></i>						
<ul style="list-style-type: none"> <li>Digital literacy</li> <li>Affordability of connectivity</li> <li>Affordability of devices</li> <li>Access to electricity</li> </ul>	<ul style="list-style-type: none"> <li>Suppliers experience a lack of uptake due to digital illiteracy</li> </ul>	<ol style="list-style-type: none"> <li>Suppliers experience hesitance from schools &amp; teachers to transition to digital learning</li> </ol>	Kenya, South Africa			
		<ol style="list-style-type: none"> <li>Low internet penetration rate resulting in low familiarity</li> </ol>	Kenya, Rwanda, Sierra Leone, Benin, Malawi			
		<ol style="list-style-type: none"> <li>High cost of first-mile / middle-mile bandwidth (wholesale internet prices) for landlocked countries having no direct access to international connectivity</li> </ol>	Botswana, Malawi, Zimbabwe			
	<ul style="list-style-type: none"> <li>Price of connectivity is high</li> </ul>	<ul style="list-style-type: none"> <li>Price of connectivity is high</li> </ul>	<ol style="list-style-type: none"> <li>High cost of first-mile / middle-mile bandwidth (wholesale internet prices) due to limited competition in the first-mile</li> </ol>	Sierra Leone, Benin, Malawi		
			<ol style="list-style-type: none"> <li>High cost of first-mile / middle-mile bandwidth because of lack of in-country data centers or Internet Exchange Points (IXP)</li> </ol>	Botswana		
			<ol style="list-style-type: none"> <li>High cost of networking equipment (e.g. import duties, inflation, lack of foreign currency/unfavorable exchange rates)</li> </ol>	Sierra Leone, Malawi, Zimbabwe		
			<ol style="list-style-type: none"> <li>High cost of infrastructure development &amp; maintenance</li> </ol>	Botswana		
			<ol style="list-style-type: none"> <li>High cost for maintenance &amp; after-sales support to customers</li> </ol>	Botswana, Sierra Leone, Malawi		
			<ol style="list-style-type: none"> <li>High cost of licenses &amp; spectrum (e.g. scarcity of spectrum, lack of foreign currency (license fees in US dollars))</li> </ol>	Kenya, Malawi		
			<ol style="list-style-type: none"> <li>High inflation undermining profitability on longer-term contracts</li> </ol>	Sierra Leone		
			<ol style="list-style-type: none"> <li>Limited competition resulting in high supplier power &amp; higher prices (e.g. due to gov't regulations, lack of available spectrum)</li> </ol>	Kenya, Rwanda, Sierra Leone, Benin, Zimbabwe		
			<ul style="list-style-type: none"> <li>Low available government budget for school connectivity</li> </ul>	<ul style="list-style-type: none"> <li>Low available government budget for school connectivity</li> </ul>	<ol style="list-style-type: none"> <li>Low GNI per capita which is reflected in government budgets</li> </ol>	Rwanda, Sierra Leone, Malawi, Zimbabwe
					<ol style="list-style-type: none"> <li>Need for more advocacy on school connectivity in the public agenda</li> </ol>	Nigeria, Kenya
					<ol style="list-style-type: none"> <li>Volatility of the yearly available government budget (for school connectivity)</li> </ol>	Malawi
			<ul style="list-style-type: none"> <li>Price of devices is high</li> </ul>	<ul style="list-style-type: none"> <li>Price of devices is high</li> </ul>	<ol style="list-style-type: none"> <li>High cost of devices (e.g. import duties, inflation, lack of foreign currency)</li> </ol>	Kenya, Sierra Leone, Malawi, Zimbabwe
					<ol style="list-style-type: none"> <li>Lack of electricity infrastructure</li> </ol>	Rwanda, Sierra Leone, Benin, Malawi, Botswana
			<ul style="list-style-type: none"> <li>Lack of electricity limits the uptake of connectivity, particularly in rural areas</li> </ul>	<ul style="list-style-type: none"> <li>Lack of electricity limits the uptake of connectivity, particularly in rural areas</li> </ul>	<ol style="list-style-type: none"> <li>Electricity needs to be paid in US dollars and there is a lack of foreign currency or unfavorable exchange rate resulting in high cost</li> </ol>	Zimbabwe
					<ol style="list-style-type: none"> <li>Inadequate structure of schools which limits the possibility of deploying rooftop solar panels</li> </ol>	Sierra Leone
					<ol style="list-style-type: none"> <li>Low reliability of electricity infrastructure</li> </ol>	South Africa

Notes: 1) The market assessment reflects the perspective of connectivity suppliers as retrieved through interviews, complemented with desk research. The insights have been validated with subject matter experts from UNICEF, ITU and Deloitte, but have not been confirmed with governments or schools; 2) Usage gap barriers refer to the barriers to connectivity which are experienced in areas where there is coverage of (fiber/mobile) internet; 3) These refer to countries where the root cause has been identified, but they may also apply in other countries; Sources: Interviews, Deloitte analysis

# Market shortcomings & root causes

A variety of market shortcomings and root causes have been identified across the 9 countries, which can be addressed by Giga to improve the market

## Overview of identified market shortcomings & root causes<sup>1</sup> (2/2)

Barrier	Market shortcoming	Root causes	Applicable countries <sup>4</sup>
<i>Usage gap barriers<sup>2</sup></i>			
• Security (vandalism & theft)	• Theft & vandalism pose a barrier for the uptake of connectivity	20 • Theft or vandalism of equipment, devices & energy infrastructure	Kenya, Nigeria, Sierra Leone, South Africa
		21 • In some countries there are areas with security concerns (e.g. terrorism threat) which result in inability to do installation & maintenance, or a high cost of doing so (due to security measures)	Kenya, Nigeria
• Maintenance & after-sales	• Challenge of providing maintenance & after-sales support in rural areas	22 • Large distance from main support centers (resulting in high costs for allowances and fuel)	Sierra Leone, Botswana
		23 • Difficult landscape (e.g. mountainous terrain) & lack of general road infrastructure	Sierra Leone
		24 • Security concerns (e.g. terrorism threat) pose a barrier for providing adequate support	Kenya
		25 • Lack of business viability to invest in high-quality network	Botswana, Malawi
• Quality	• Low quality of connectivity	26 • Low-income levels resulting in preference for low-cost low-quality options (e.g. unlicensed frequencies)	Kenya, Rwanda
		<i>Coverage gap barriers<sup>3</sup></i>	
• Business viability	• Lack of profitability in rural areas	27 • Low revenue density (low population density) and difficulty to achieve economies of scale	Kenya, Sierra Leone, Botswana, Zimbabwe
		28 • Lack of demand from rural areas (e.g. low disposal income)	Kenya, Sierra Leone, Zimbabwe
		29 • Lack of existing middle-mile fiber/mobile infrastructure	Nigeria, Sierra Leone, Malawi, Zimbabwe
		30 • Inability to deploy certain connectivity solutions because of the landscape (e.g. FWA requires line-of-sight, which is not feasible in mountainous areas)	Sierra Leone
		31 • High costs of infrastructure development (e.g. difficult landscape, lack of general road infrastructure)	Kenya, Sierra Leone, Malawi, Zimbabwe
		32 • High cost of installation, maintenance & after-sales support	Sierra Leone, Malawi
		33 • Areas of opportunity for a more effective implementation of the USF	Nigeria, Malawi
• Funding security	• Lack of access to finance by market players	34 • High cost of capital (high interest rate)	Kenya, Nigeria, Sierra Leone, Malawi, Zimbabwe
		35 • Lack of foreign currency / unfavorable exchange rates and investment contracts require to be paid in US dollars	Zimbabwe
		36 • Lack of access to finance for smaller players (difficulty to access USF funding or development aid)	Kenya, Nigeria
		37 • Lack of access to long-term (development) funding to cover the recurring cost of connectivity	Sierra Leone


Notes: 1) Please note, the market assessment reflects the perspective of connectivity suppliers as retrieved through interviews, complemented with desk research. The insights have been validated with subject matter experts from UNICEF, ITU and Deloitte, but have not been confirmed with governments or schools; 2) Usage gap barriers refer to the barriers to connectivity which are experienced in areas where there is coverage of (fiber/mobile) internet; 3) Coverage gap barriers refer to the barriers for expanding coverage of fiber/mobile to underserved areas; 4) These refer to countries where the root cause has been identified, but they may also apply in other countries; Sources: Interviews, Deloitte analysis



# Catalogue of recommended actions

Increasing market information can help suppliers identify market opportunities, and can help lower the cost of school connectivity

## Catalogue of recommended actions (1/3)


Recommended action	Explanation of how the action can address identified market shortcomings	Root causes addressed <sup>1</sup>
 <i>Market lever: increase market information</i>		
<ul style="list-style-type: none"> <li>Include the <b>proximity of other potential customers</b> (town hall, health clinic, etc.) in <b>Giga's connectivity map</b> of schools (e.g. as part of a score of the attractiveness of a school)</li> </ul>	<ul style="list-style-type: none"> <li>Information on potential other customers around schools can encourage infrastructure investments into underserved areas</li> </ul>	27, 28
<ul style="list-style-type: none"> <li>Include the <b>proximity of existing telecommunication infrastructure</b> in <b>Giga's connectivity map</b>, to help suppliers assess the difficulty to connect</li> </ul>	<ul style="list-style-type: none"> <li>Information on existing infrastructure helps suppliers assess the required investment to connect schools, thereby lowering risk</li> </ul>	29, 31
<ul style="list-style-type: none"> <li>Include <b>access to electricity</b> and the <b>proximity of schools/communities to electricity infrastructure</b> in Giga's connectivity map</li> </ul>	<ul style="list-style-type: none"> <li>As access to electricity is an enabling requirement for connectivity, this helps suppliers &amp; government assess which schools can be connected more easily</li> </ul>	16
<ul style="list-style-type: none"> <li>Include the <b>quality of the (physical) structure of schools</b> in <b>Giga's connectivity map</b> to help suppliers assess the feasibility of installing solar panels alongside connectivity equipment</li> </ul>	<ul style="list-style-type: none"> <li>In areas where there is no electricity, connectivity needs to be provided in combination with solar panels; however, the structure of schools need to be able to hold rooftop solar panels</li> </ul>	18
<ul style="list-style-type: none"> <li>Publish <b>information on electricity projects/RFPs</b>, such that connectivity providers can piggyback</li> </ul>	<ul style="list-style-type: none"> <li>Publishing information about new electricity projects can help suppliers identify new business opportunities (as electricity is an enabling requirement for connectivity)</li> </ul>	16
<ul style="list-style-type: none"> <li>Support governments in <b>sharing their long-term plans</b> of <b>school connectivity projects</b></li> </ul>	<ul style="list-style-type: none"> <li>Increasing market information of upcoming school connectivity projects enable market players to spot business opportunities and plan accordingly</li> </ul>	12, 13, 14
<ul style="list-style-type: none"> <li>Create a <b>dashboard with prices for school procurement contracts</b> to help governments benchmark what an appropriate price is (could be a sub-indicator in ITU's ICT prices dashboard)</li> </ul>	<ul style="list-style-type: none"> <li>An international benchmark can help governments assess what a suitable price is to pay for school connectivity (based on some key characteristics (e.g. size of schools, distance from existing infrastructure etc.), facilitating cost efficiency in case of low available government budgets</li> </ul>	12, 13
<ul style="list-style-type: none"> <li><b>Track the quality of school internet</b> and <b>support governments in enforcement of service-level agreements</b> as specified in school connectivity contracts</li> </ul>	<ul style="list-style-type: none"> <li>Tracking of quality of internet can help governments enforce the quality requirements as specified in school contracts (service-level agreements)</li> </ul>	25, 26
<ul style="list-style-type: none"> <li><b>Share best practices</b> (e.g. from Rwanda) on <b>bulk bandwidth purchasing agreements</b> with other countries</li> </ul>	<ul style="list-style-type: none"> <li>Some landlocked countries (e.g. Rwanda) have successfully established long-term bulk purchase agreements to bring down cost of bandwidth</li> </ul>	3
<ul style="list-style-type: none"> <li><b>Sharing of best practices</b> on <b>training of communities</b> for <b>local support &amp; maintenance</b>, particularly for satellite technology (less complex than other connectivity technologies)</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance and after-sales support is considered a high cost component for rural areas; sharing of best practice trainings can help lower the costs</li> </ul>	8, 22, 23, 24
<ul style="list-style-type: none"> <li>Create an <b>overview of relevant initiatives</b> that focus on school connectivity to <b>help suppliers spot opportunities</b> for partnerships or funding</li> </ul>	<ul style="list-style-type: none"> <li>An overview of relevant initiatives can help market players (particularly small ISPs) to engage in partnerships and access funding</li> </ul>	36

Note: 1) The numbers in this column refer to the identified root causes as presented on slides 9 & 10  
Sources: Interviews, workshop with UNICEF & ITU, Deloitte analysis

# Catalogue of recommended actions

Transaction costs can be lowered through pooled procurement of last-mile connectivity as well as through national initiatives to reduce first- & middle-mile connectivity costs

## Catalogue of recommended actions (2/3)

Recommended action	Explanation of how the action can address identified market shortcomings	Root causes addressed <sup>1</sup>
 <i>Market level: reduce transaction costs</i>		
<ul style="list-style-type: none"> <li>Look for opportunities for <b>pooled procurement of last-mile school connectivity</b> to bring down prices</li> </ul>	<ul style="list-style-type: none"> <li>Bringing together multiple schools in one procurement contract can bring economies of scale and better return on investment of suppliers, by reducing overhead of procurement processes, enable bulk procurement of network equipment and more efficient roll-out &amp; maintenance</li> <li>It is recommended to consider the characteristics of the different connectivity technologies and existing infrastructure by pooling schools which can be served efficiently with the same type of connectivity solution, to enhance economies of scale and to account for supplier characteristics (e.g. licenses, capabilities, existing infrastructure)</li> </ul>	6, 7, 8
<ul style="list-style-type: none"> <li>Look for opportunities for <b>cross-country pooled procurement of satellite school connectivity</b></li> </ul>	<ul style="list-style-type: none"> <li>As for satellite internet, cross-country pooled procurement might even be possible to fully utilize economies of scale as there is less dependency on existing infrastructure and footprint of existing market players. Differences in government procurement processes, licensing regimes, suppliers' network of partners for maintenance &amp; support and supplier's ground station infrastructure should be considered</li> </ul>	6, 8
<ul style="list-style-type: none"> <li>Look for opportunities for <b>pooled procurement</b> of last-mile connectivity <b>with other public organizations</b> within <b>communities</b> (e.g. town hall, health center, police station)</li> </ul>	<ul style="list-style-type: none"> <li>Pooled procurement as a community of which the school is a part of improves the return on investment of supplier infrastructure investments</li> </ul>	6, 8, 27
<ul style="list-style-type: none"> <li>Look for opportunities for <b>pooled procurement of devices</b> to bring down prices</li> </ul>	<ul style="list-style-type: none"> <li>Access to affordable devices is a prerequisite for connectivity; pooled procurement brings economies of scale and reduces price per device</li> </ul>	15
<ul style="list-style-type: none"> <li>Explore <b>bulk procurement of bandwidth</b> to bring down prices, particularly for landlocked countries</li> </ul>	<ul style="list-style-type: none"> <li>Assisting governments (particularly of landlocked countries) in making long-term agreements for international bandwidth capacity can lower the costs of wholesale connectivity prices (e.g. best practice of Rwanda)</li> </ul>	3, 4
<ul style="list-style-type: none"> <li>Explore opportunity to build local <b>data centers for education content</b> to reduce peering costs</li> </ul>	<ul style="list-style-type: none"> <li>Local (in-country) data centers can reduce the cost of peering data internationally; Giga can support with assessing the business case</li> </ul>	5
<ul style="list-style-type: none"> <li>Promote regulatory requirements to <b>enhance competition</b> in the last-mile (e.g. <b>open access</b> middle-mile infrastructure, requirements for the <b>sharing of unused frequencies</b>)</li> </ul>	<ul style="list-style-type: none"> <li>Giga can advocate for regulations to enhance competition in the last-mile, which could reduce prices of last-mile connectivity solutions</li> </ul>	11
<ul style="list-style-type: none"> <li>Explore <b>possibilities to reduce reliance on a single first-mile operator</b> (potentially by advocating for the entrance of new infrastructure players)</li> </ul>	<ul style="list-style-type: none"> <li>The reliance on a single backbone operator may in some countries lead to high wholesale prices; advocating for a new entrant could help increase competition, resulting in lower wholesale prices</li> </ul>	4

Note: 1) The numbers in this column refer to the identified root causes as presented on slides 9 & 10  
Sources: Interviews, workshop with UNICEF & ITU, Deloitte analysis

# Catalogue of recommended actions

Through addressing supplier risks and facilitating access to finance & technology, Giga can help improve the market environment for last-mile connectivity suppliers

## Catalogue of recommended actions (3/3)

Recommended action	Explanation of how the action can address identified market shortcomings	Root causes addressed <sup>1</sup>
<b>Market lever: balance supplier &amp; buyer risk</b>		
<ul style="list-style-type: none"> <li>Orchestrate an <b>integrated approach to connectivity</b>, including electricity, devices and training through combined contracting</li> </ul>	<ul style="list-style-type: none"> <li>Electricity, devices and training are key enabling requirements for connectivity; through combined contracting, this enlarges the market of school connectivity (as more schools can be included)</li> </ul>	1, 2, 15, 16
<ul style="list-style-type: none"> <li>Include <b>market players in the planning of school connectivity initiatives</b>, to increase supplier engagement and appetite for school connectivity and to ensure effective &amp; efficient roll-out</li> </ul>	<ul style="list-style-type: none"> <li>Market players express their desire to be included in the planning of school connectivity, to jointly assess the required quality &amp; solution</li> </ul>	7, 29, 30, 31
<ul style="list-style-type: none"> <li>Ensure that the <b>risk of inflation is well-managed</b> in connectivity contracts (e.g. agree on price in US dollars and then get paid in the equivalent value of the local currency at the time of delivery)</li> </ul>	<ul style="list-style-type: none"> <li>Inflation can make connectivity contracts unprofitable; adequate price indexation or contracting in US Dollars can address this risk</li> </ul>	10
<ul style="list-style-type: none"> <li>Provide <b>long-term contracts</b> (5 to 10 years) to ISP's to reduce their risk and ensure Return on Investment (ROI)</li> </ul>	<ul style="list-style-type: none"> <li>Longer-term contracts reduce supplier risk, and enables suppliers to make investments based on the perspective of longer-term revenues</li> </ul>	7, 31
<ul style="list-style-type: none"> <li>Explore possibility of <b>allowing market players to include monetization models</b> as part of school connectivity contract</li> </ul>	<ul style="list-style-type: none"> <li>Allowing market players to include monetization models (e.g. advertisement videos of local businesses, paid public Wi-Fi) can increase profitability and reduce prices for schools</li> </ul>	12, 13
<b>Market lever: improve access to finance &amp; technology</b>		
<ul style="list-style-type: none"> <li>Set up a <b>dedicated financing vehicle</b> to provide <b>low-interest loans</b> for middle-mile connectivity</li> </ul>	<ul style="list-style-type: none"> <li>In countries with high interest rates, financing infrastructure development is a challenge (particularly for smaller players)</li> </ul>	33, 34, 35
<ul style="list-style-type: none"> <li>Support <b>smaller players in accessing funding</b> from the Universal Service Fund, development aid and private sector financing</li> </ul>	<ul style="list-style-type: none"> <li>Smaller players experience difficulties in accessing funding; supporting them through these processes enable them to engage in school contracts</li> </ul>	36
<ul style="list-style-type: none"> <li>Create more <b>OPEX-oriented financing vehicles</b> to cover the recurring costs of connectivity (e.g. to accommodate for satellite connectivity)</li> </ul>	<ul style="list-style-type: none"> <li>Suppliers indicate that most (development) funding is focused on CAPEX investments; there is a need for OPEX-oriented financing</li> </ul>	37
<ul style="list-style-type: none"> <li>Support governments with <b>accessing development funding</b> earmarked for school connectivity</li> </ul>	<ul style="list-style-type: none"> <li>In some countries with low government budgets, school connectivity may be considered a luxury and other investments are prioritized if there is no external development funding specifically for school connectivity</li> </ul>	12, 13, 14, 33
<ul style="list-style-type: none"> <li>Develop a <b>proposition for monetizing connectivity by schools</b> (e.g. paid public Wi-Fi)</li> </ul>	<ul style="list-style-type: none"> <li>Innovative monetization models can enable cost sharing by schools with the community, increasing affordability of connectivity</li> </ul>	12, 13
<ul style="list-style-type: none"> <li>Facilitate <b>knowledge transfer of low-cost connectivity solutions</b> (e.g. FWA using unlicensed frequencies) and <b>connectivity solutions that combine electricity</b> (e.g. satellite connectivity with solar kits) to other countries</li> </ul>	<ul style="list-style-type: none"> <li>Facilitating knowledge transfer internationally can help the adoption of novel school connectivity solutions</li> </ul>	9, 11, 12, 13, 16, 31

Note: 1) The numbers in this column refer to the identified root causes as presented on slides 9 & 10  
Sources: Interviews, workshop with UNICEF & ITU, Deloitte analysis



3

# Country-level insights

Market assessment

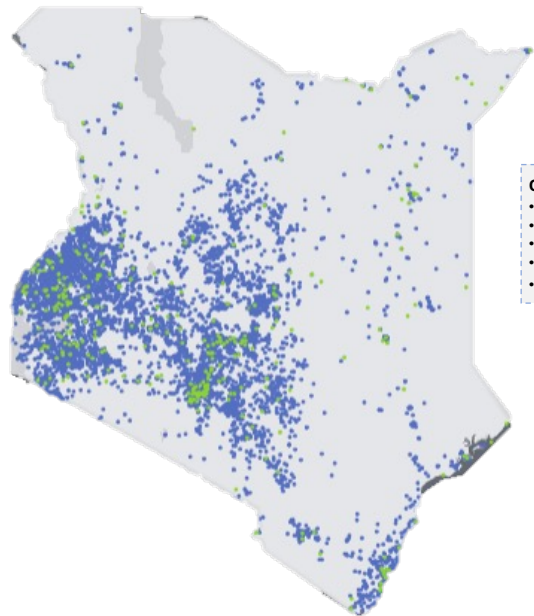




# Kenya | Broader context & status of school connectivity

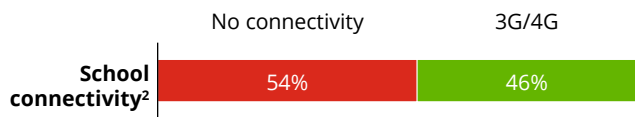
More than half of schools in Kenya are not connected to the internet, but the government is committed to connect all schools by 2030 as per their National Broadband Strategy

Out of a total of 43,000 schools, 23,300 still need to be connected



**Overview**

- Population: 56.8 million
- Pop. density: 97 inhab. / km<sup>2</sup>
- Urban/rural split: 38%/72%
- GNI/capita: 2,170 USD
- GNI/capita (PPP): 5,680 USD



## Government support for school connectivity

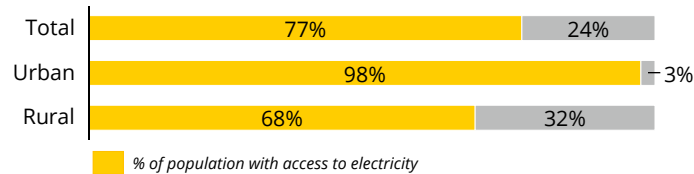


- The government adopted the **National Broadband Strategy** which aims for **100% connectivity** for all schools in 2030
- The EU launched a **Digital Economy Package** for Kenya, which will provide funding for **internet for 1,300 schools** in underserved areas

## Electricity



- Access to electricity can be a **barrier** for connectivity



## Digital literacy



- Kenya has a digital literacy score of **4.2** on the Wiley Digital Skills Gap Index<sup>3</sup>, which ranks the country **2<sup>nd</sup> out of 26** Sub-Saharan African countries
- Digital literacy is relatively low in Kenya; **29% of the population** in Kenya is using the internet

## Key takeaways


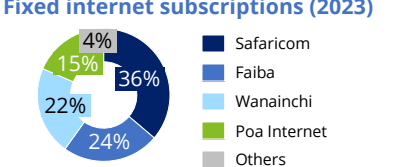
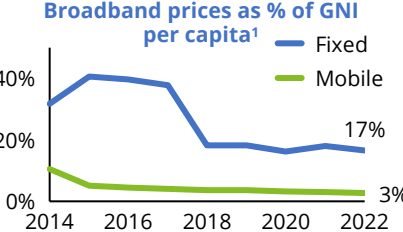
- **Affordability:** The government has set ambitious goals for school connectivity, but the **overall budget is relatively low** given the relatively low GNI per capita<sup>4</sup>
- **Delivery: Lack of electricity** prevents uptake of connectivity solutions, especially **in rural areas**, although electricity coverage is relatively good compared to other countries in Africa
- **Acceptability: Digital illiteracy** prevents uptake of internet in schools

Notes: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production; 2) Connectivity of schools as found from Giga's Kenya Opportunity Brief Giga's; please note that this is not aligned with Giga's connectivity map, as data on connectivity per school is largely unavailable (blue colour) 3) The Wiley 'Digital Skills Gap Index' measures a country's digital development in terms of digital skills on 6 pillars (e.g. digital skills institutions, government support for bridging the digital skills gap); 4) Data on government expenditure on school connectivity has not been found, but the available government budget has been compared among the 9 focus countries by looking at GNI per capita and government expenditure on education as percentage of GDP; Sources: Giga, UNICEF, WorldBank, Wiley, Deloitte analysis

# Kenya | Fiber internet market

The market for fiber internet is quite fragmented with four main providers, but uptake amongst the population is low and prices are high compared to the GNI per capita

## Key insights into the fiber internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>• <b>Five fiber optic international submarine cables land in Kenya.</b> This international bandwidth is further transported through the <b>National Optic Fiber Backbone Infrastructure (NOFBI)</b>, which spans over <b>6,400 km</b> and touches <b>all 47 counties</b></li> <li>• The population with a <b>fixed internet</b> connection is <b>below 2%</b></li> </ul>	
<b>Market players</b>	<ul style="list-style-type: none"> <li>• There is significant competition in the fixed connectivity market, with <b>many Internet Service Providers (ISPs) (387)</b></li> <li>• In terms of subscriptions, <b>Safaricom is leading</b> in the fixed market with a market share of <b>36%</b>, followed by Faiba (24%), Wananchi (22%), and Poa! Internet (15%)</li> </ul>	<p><b>Fixed internet subscriptions (2023)</b></p> 
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>• The price for fixed internet service has gone down in the past years (from ~40% to now 17% of GNI per capita), but still is <b>significantly above Broadband Commission's target of 2% of GNI per capita</b></li> <li>• Price of fixed broadband is <b>\$1,76 per Mbps per month</b> in Kenya, scoring <b>average</b> compared to the 9 other assessed countries</li> <li>• <b>Quality</b> of fixed internet is <b>relatively low</b> in Kenya, ranking <b>158<sup>th</sup> out of 181</b> in terms of fixed broadband quality in Ookla's Speedtest Global Index</li> </ul>	<p><b>Broadband prices as % of GNI per capita<sup>1</sup></b></p> 
<b>Market trends</b>	<ul style="list-style-type: none"> <li>• <b>Market players recognize the market opportunity</b> of school connectivity, given that it involves connecting so many sites</li> </ul>	<p>“ There is no bigger opportunity for us; there is no company that has 15000 sites. To connect all of these schools is a strategic pillar for us.  - <b>Infrastructure provider</b> ”</p>

## Key takeaways

- + **Competition:** there is a **large number of ISPs**, resulting in significant competition
- + **Affordability:** prices for fixed internet are **average** but **still significantly above Broadband Commission's target of 2% of GNI per capita**
- + **Competition:** certain market players indicate that they **recognize the market opportunity** of connecting schools in Kenya


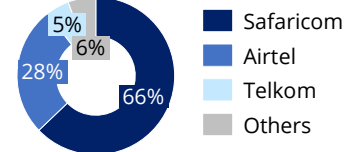
Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
Sources: Company websites, ITU, Cable.co.uk, CIO Africa, Techweez, Ookla, Interviews, Deloitte analysis



# Kenya | Wireless internet market

Although there is limited competition in the mobile internet market, affordability is relatively good in Kenya

## Key insights into the wireless internet market



<p>Coverage</p>	<ul style="list-style-type: none"> <li>• <b>Around 93%</b> of the population have good <b>mobile broadband coverage (3G/4G)</b></li> </ul>	 <p>● 3G/4G coverage</p>	<h3>Key takeaways</h3> <ul style="list-style-type: none"> <li>+ <b>Availability: high</b> mobile coverage across the country and population</li> <li>- <b>Competition:</b> there is a <b>dominant mobile operator</b>, which result in <b>increased prices</b> for customers</li> <li>+ <b>Affordability:</b> the <b>price</b> of mobile connectivity is <b>relatively low</b> in Kenya</li> <li>+ <b>Affordability:</b> some innovative market players can <b>provide low-cost connectivity</b> in semi-urban and rural areas</li> <li>- <b>Quality:</b> Kenya <b>ranks low</b> amongst other countries in terms of <b>mobile broadband speed</b></li> </ul>
<p>Market players</p>	<ul style="list-style-type: none"> <li>• There are <b>three major Mobile Network Operators:</b> Safaricom, Airtel Kenya and Telkom Kenya. These <b>players also own most of the tower infrastructure</b></li> <li>• The mobile internet market is <b>dominated by Safaricom</b> with a market share of 66% of subscriptions, followed by Airtel (28%) and Telkom (5%)</li> <li>• Besides the MNOs, there are market players (e.g. <b>Poa! Internet, Mawingu</b>) that provide <b>Fixed-Wireless Access (FWA)</b> connectivity in semi-urban and rural areas</li> </ul>	<p>Mobile internet subscriptions (2022)</p> 	
<p>Pricing &amp; quality</p>	<ul style="list-style-type: none"> <li>• <b>Price</b> of mobile connectivity is at <b>3% of GNI per capita</b>, and on average <b>\$0,59 USD per GB of mobile data</b> which is considered to be <b>relatively affordable</b></li> <li>• <b>Innovative players</b> like Mawingu and Poa! Internet provide low-cost connectivity solution (<b>~\$10 USD per month for 4 Mbps</b>)</li> <li>• Kenya's median mobile speed is <b>22 Mbps download and 9 Mbps upload</b>, which ranks Kenya 104th out of 141 countries</li> </ul>	<p>“ The main MNOs are not entering the Fixed Wireless Access (FWA) market, because their main play is mobile and fiber, while we are in FWA. You pay 1500 shilling (~\$10 USD) for 4 Mbps. - ISP ”</p>	
<p>Market trends</p>	<ul style="list-style-type: none"> <li>• <b>Safaricom announced the activation of 5G</b> in with planned expansion to 150 sites across nine towns in 2023</li> <li>• <b>Alphabet</b> is working with <b>Liquid Telecom</b> on <b>delivering internet by using lasers</b> through its <b>'Taara' project</b></li> <li>• <b>Poa! Internet</b> is exploring <b>innovative monetization models</b> to connect underserved areas, enabling cost sharing within the community</li> </ul>	<p><b>GSMA</b> August 2022</p> <p>5G gets boost in Kenya with successful spectrum assignment</p>	

Sources: Giga, ITU, GSMA, Communications Authority of Kenya, Cable.co.uk, Ookla, Company websites, ITU, Interviews, Deloitte analysis

# Kenya | Satellite internet market

The satellite internet market in Kenya is active with new market players joining and established market players developing new offerings

## Key insights into the satellite internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>Kenya is covered by <b>GEO/VSAT</b> satellites and Starlink's <b>LEO satellites</b></li> </ul>	<p>“ Remote areas we will not do with fiber, but we will do satellite. Satellite we don't use for backhaul anymore, but for us it is a last-mile technology.   - <b>Infrastructure provider</b> ”</p>	<h3>Key takeaways</h3> <ul style="list-style-type: none"> <li>+ <b>Availability: GEO satellite internet</b> is available in Kenya and <b>LEO satellite internet</b> has also recently become available</li> <li>+ <b>Competition: several active market players</b> in the satellite internet market</li> <li>- <b>Affordability:</b> satellite internet is <b>relatively expensive</b> compared to other connectivity options</li> <li>+ <b>Quality: LEO satellite</b> offers a high-quality connectivity solution for areas where there is no fiber or mobile coverage</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>In 2021 <b>five companies</b> were licensed to <b>operate in the satellite internet market</b> in Kenya, including Globalstar and Viasat Kenya</li> <li>Since July 2023, Starlink has started its operations in Kenya, providing LEO satellite internet</li> <li>Kenya is facing <b>challenges</b> with regards to <b>technical know-how</b> in the industry which <b>slowed down the growth</b> of this industry</li> </ul>		
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>A <b>monthly subscription</b> for Starlink is <b>\$42 USD</b> and a <b>one-off price for equipment and shipping</b> of <b>~\$600 USD, offering high-speed and low latency internet</b> <sup>1</sup></li> </ul>	<p>“ We are launching LEO satellite service together with our partner. It is still in testing phase, but it is a promising technology.   - <b>MNO</b> ”</p>	
<b>Market trends</b>	<ul style="list-style-type: none"> <li><b>Starlink</b> started their operations in Kenya and partnered with Karibu Connect as a first authorized reseller</li> <li>Following Starlink, <b>Safaricom</b> is set to <b>launch LEO satellite internet services</b> through a partnership with <b>AST SpaceMobile</b></li> </ul>	 <p>July 2023 Safaricom Partners with AST SpaceMobile to Compete with Starlink's Presence in Kenya</p>	

Note: 1) Prices based on online available information on residential subscription price (source: Starlink Insider) and these have not been verified for school connectivity  
Sources: Company websites, Starlink Insider, Interviews, Deloitte analysis

# Kenya | Enabling environment

Access to finance is a challenge in Kenya, particularly for smaller players; the many regulatory changes may also pose a challenge for existing or new market players



## Regulations

- **Licenses to operate** in the telecommunication market in Kenya are **issued by the Communications Authority (CA)**
- The government has initiated a range of pro-business reforms over the last few years, including regulations on starting businesses and obtaining access to electricity
- **The Finance Act** has also seen various reforms over the past years (2019, 2020, 2023), **introducing new taxes**, including a **Digital Service Tax**. Some sources indicate that the oscillation between business reforms and **conflicting taxation policies** raise uncertainty over the long-term plans for improving the investment climate
- In 2023 the government **reversed** a rule in Kenya's National ICT policy that required ICT firms **to have at least 30% substantive Kenyan ownership to be licensed**

“ The Kenyan regulator charges 1% of gross revenue: 0.5% to Universal Service Fund (USF) for marginalized areas and 0.5% to sustain themselves. ”  
- ISP

G4 Kenya's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 4: 'Integrated regulation'**<sup>1</sup>



## Access to finance

- The 'PPP Act 2021' **seeks to expand opportunities for Public-Private Partnerships in Kenya**. Despite these measures, **Foreign Direct Investments (FDI) is still recovering** from the COVID-19 pandemic. **Communications and Media** is considered one of the **leading sectors** in terms of FDI in Kenya

“ The government should make the USF funds more accessible for smaller players. Currently often 200-page proposals need to be submitted to get access, and that is not feasible for smaller ISPs with limited resources. ”  
- ISP

### Access to finance indicators

- Exchange rate to USD: **0.0066** (2023)
- Government Debt to GDP (% of GDP): **67.3%** (2022)
- Interest rate: **10.5%** (2023)
- Domestic Credit to private sector (% of GDP)<sup>2</sup>: **31.5%** (2022)

## Key takeaways

- **Competition:** oscillation in regulations for digital services and investments may raise uncertainty for (international) new entrants
- **Funding security:** it is difficult for smaller players to access the Universal Service Fund
- **Funding security:** interest rate is relatively high (10.5%), which may hamper infrastructure investments

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)  
Sources: ITU, World Bank Development Indicators, Trading Economics, International Trade Administration, UNCTAD's Investment Report 2022, Investment Monitor, Crunchbase, OECD, University of Oxford, Interviews, Deloitte analysis



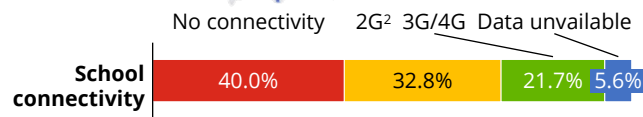
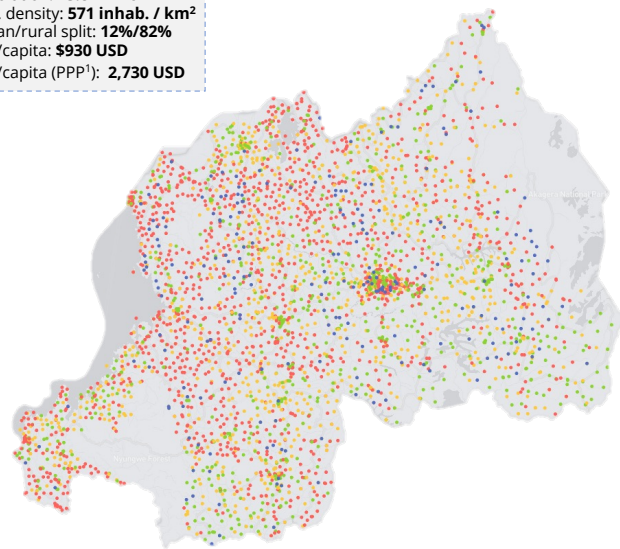
# Rwanda | Broader context & status of school connectivity

Only 22% of schools in Rwanda have meaningful connectivity, with access to electricity and digital literacy posing barriers for expanding connectivity

**Although 55% of schools are connected, only 22% of schools have a meaningful internet connection (3G/4G)**

**Overview**

- Population: **13.8 million**
- Pop. density: **571 inhab. / km<sup>2</sup>**
- Urban/rural split: **12%/82%**
- GNI/capita: **\$930 USD**
- GNI/capita (PPP<sup>1</sup>): **2,730 USD**



## Government support for school connectivity

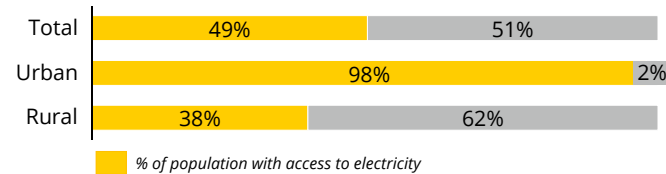


- The Rwandan government has implemented the **One Laptop per Child (OLPC) program**, which has distributed over 200,000 laptops to primary school students across the country. This program helps to create a culture of technology and innovation from a young age
- In March 2023, **government ministers visited** the first **school** that was **connected** to the **internet via Starlink**

## Electricity



- Access to electricity is **major barrier**, particularly in rural areas



## Digital literacy



- Rwanda** has a **score of 4.5** on the Wiley 'Digital Skills Gap Index', which ranks Rwanda **4<sup>th</sup> out of 26** countries in **Sub-Saharan Africa**
- Digital literacy is relatively low in Rwanda: **30%** of the population in Rwanda **used the internet** in 2021

## Key takeaways

- + Affordability:** the **government is committed** to **providing ICT and high-speed internet** to schools
- + Acceptability:** although **digital literacy** is relatively low in Rwanda, the **OLPC program includes training of teachers**
- Affordability:** although the government is committed to expanding connectivity, **available budget** is expected to be **low** given the relatively low GNI per capita <sup>2</sup>
- Delivery: lack of electricity** in rural areas increases costs for internet connectivity solutions

Notes: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production; 2) Data on government expenditure on school connectivity has not been found, but the available government budget has been compared among the 9 focus countries by looking at GNI per capita and government expenditure on education as percentage of GDP;  
Sources: Giga, BCG, GSMA, WorldBank, Leoncom, Sierraloaded, Deloitte analysis

# Rwanda | Fiber internet market

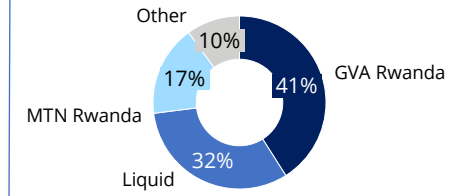
The government of Rwanda has made interventions to bring down cost of bandwidth; however, affordability of fiber remains a challenge

## Key insights into the fiber internet market

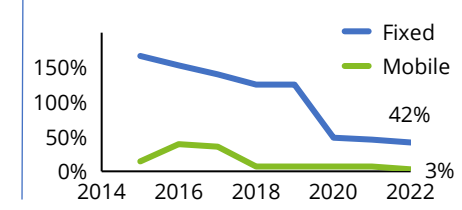
<b>Coverage</b>	<ul style="list-style-type: none"> <li>Given the <b>landlocked character</b> of Rwanda, the <b>government</b> deployed initiatives to <b>procure undersea fiber optic cable capacity</b> in Kenya and Tanzania</li> <li>Rwanda has invested in <b>expanding its fiber network</b>, spanning over <b>6,000 km</b> since 2019. Nearly all schools are within a 30 km range of the fiber network.</li> <li>Additionally, there are <b>several thousand kilometres of fiber deployed by other (private) operators</b> as a base for fixed and mobile internet</li> <li><b>Less than 1%</b> of Rwandans have a <b>fixed internet connection</b></li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>The main Fixed Network Operators include <b>GVA Rwanda, Liquid Telecom Rwanda and MTN Rwanda</b></li> <li><b>GVA Rwanda</b> is the <b>market leader</b> in terms of fixed broadband subscriptions (<b>41%</b>) followed by Liquid Telecom (32%) and MTN Rwanda (17%)</li> </ul>
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li><b>Bulk purchases</b> by the government greatly <b>expanded</b> Rwanda's international <b>bandwidth capacity</b> with some of the <b>lowest wholesale prices</b> in Africa</li> <li>Price of fixed broadband is <b>relatively low (\$0.51 USD per Mbps per month)</b>, although the price of a fixed <b>broadband package</b> is generally <b>not affordable (at 42% of GNI per capita)</b></li> <li>According to the Ookla speedtest, Rwanda has a <b>download speed of 34 Mbps</b> and <b>upload speed of 10 Mbps</b>, which ranks Rwanda <b>113<sup>th</sup> out of 181</b> countries</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li>The World Bank Group has approved <b>\$100 million</b> to help the Government of Rwanda <b>increase access and adoption of digital services</b> including broadband</li> </ul>

“ Rwanda has made certain interventions to bring down the costs of bandwidth. They have used development finance to make long-term commitments.  
- Infrastructure provider ”

Fixed broadband subscriptions (2023)



Broadband prices as % of GNI per capita<sup>1</sup>



THE WORLD BANK  
December 2021  
World Bank Provides \$100 Million to Accelerate Rwanda's Digital Transformation

## Key takeaways

- + **Availability:** the fiber network **spans most of the country** and international bandwidth is available
- **Affordability:** despite **successful government interventions** to bring down costs, **affordability of fixed broadband** remains a **challenge**
- + **Competition:** there are **multiple larger FNOs** competing in the market
- + **Quality:** quality of fixed broadband is relatively high in Rwanda

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
Sources: Giga, ITU, Rwanda Utilities Regulatory Authority, UN-OHRLLS, Ookla, Rwanda Today, ISP, Cable.co.uk, Interviews, Deloitte analysis



# Rwanda | Wireless internet market

There is a well-established 4G network in Rwanda, and mobile connectivity is relatively affordable; however, competition is limited

## Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>The <b>3G/4G network</b> in Rwanda covers <b>98% of schools</b>, and the <b>4G network covers 97% of population</b></li> </ul>	<p><b>School coverage</b></p> <table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>3G/4G</td> <td>98%</td> </tr> <tr> <td>2G</td> <td>2%</td> </tr> <tr> <td>No coverage</td> <td>0%</td> </tr> <tr> <td>Data unavailable</td> <td>0%</td> </tr> </tbody> </table>	Category	Percentage	3G/4G	98%	2G	2%	No coverage	0%	Data unavailable	0%
Category	Percentage											
3G/4G	98%											
2G	2%											
No coverage	0%											
Data unavailable	0%											
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>The 4G infrastructure market used to be fully owned by <b>Korea Telecom Rwanda Networks (KTRN)</b>, but in July 2023 the Utilities Regulatory Authority (RURA) has modified the license of KTRN to <b>allow other companies to deploy 4G networks</b></li> <li><b>MTN</b> is the <b>market leader</b> in the 4G market with <b>66%</b> of subscriptions. <b>Airtel</b> is another significant player with 21% of subscriptions. The <b>remaining 13%</b> of 4G subscriptions is covered by <b>18 different ISPs</b></li> </ul>	<p><b>Market share 4G subscribers (2022)</b></p> <table border="1"> <thead> <tr> <th>Company</th> <th>Market Share</th> </tr> </thead> <tbody> <tr> <td>MTN</td> <td>66%</td> </tr> <tr> <td>Airtel</td> <td>21%</td> </tr> <tr> <td>Others</td> <td>13%</td> </tr> </tbody> </table>	Company	Market Share	MTN	66%	Airtel	21%	Others	13%		
Company	Market Share											
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<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li><b>Price of mobile connectivity</b> is <b>relatively low</b> in Rwanda (at 3% of GNI per capita, and on average \$0,55 USD per GB of mobile data)</li> <li>The <b>opening of the 4G infrastructure market</b>, is <b>expected to reduce the cost of wholesale 4G</b> which will also reduce consumer prices</li> <li>The speed of mobile broadband in Rwanda is average with <b>27 Mbps down- and 8 Mbps upload speed</b></li> </ul>	<p><b>Connecting Africa</b> July 2023</p> <p>Korea Telecom Rwanda Networks loses 4G infrastructure monopoly</p>										
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>The government of Rwanda is preparing to <b>pilot 5G internet</b> by the end of 2023. The government is establishing 5G related infrastructure as part of the <b>revised National Broadband Policy and Strategy</b> from October 2022. The government aims to have a total of <b>60 5G sites in operation by 2025</b></li> </ul>	<p>The New Times February 2023</p> <p><b>Rwanda set to pilot 5G internet</b></p>										

## Key takeaways

- + **Availability:** Rwanda has achieved **nearly universal coverage of 3G/4G** (98% of schools are covered)
- **Competition:** dominance of one market player with a 66% market share of 4G subscriptions (MTN); the 4G infrastructure market used to be a monopoly, but this has recently been changed
- + **Affordability:** the **price of mobile connectivity** is **relatively low** in Rwanda and is **near the target of 2% of GNI per capita**

Sources: Giga, ITU, Rwanda Ministry of ICT & Innovation, Connecting Africa, Cable.co.uk, Ookla, The New Times, Interviews, Deloitte analysis







# Rwanda | Satellite internet market

LEO satellite internet has become available in Rwanda and the government is collaborating with market players to make LEO satellite internet available to schools

## Key insights into the satellite internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>Rwanda is <b>covered</b> by Starlink's <b>LEO satellites</b> and by <b>GEO/VSAT satellites</b></li> </ul>	 <p>SPACE IN AFRICA</p> <p>February 2023</p> <p>SpaceX's Starlink Licensed in Rwanda</p>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>Several providers <b>offer GEO/VSAT internet (Vizocom, Ntvsat and GlobalTT)</b></li> <li>In early 2023, <b>Starlink</b> entered the market in Rwanda as currently the <b>only provider of LEO satellite internet</b></li> <li>The <b>Rwandan Space Agency (RSA)</b> indicates that Starlink's <b>services</b> have the potential to <b>increase the competitiveness</b> in the <b>broadband services sector</b></li> </ul>	
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>The Minister of ICT and Innovation states that the <b>Starlink's LEO internet</b> is about <b>three times faster than the available products</b> on the Rwandan market at almost the <b>same price point</b></li> <li>Price of Starlink satellite internet is around <b>\$39 USD per month</b> with a <b>one-off equipment &amp; shipping price of ~\$460 USD</b> <sup>1</sup></li> </ul>	<p>The New Times</p> <p>February 2023</p> <p><b>Starlink internet is fast and affordable, ICT Minister says</b></p>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>The Rwanda Space Agency (RSA) has announced that <b>Starlink has been licensed</b> to provide <b>internet services</b> to Rwanda</li> <li>The Ministry of ICT and Innovation plans to <b>pilot the internet services</b> from <b>Starlink's satellite</b> technology in <b>500 Rwandan schools</b>; the <b>first 50 schools</b> have already been provided Starlink internet</li> </ul>	<p>The New Times</p> <p>February 2023</p> <p><b>Starlink internet to be piloted in 500 schools</b></p>

### Key takeaways

- + **Availability: LEO satellite internet** has become available in Rwanda, and the government is collaborating with market players to make LEO satellite internet **available for schools**
- + **Affordability & Quality:** first signals indicate that **LEO satellite internet** is **competitive with other connectivity solutions**
- **Competition: Starlink** currently is the **only company offering LEO satellite services**

Note: 1) Prices based on online available information on residential subscription price (source: Starlink Insider) and these have not been verified for school connectivity  
 Sources: Company websites, The New Times, Starlink Insider, Rwanda Space Agency, Interviews, Deloitte analysis

# Rwanda | Enabling environment

The government is focused on improving prices in the telecommunications market and encourage foreign direct investment into the Rwanda economy



## Regulations

- The Government of Rwanda is aiming to **improve competition** among **internet service providers** to **lower the costs** for Rwandans. One such initiative is the establishment of the **Rwanda Internet Exchange Point (RIXP)**, which allows local ISPs to **exchange internet traffic within the country**, rather than routing it through international networks
- **Taxes and regulatory fees** also play a role in determining internet prices in Rwanda. ISPs are subject to various taxes and levies, including a value-added **tax (VAT) of 18% on internet services**, as well as **regulatory fees** imposed by the Rwanda Utilities Regulatory Authority (RURA). These **costs** are often **passed on to consumers** in the form of higher prices for internet access
- The **Ministry of ICT (MINICT)** addresses national priorities relating to **economic growth** and **poverty reduction through** policies and programs related to information, **technology, communication** and **innovation** as well as **citizen's empowerment**



Rwanda's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 4: 'Integrate regulation'**<sup>1</sup>



## Access to finance

- **Foreign Direct Investments (FDI)** have been **on the rise** after a moderate dip during the COVID-19 pandemic and exceeding the investments from before the pandemic. The **FDI in 2022** stood at around **400 million USD**, coming from 150 million USD in 2020.
- The **Rwandan Investment Code** calls for **equal treatment** for both **foreigners and nationals** in certain operations, free transfer of funds, and compensation in cases of expropriation. This makes Rwanda an **interesting economy** for **foreign investors and companies**

### Access to finance indicators



Exchange rate to USD: **0.00081**



Government Debt to GDP (% of GDP): **67.5%** (2022)



Interest rate: **7.5%** (2023)



Domestic Credit to private sector (% of GDP): **22.5%** (2022)

## Key takeaways

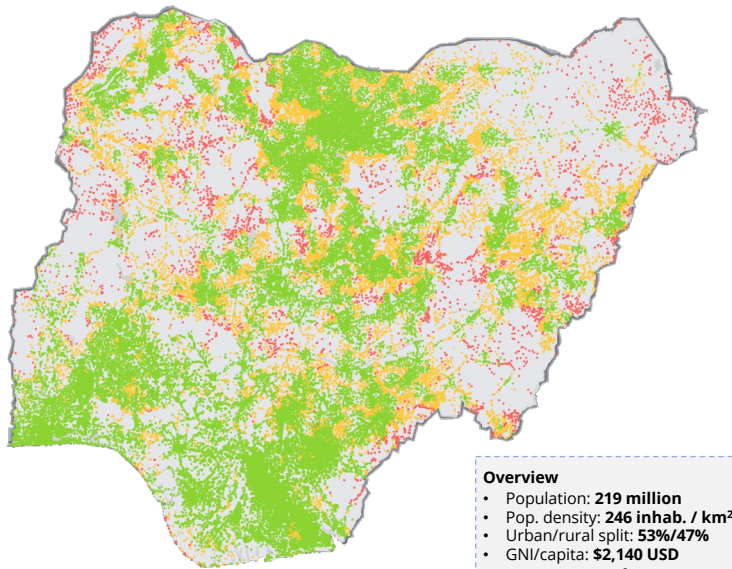
- + **Affordability:** the establishment of the **Rwanda Internet Exchange Point** has helped to **reduce the cost of internet** and improve the overall quality of internet services in Rwanda
- **Affordability:** **taxes and regulatory fees** are **passed onto consumers**
- **Funding security:** there is a **relatively high interest rate (7.5%)**, which may hamper investments

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation;  
 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)  
 Sources: ITU, World Bank Development Indicators, Trading Economics, interviews, Deloitte analysis

# Nigeria | Broader context & status of school connectivity

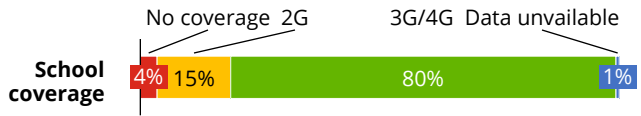
In Nigeria, there is a lack of information on the connectivity of schools, but connectivity is expected to be relatively high in urban areas but low in rural areas

Of all >110,000 schools, 80% of schools are covered by 3G/4G but actual connectivity is unknown<sup>1</sup>



**Overview**

- Population: 219 million
- Pop. density: 246 inhab. / km<sup>2</sup>
- Urban/rural split: 53%/47%
- GNI/capita: \$2,140 USD
- GNI/capita (PPP<sup>2</sup>): \$5,560 USD



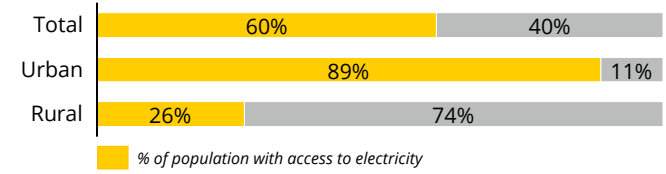
## Government support for school connectivity

- In March 2022, the Ministry of Education launched the **Nigeria Learning Passport (NLP)** together with **UNICEF** and **Microsoft**. The NLP offers **digital learning resources** and is supported by **Airtel** and **IHS Towers** to connect more schools and provide **free access to the NLP** on Airtel devices
- In March 2023, the government approved the budget of N24.2 billion (~\$31 million USD) to install **broadband internet** connections in **43 schools, 20 airports and 6 shopping malls**



## Electricity

- In **rural areas**, access to electricity is **major barrier**



## Digital literacy

- Digital literacy is average in Nigeria; **55% of individuals** in Nigeria are using the internet
- Nigeria scores a 3.6 on the Wiley 'Digital Skills Gap Index', **ranking 11<sup>th</sup> out of 26 countries** in Sub-Saharan Africa



## Key takeaways

- + **Affordability:** the government is making efforts to **improve school connectivity and digital education**, illustrated by the National Learning Passport (NLP) initiative
- **Delivery:** while in urban areas there is relatively high access to electricity (~89% of population), **in rural areas there is a lack of access to electricity** (only ~26% of population have access)
- **Acceptability:** there is a **lack of digital skills** with only 55% of individuals using the internet

Notes: 1) Status of school connectivity is unknown by Giga as Giga has not (yet) engaged with the government to obtain this data; 2) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production  
Sources: Giga, ITU, World Bank, GSMA, Wiley, Deloitte analysis

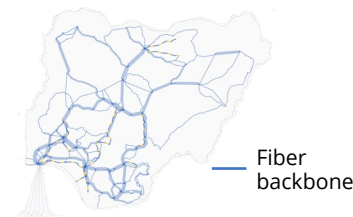


# Nigeria | Fiber internet market

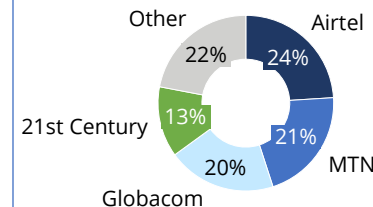
The fiber market in Nigeria is concentrated in the biggest city Lagos and the capital Abuja, and expanding to rural areas is considered not economic viable

## Key insights into the fiber internet market

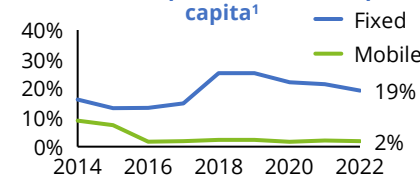
<b>Coverage</b>	<ul style="list-style-type: none"> <li>In Nigeria, there are <b>6 international submarine cables</b> entering in Lagos</li> <li><b>Total optical-fiber cable deployment</b> was <b>~96,000 km</b> (on-land fiber &amp; submarine cable) across Nigeria by the end of 2022</li> <li>There are <b>&lt;1 fixed broadband subscriptions per 100 inhabitants</b></li> <li>Investments in the fiber market focus on urban areas, and it is considered <b>too expensive to deploy fiber in rural areas</b> due to the low population density and high cost of maintenance</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>In terms of <b>on-land fiber deployment</b>, the three main <b>MNOs Airtel, MTN and Globacom</b> account for a large share (~44,500 km, <b>65%</b>); besides the MNOs, the fixed network operator <b>21<sup>st</sup> Century</b> (~9,000 km, <b>13%</b>) is also a significant player</li> <li>In terms of <b>Fiber-to-the-Home/Building subscriptions</b>, <b>ipNX is the market leader</b> with <b>64%</b> of the ~50,300 subscriptions. <b>MTN (11%)</b> and <b>Suburban Broadband (8%)</b> are other players in the fiber market</li> <li>There is a <b>large number of Internet Service Providers (ISPs)</b> in Nigeria (264), but ISPs in Nigeria are <b>concentrated mostly in Lagos and Abuja</b></li> </ul>
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li><b>Fixed broadband prices</b> in Nigeria relative to the <b>GNI per capita is at 19%</b> and have not reduced over the last years</li> <li>Fiber broadband from ipNX is priced between <b>~\$27 USD per month</b> (35 Mbps down, unlimited vol.) and <b>~\$235 USD per month</b> (600 Mbps down, unlimited vol.)</li> <li><b>Quality of fixed broadband</b> is reported as 18 Mbps down, 12 Mbps up and latency of 28ms, <b>ranking Nigeria 142<sup>th</sup></b> in the Ookla Speedtest Global Index</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li>The \$428 million <b>backbone project (NICTIB II)</b>, financed by the Export-Import Bank of China, aims to develop <b>3,250 km of fiber across 19 states</b> (out of 36 states in Nigeria); the NICTIB II was <b>deemed 98% complete in Dec. 2022</b></li> </ul>



On-land fiber deployment 2022



Broadband prices as % of GNI per capita<sup>1</sup>



ECONOMIC CONFIDENTIAL

July 2023

NICTIB II: Fiber Optic Cable Infrastructure Brings Hope and Concerns to Communities, by Khadija Ishaq Bawas

## Key takeaways

- **Availability:** investments in fiber in rural areas are **considered too expensive**, due to the low population density and high costs for maintenance
- + **Competition:** there are **many ISPs (264)**, indicating **low barriers to entry**
- **Affordability:** Over the last 10 years, prices of fixed broadband relative to GNI per capita have barely reduced, indicating that **affordability is a persistent challenge**
- **Quality:** **fixed internet seems to be relatively low** compared to other countries in the region

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita

Sources: Giga, ITU, World Bank, Submarine Cable Networks, Nigeria Communications Commission (NCC) Annual Report 2022, Economic Confidential, ipNX, Ookla, Interviews, Deloitte analysis

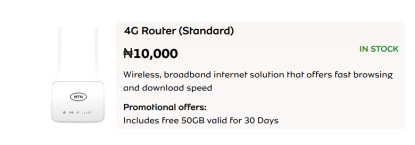
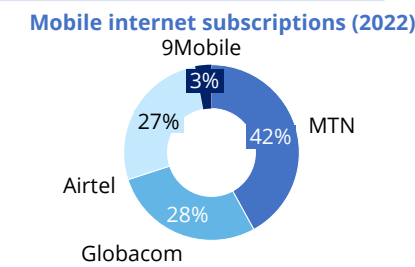
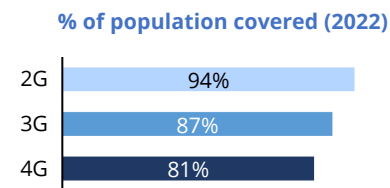


# Nigeria | Wireless internet market

The mobile internet market in Nigeria is competitive and prices are relatively low, but most players lack economic incentive to expand their operations to rural areas

## Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>In Nigeria, the <b>majority of schools (80%)</b> is covered by 3G or 4G</li> <li><b>&gt;80% of population is covered by 4G</b> (LTE/WiMAX), 87% of population is covered by 3G and 94% of population is covered by 2G</li> <li>Current <b>broadband penetration</b> stands at around <b>50% of population</b></li> <li>Like the fiber market, there is a <b>lack of economic incentive</b> for MNOs to expand their mobile infrastructure to remote areas</li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>In the <b>mobile internet market</b>, <b>MTN is the market leader</b> with 66 million subscriptions (<b>42% market share</b>) followed by <b>Globacom (28%), Airtel (27%)</b> and <b>9Mobile (3%)</b></li> <li><b>Mafab Communications</b> is a <b>new player</b> which entered the market in 2021, focusing solely on <b>5G</b></li> <li>Besides the MNOs, there are also 'collocation &amp; infrastructure sharing' companies that own <b>mobile towers</b>; in this segment, <b>IHS Nigeria</b> is the market leader (<b>48%</b>) followed by <b>Globacom (25%)</b> and <b>ATC Wireless Infrastructure (22%)</b></li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>Prices of <b>mobile broadband</b> internet are <b>relatively low</b>; data-only mobile broadband is at 1.8% of GNI per capita, and \$0.39 USD per GB of mobile data (2nd least expensive of the 9 focus countries)</li> <li><b>Quality of mobile broadband</b> is reported as 27 Mbps down, 12 Mbps up and latency of 32ms, <b>ranking Nigeria 85<sup>th</sup></b> in the Ookla Speedtest Global Index</li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>In October 2022, the <b>European Investment Bank</b> agreed to provide <b>€100 million in funding</b> to <b>MTN Nigeria</b> to support the expansion of its 4G network</li> <li>In June 2023, the Nigeria Communications Commission (NCC) issued <b>25 mobile virtual network operator (MVNO)<sup>2</sup> licenses</b> to increase competition, reduce prices and improve network coverage in underserved areas</li> <li>In June 2023, <b>Airtel</b> became the third operator to <b>launch 5G</b>, following earlier deployments of <b>MTN Nigeria</b> and newcomer <b>Mafab Communications</b></li> </ul>



**Oct. 2022**  
 Nigeria: EIB backs MTN Nigeria with €100m for high-speed network expansion

**June 2023**  
 Nigeria begins MVNO operations, 25 firms get licences

**June 2023**  
 Airtel joins the 5G race in Nigeria

## Key takeaways

- **Availability:** there is a **lack of economic incentive** for MNOs to **expand** their mobile infrastructure to rural areas
- + **Competition:** There is a **competitive mobile internet market** in Nigeria with several large MNOs, and the **recent introduction of MVNOs**
- + **Affordability:** Prices of **mobile broadband** internet are **relatively low** in Nigeria compared to other countries
- + **Quality seems to be relatively high** compared to other countries in the region

Sources: Giga, ITU, Nigeria Communications Commission (NCC) Annual Report 2022, Cable.co.uk, Vanguard, MTN, EIB, The Guardian, Total Telecom, Interviews, Deloitte analysis



# Nigeria | Satellite internet market

There is an active and competitive satellite internet market in Nigeria, and satellite internet is offered at an affordable price point

## Key insights into the satellite internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>• There is an <b>active satellite market</b> in Nigeria, and <b>VSAT internet</b> is being used across the country</li> <li>• As of June 2023, <b>Starlink Nigeria</b> had a total <b>customer base of 6,756</b> in Nigeria</li> <li>• However, there are still several <b>challenges</b> for satellite internet in rural areas, including affordability, access to electricity, security, (digital) illiteracy and the provision of after-sales services</li> </ul>	<p>“ Our coverage is as wide as you need it; if there is no fiber infrastructure and you don't have mobile network access at your location, we can service you with VSAT connectivity. ”</p> <p>- ISP</p>	<p><b>Key takeaways</b></p> <ul style="list-style-type: none"> <li>+ <b>Competition:</b> there is an <b>active</b> and <b>competitive</b> market for satellite connectivity in Nigeria</li> <li>+ <b>Availability:</b> besides various <b>GEO satellite</b> internet providers, <b>LEO satellite internet</b> is also available in Nigeria</li> <li>+ <b>Affordability:</b> satellite connectivity is at a <b>competitive price point</b> in Nigeria, with VSAT players offering satellite internet for as affordable as <b>~\$10 USD per month</b></li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>• There are many players active in the <b>satellite market</b> of Nigeria, ranging from state-owned satellite operator <b>NIGCOMSAT</b> to satellite internet providers such as <b>Yahclick, Avanti and Eutelsat</b></li> <li>• Furthermore, there is the entrance of <b>LEO-satellite players such as Starlink</b> (which is available in Nigeria since January 2023 with Nigeria being the first African country to receive Starlink's service) and <b>Eutelsat OneWeb</b></li> <li>• Additionally, there are ISPs such as <b>Coolink, Derive Communications and Tizeti</b> which partner up with satellite internet providers to service their customers with satellite connectivity</li> </ul>	<p>“ We differentiate from our competitors by focusing on government enterprises. Furthermore, we have a network of resellers across the country and can deploy &amp; service customers in each state. ”</p> <p>- Satellite operator</p>	
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>• Starlink's LEO connectivity was introduced to the Nigerian market at <b>\$48 USD per month</b> with a <b>one-off equipment &amp; shipping price of \$380 USD</b> <sup>1</sup></li> <li>• VSAT players such as Coolink on the other hand offer satellite internet as affordable as <b>~\$10 USD per month</b> (20 Mbps) with an equipment price of <b>~\$80 USD</b></li> </ul>	<p>“ LEO satellite internet might be an option for private schools but at least for now is too expensive for public schools and GEO is preferred. ”</p> <p>- ISP</p>	
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>• The Nigerian state-owned satellite operator <b>NIGCOMSAT</b> has recently <b>partnered with Yahclick</b>, to expand their GEO satellite footprint in Nigeria and beyond</li> <li>• Nigerian ISP <b>Tizeti</b> and <b>Eutelsat</b> have partnered to provide <b>GEO satellite internet</b> to underserved areas through a <b>public wi-fi hotspot service</b>, particularly in remote areas that are difficult to reach by terrestrial broadband infrastructure.</li> </ul>	<p>June 2023 NIGCOMSAT and YahClick to Enhance Broadband Connectivity in Sub-Saharan Africa</p> <p>Nov. 2022 Eutelsat, Tizeti partner to boost broadband penetration in Nigeria</p>	

Note: 1) Prices based on online available information on residential subscription price (source: Business Insider Africa) and these have not been verified for school connectivity  
Sources: Business Insider Africa, Coolink, Space in Africa, Business Day, Interviews, Deloitte analysis



# Nigeria | Enabling environment

There is significant commitment from the government to improve connectivity, but access to finance is a challenge, particularly for smaller players



## Regulations

- In March 2020, Nigeria's **National Broadband Plan (2020-2025)** was launched with the aim to improve network coverage and quality. The target is to achieve download speeds of minimum 25 Mbps in urban areas and 10 Mbps in rural areas, with effective coverage available to >90% of population by 2025 at a price not more than 2% of median income / 1% of minimum wage
- MNOs who have reached a **5G license**, are under the **licensing requirements** from the Nigeria Communications Commission (NCC) required to expand their coverage to reach at least two states in each of the country's six main regions within two years

“ The government is making efforts through the Nigeria Communications Commission (NCC). They specifically have a department for broadband penetration in the rural areas. They are making efforts, and we have been involved in government projects to reach the unreachable ”  
- ISP



Nigeria's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 4: 'integrated regulation'** <sup>1</sup>



## Access to finance

- **The interest rate in Nigeria is high (18.75%)**, which poses a challenge for capital-heavy investments such as developing new connectivity infrastructure
- Nigeria has a **Universal Service Fund**, but it is **not considered to be successful up to now as limited funding has been provided**

“ Access to finance for smaller players is a big issue as they cannot access development funding. A good example is Nigeria, where there are lots of local licenses, but none of the smaller players have been able to raise \$50-100 million to expand fiber in the region. ”  
- Infrastructure company

### Access to finance indicators

- Exchange rate to USD: **0.00013** USD (2023)
- Government Debt to GDP (% of GDP): **38%** (2022)
- Interest rate: **18.75%** (2023)
- Domestic Credit to private sector (% of GDP)<sup>2</sup>: **13.56%** (2021)

## Key takeaways

- + **Funding security: Nigeria** has a **well-established telecommunications market**, and **significant commitment** from the government to improve the coverage and quality of internet
- **Funding security: the high interest rate** poses a challenge for capital-heavy investments such as connectivity infrastructure
- **Funding security: smaller players** in particular **struggle to gain access to finance**, as smaller players often **cannot access development funding**

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

Sources: ITU, World Bank Development Indicators, Trading Economics, S&P Global, OECD, Nigeria Communications Commission (NCC) Annual Report 2022, Interviews, Deloitte analysis

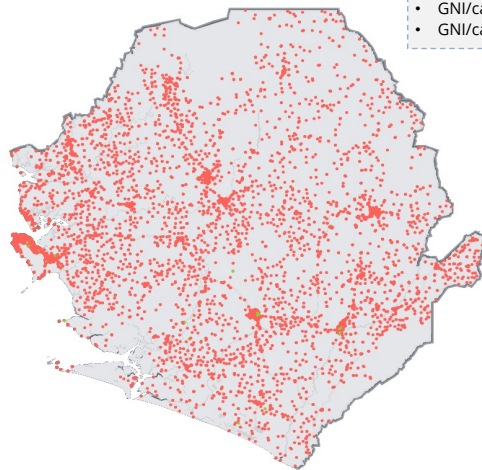
# Sierra Leone | Broader context & status of school connectivity

In Sierra Leone, only 1.5% of schools are connected, the government is committed to increase connectivity in schools, but digital illiteracy and lack of electricity access create barriers

Out of a total of 12,000 schools, **only 192 schools** have reported to be **connected**

**Overview**

- Population: **8.4 million**
- Pop. density: **122 inhab. / km<sup>2</sup>**
- Urban/rural split: **43%/57%**
- GNI/capita: **\$510 USD**
- GNI/capita (PPP): **1,900 USD**

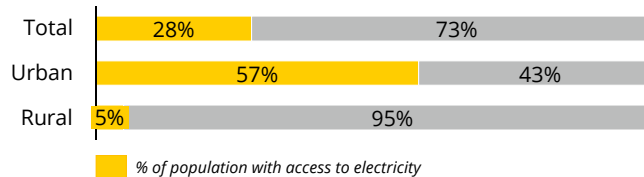


## Government support for school connectivity

- **Government organizations** Ministry of Basic and Secondary School Education (MBSSE) and the Directorate of Science, Technology and Innovation (DSTI) collaborate to **ensure that schools are equipped with connectivity solutions**
- The government **partnered with WorldVision and ProFuturo to provide digital learning in schools**, and with **Giga to increase school connectivity**

## Electricity

- Access to electricity is **major barrier**, particularly in rural areas



## Digital literacy

- Digital literacy is **low** in Sierra Leone, with only **18%** of the population **using the internet** (least internet usage of the 9 assessed countries)

## Key takeaways

- + **Affordability: significant commitment** from the government to increase school connectivity, and **good collaboration** between government, market players and other partners (e.g. Giga)
- **Affordability:** however, **government budget is low**, given the **very low GNI per capita** <sup>2</sup>
- **Delivery: access to electricity** in rural areas is a **major challenge**
- **Acceptability:** there is a **lack of digital literacy** which may hamper the uptake of school connectivity

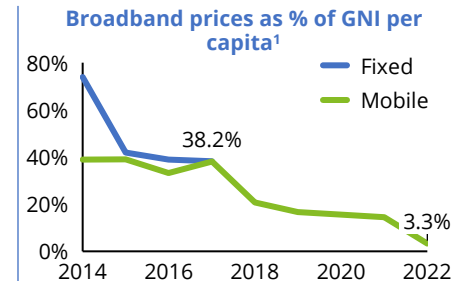
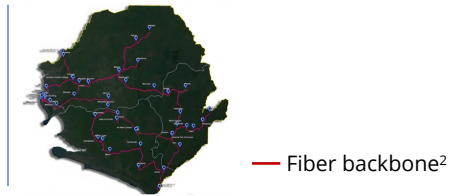
Notes: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production; 2) Data on government expenditure on school connectivity has not been found, but the available government budget has been compared among the 9 focus countries by looking at GNI per capita and government expenditure on education as percentage of GDP  
Sources: Giga, BCG, GSMA, WorldBank, Leonecom, Sierraloaded, Deloitte analysis

# Sierra Leone | Fiber internet market

Affordability of fixed broadband connectivity is a major challenge in Sierra Leone; with the reliance on a single first-mile operator as a possible root cause for high prices

## Key insights into the fiber internet market

Coverage	<ul style="list-style-type: none"> <li>The <b>Africa Coast to Europe (ACE)</b> submarine cable lands in capital Freetown</li> <li>In <b>August 2023</b>, Huawei handed over the completed <b>National Fiber Optic Backbone</b> to operator <b>Leonecom</b></li> <li>Although fiber coverage used to be low and <b>usage still is (&lt;1%)</b>, the National Fiber Optic Backbone Project has recently been completed (August 2023), spanning <b>14 of the 16 districts</b> and connecting all major towns and cities in Sierra Leone</li> </ul>
Market players	<ul style="list-style-type: none"> <li>The access point of the ACE submarine cable (first-mile) is managed by <b>ZoodLabs</b></li> <li>The National Fiber Optic Backbone is operated by <b>Leonecom</b></li> <li>There are <b>three Fixed Network Operators: Sierratel, Orange and Africell</b></li> <li>According to the latest registry of regulator NATCOM (2020), there were <b>17 Internet Service Providers (ISPs)</b> active in Sierra Leone (+ the MNOs who also act as ISPs)</li> </ul>
Pricing & quality	<ul style="list-style-type: none"> <li><b>High price of fixed connectivity</b>, which is priced at <b>38% of GNI per capita</b> and on average <b>\$5,56 USD per Mbps per month</b> (3rd most expensive of the 9 focus countries)</li> <li>The ISP K3Tele offers an <b>unlimited business internet connection</b> for <b>\$399 USD</b> per month at <b>100 Mbps download speed</b></li> <li>According to the Ookla speedtest global index <b>download speed is 14 Mbps and upload is 8 Mbps</b>, which ranks the country <b>145<sup>th</sup> out of 181</b></li> </ul>
Market trends	<ul style="list-style-type: none"> <li><b>Africell</b> received a <b>USD 100 million grant</b> from the United States Trade and Development Agency (USTDA) for a <b>feasibility study to expand fixed broadband network</b> in up to 32 cities and towns</li> </ul>



## Key takeaways

- **Competition:** there is a **single first-mile operator** which potentially leads to **higher wholesale bandwidth prices**
- + **Competition:** Although the **fiber market is small**, there are **17 ISPs** which suggests **low barriers to entry**
- **Affordability:** **high price** of fixed connectivity (~38% of GNI per capita)
- **Quality:** **Relatively low quality** of fixed broadband internet

Notes: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita; 2) The coverage of the National Fiber Optic Backbone as retrieved from the Leonecom website

Sources: Giga, ITU, World Bank, Submarine Cable Networks, NATCOM Register of Licensed Telecom Operators in Sierra Leone (2020), NATCOM annual report (2019), Cable.co.uk, Interviews, Deloitte analysis



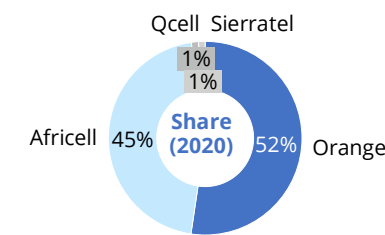
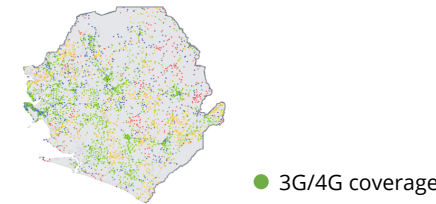


# Sierra Leone | Wireless internet market

The mobile market in Sierra Leone is dominated by two major operators; affordability however has significantly improved over the last years

## Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>• Around <b>57%</b> of schools are covered by a <b>strong 3G or 4G network</b></li> <li>• Sierra Leone <b>aims for 80% 3G/4G coverage by 2024</b></li> <li>• There are <b>98 mobile cellular subscriptions</b> per 100 inhabitants</li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>• There are <b>four Mobile Network Operators</b>: Orange, Africell, Qcell and Sierratel</li> <li>• In the <b>mobile market, Orange and Africell</b> are the <b>market leaders</b> with 52% and 45% share respectively</li> <li>• <b>Sierratel's</b> network used to be based on CDMA technology, but recently launched its 4G network</li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>• <b>Affordability</b> of mobile connectivity has <b>significantly improved</b> over the last years, with now a <b>relatively low price</b> of mobile connectivity (at 3% of GNI per capita, and average price of \$0.67 USD per GB)</li> <li>• <b>Orange</b> offers 4G mobile Wi-Fi at 10 Mbps (300 GB): ~\$50 USD per month; <b>Africell</b> offers 4G mobile broadband at 10 Mbps (unlimited data): ~\$70 USD per month</li> <li>• Providing connectivity in <b>rural areas</b> is considered a <b>major challenge</b>, given the <b>difficult terrain</b> (Sierra Leone is a mountainous country) resulting in <b>high costs</b></li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>• Africell has <b>received the country's first 5G spectrum</b> in 2022</li> <li>• Orange is <b>trialing 5G service</b> for its subscribers in <b>Freetown</b></li> </ul>



“ Sierra Leon is a mountainous country; this is one of the biggest showstoppers, especially for point-to-point microwave solutions - MNO ”

**africell** Nov. 2022  
Africell receives 5G spectrum in Sierra Leone

**Key takeaways**

- **Availability:** 3G/4G network coverage is low for schools as **only 57% of schools are covered**
- **Competition:** there is **limited competition** in the mobile market as **two providers** dominate the market
- + **Affordability:** Relatively low price of mobile connectivity (at 3% of GNI per capita, and average price of \$0.67 USD per GB)



Sources: Giga, ITU, NATCOM Register of Licensed Telecom Operators in Sierra Leone (2020), NATCOM annual report (2019), Cable.co.uk, Africell, Telecom Review Africa, Interviews, Deloitte analysis



# Sierra Leone | Satellite internet market

## Satellite internet might provide a solution for the challenging terrain in Sierra Leone, but affordability is likely to be a challenge

### Key insights into the satellite internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>In Sierra Leone both <b>GEO/VSAT</b> and <b>LEO satellite internet</b> is <b>available</b></li> <li>Satellite internet offers the <b>potential to reach remote areas</b> without large additional capital investments of extending the middle-mile network (fixed or mobile) and <b>can be used in mountains and forests</b> (under the condition that a <b>line of sight</b> with the satellite can be established for GEO satellite internet)</li> </ul>	<p>Example Eutelsat satellite coverage</p> 
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>A <b>variety of providers</b>, such as Vizocom, Globaltt and Ntvsat, <b>offer GEO/VSAT internet</b> in Sierra Leone</li> <li><b>Starlink</b> has been granted a license and will initiate the <b>LEO satellite internet</b> market in Sierra Leone</li> </ul>	<p>“ Satellite internet is very expensive – we have Eutelsat and the costs are way higher than other solutions - MNO ”</p>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>Prices for GEO/VSAT satellite internet are estimated to range from <b>~\$40-\$150 USD per month</b> <sup>1</sup></li> <li><b>Starlink has not announced prices</b> for its services in Sierra Leone, but it is likely that they will be <b>similar to prices in Nigeria</b> which are approximately \$48 USD per month and \$380 USD for the equipment &amp; shipping</li> </ul>	<p>“ It depends on the costs – if the costs are okay then I’m sure we will do a partnership with Starlink. - MNO ”</p>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>In June 2023, Sierra Leone granted a <b>license to Starlink</b>; Sierra Leone is the <b>fifth African country</b> where <b>Starlink will operate</b>, after Nigeria, Mozambique, Rwanda and Mauritius</li> </ul>	 <p>June 2023 Sierra Leone joins Elon Musk’s Starlink satellite service</p>

**Key takeaways**

- + **Availability:** satellite internet can offer a viable alternative to fiber & mobile in **mountainous areas** of Sierra Leone
- **Affordability:** price of **satellite internet** (GEO and LEO) are considered **high** compared to other connectivity solutions
- + **Availability:** **Starlink** recently received an **operating license** in Sierra Leone

Note: 1) Prices based on online available information on subscription price (source: TS2) and these have not been verified for school connectivity  
Sources: African Business, Company websites, TS2, Interviews, Deloitte analysis

# Sierra Leone | Enabling environment

The government is supportive of increasing connectivity across the country; however, access to affordable finance is a major obstacle for further investments in connectivity



## Regulations

- In June 2022, a new law was passed to govern the telecommunications industry in Sierra Leone: the **National Communications Authority Act 2022**. The act provides the regulatory and licensing framework for telecommunication operators
- Network operators require a **telecommunication service authorization (license)** from the NatCA
- Key requirements for network operators include **mandatory coverage targets, universal access and quality targets** (minimum data speed, transparency of the conditions of the service level agreement and equal access to services)

“ The challenge is the sustainability of connectivity after the government projects have ended. Funding is required to cover the recurring costs, but because of inadequate management decisions, there is no money collected from schools and funding stops. ”  
- ISP

G2 Sierra Leone’s telecom regulation maturity is classified by ITU’s ICT Regulatory tracker as **Generation 2: ‘early open markets’**<sup>1</sup>



## Access to finance

- **Interest rates in Sierra Leone are high (21%)** compared to other countries, which is a problem for capital-heavy investments such as developing new connectivity infrastructure
- Along with other ECOWAS countries, Sierra Leone established a **Universal Service Fund, the UADF to fund investments in ICT**

“ Cost of equipment is a major cost component. In Sierra Leone, the economy has fallen drastically, and because of inflation the cost of goods has gone threefold. This has jeopardized the profitability of our contracts. ”  
- MNO

### Access to finance indicators

- Exchange rate to USD: **0.000051** (2023)
- Government Debt to GDP (% of GDP): **98.8%** (2022)
- Interest rate: **21.3%** (2023)
- Domestic Credit to private sector (% of GDP)<sup>2</sup>: **0.00635%** (2022)

## Key takeaways

- **Delivery: high inflation** affects the **profitability** of operators and their **ability** to meet contracts
- **Affordability: lack of long-term funding** that is available for school connectivity and to cover the recurring costs
- **Funding security: high cost of capital** due to high interest rates

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

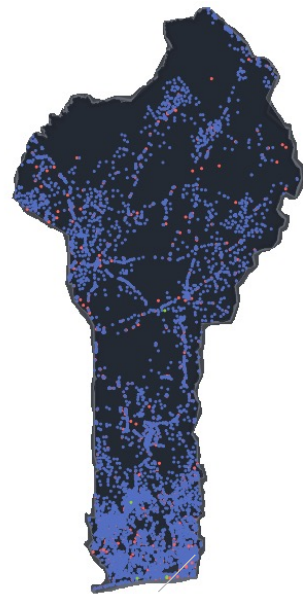
Sources: ITU, World Bank Development Indicators, Trading Economics, Interviews, Deloitte analysis



# Benin | Broader context & status of school connectivity

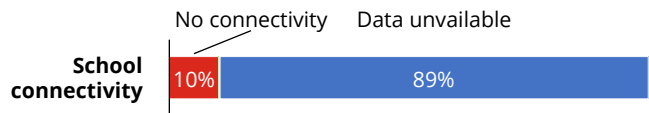
In Benin, there is a lack of information on the connectivity of schools, but connectivity is expected to be low due to challenges of affordability, electricity and digital literacy

**Out of a total of 8,668 schools, only 20 schools have reported to be connected**



**Overview**

- Population: **13 million**
- Pop. density: **122 inhab. / km<sup>2</sup>**
- Urban/rural split: **51%/49%**
- GNI/capita: **\$1,400 USD**
- GNI/capita (PPP): **\$4,020 USD**



## Government support for school connectivity

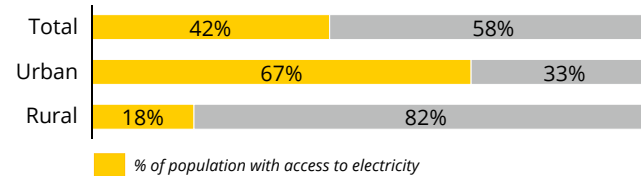


- In 2022, the **Beninese Education and Research Network (RBER)** was launched, connecting 10 universities and academic centers
- The **Agence des Systèmes d'Information et du Numérique (ASIN)** has a **dedicated initiative** to connect primary & secondary schools

## Electricity



- Access to electricity is **major barrier**, particularly in rural areas



## Digital literacy



- Digital literacy is relatively low in Benin; only **34% of individuals** in Benin are using the internet
- Benin scores a 3.2 on the Wiley 'Digital Skills Gap Index'<sup>3</sup>, **ranking 14<sup>th</sup> out of 26 countries** in Sub-Saharan Africa

## Key takeaways

- **Affordability:** the Benin population has **low purchasing power** considering GNI per capita<sup>2</sup> and there is at least **one dedicated initiative** from the government to connect schools to the internet
- **Access to electricity** is a major challenge in Benin, especially in rural areas
- **Acceptability:** there is a **lack of digital skills** with only 34% of individuals using the internet

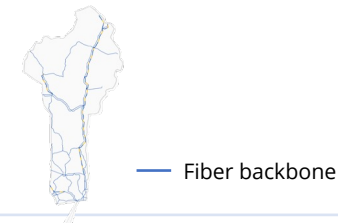
Notes: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production; 2) Data on government expenditure on school connectivity has not been found, but the available government budget has been compared among the 9 focus countries by looking at GNI per capita and government expenditure on education as percentage of GDP; 3) The Wiley 'Digital Skills Gap Index' measures a country's digital development in terms of digital skills on 6 pillars (e.g. digital skills institutions, government support for bridging the digital skills gap); Sources: Giga, ITU, World Bank, GSMA, Wiley, Deloitte analysis

# Benin | Fiber internet market

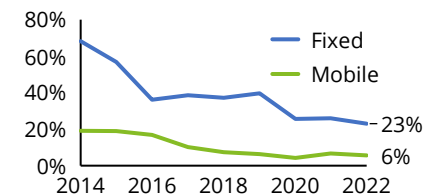
State-owned company SBIN is the only fiber provider in Benin, and while fiber broadband could be a viable solution for urban areas, affordability is a challenge

## Key insights into the fiber internet market

<p>Coverage</p>	<ul style="list-style-type: none"> <li>There are <b>three submarine cables</b> entering Benin in Cotonou: the SAT-3/WASC, ACE and West Africa cables</li> <li>The <b>fiber-optic backbone</b> of Benin covers &gt;3,000 km and <b>86% of communes</b></li> <li><b>~50% of schools</b> in Benin are <b>located within 10 km</b> to the closest fiber node</li> <li>The <b>fixed market represents ~6%</b> of the total telecommunications market (incl. telephone), and there are <b>&lt;1 fixed broadband subscriptions</b> per 100 inhabitants</li> </ul>
<p>Market players</p>	<ul style="list-style-type: none"> <li>There is <b>one</b> fixed network operator: <b>state-owned company SBIN</b>. SBIN manages the fiber-optic backbone and deploys fixed LTE and Fiber-to-the-Home</li> <li>Besides SBIN, there is <b>one other ISP</b> that offers fiber: <b>Isocel</b>. Isocel is however <b>only active in the Cotonou area</b> (south of Benin)</li> </ul>
<p>Pricing &amp; quality</p>	<ul style="list-style-type: none"> <li>Fixed broadband prices are <b>expensive</b> relative to the gross national income (GNI) per capita (23%), which is an indicator for <b>high connectivity prices for schools</b></li> <li>Fiber-to-the-Home from SBIN (through their Celtiis brand) and Isocel are priced between <b>\$25 per month</b> (10 Mbps down, 3 Mbps up, unlimited volume) and <b>\$65 USD per month</b> (50 Mbps down, 10-12 Mbps up, unlimited volume)</li> <li>The fixed broadband has a median <b>download speed of 21 Mbps</b> and an upload speed of 9 Mbps, which ranks the country <b>133<sup>rd</sup> out of 181</b></li> </ul>
<p>Market trends</p>	<ul style="list-style-type: none"> <li>In October 2022, the Minister of Digital Transformation launched the <b>Beninese Education and Research Network (RBER)</b>. The RBER connects <b>10 universities and academic centers</b> through deployment of <b>7 km of fiber</b> and <b>420 access points</b> with an internet speed of <b>1000 Mbps</b></li> </ul>



Broadband prices as % of GNI per capita<sup>1</sup>



Oct. 2022

Benin interconnects ten universities, more to come

## Key takeaways

- **Availability:** while the fiber-optic backbone covers 86% of communes, **only 50% of schools** are located **within 10 km** from a **fiber node**
- **Competition:** the backbone is **fully managed by state-owned company SBIN**, which might result in **increased wholesale prices** if there is no substantial investment from the government
- **Affordability:** affordability of fiber connectivity is a challenge given **fixed broadband is 23% of GNI per capita**
- + **Quality:** Benin has the **third highest quality of fixed internet** of the nine focus countries

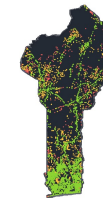
Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
Sources: Giga, ITU, World Bank, Submarine Cable Networks, ARCEP Benin annual report 2022, Celtiis, We Are Tech Africa, Interviews, Deloitte analysis

# Benin | Wireless internet market

The mobile internet market is dominated by MTN Benin and Moov Africa, but the government introduced Celtiis to the market (subsidiary of state-owned SBIN) to bring more competition

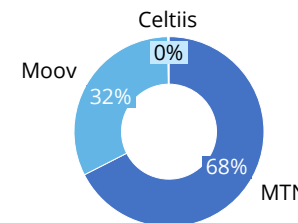
## Key insights into the wireless internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>• <b>93% of population</b> in Benin is covered by mobile broadband network</li> <li>• Around <b>84% of schools</b> are covered by a <b>strong 4G network</b></li> <li>• There are <b>109 mobile cellular subscriptions</b> per 100 inhabitants</li> <li>• The coverage of the MNOs is <b>concentrated in the densely populated south</b> of Benin, but also covers the main towns &amp; roads towards the North; <b>Moov Africa</b> seems to have the <b>largest geographical coverage</b></li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>• There are <b>three MNOs</b> in Benin: <b>Moov Africa, MTN Benin</b> and <b>Celtiis</b></li> <li>• <b>MTN</b> is the <b>market leader</b> with a revenue market share of 68% (in 2022)</li> <li>• <b>Celtiis</b> is a subsidiary of state-owned SBIN and was <b>introduced to the market in 2022</b> to bring more competition in the mobile segment. Celtiis is <b>managed by Sonatel</b> (part of Orange) and offers fiber broadband and 4G LTE technologies</li> </ul>
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>• <b>Price for mobile broadband</b> is expensive with <b>\$2.37 USD per GB of mobile data (most expensive of the 9 focus countries)</b></li> <li>• Mobile broadband is priced at <b>6% of GNI per capita</b>, which significantly exceeds Broadband Commission's target of 2% of GNI per capita</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li>• <b>Ericsson</b> and <b>MTN</b> announced a partnership to provide mobile broadband to <b>remote rural areas</b> that have limited or no connectivity. A total of 29 <b>mobile towers</b> will be deployed which will run on <b>100 percent solar and battery power</b></li> <li>• As of January 2023, the telecom regulator ARCEP opened the 5G spectrum, granting mobile network operators the <b>possibility to deploy experimental 5G networks</b>. Since then, MTN Benin announced the launch of 5G</li> </ul>



● 3G/4G coverage

Market share by revenue (2022)



July 2023



Ericsson and MTN connect remote areas with solar power in Benin



June 2023  
• Autorisation de l'expérimentation de la 5G au Bénin

## Key takeaways



- + **Availability:** the **4G network covers** most of the population in Benin and **84% of schools** and market players are investing into solutions for remote areas
- **Competition:** **MTN** is the dominant market player with a **market share of 68%**
- + **Competition:** The **entrance of Celtiis** into the **mobile market** has brought more **competition**
- + **Availability:** mobile and infrastructure players are **partnering to provide mobile access using solar-powered towers in rural areas**
- **Affordability:** mobile broadband is cheaper than fixed broadband but still at **6% of GNI per capita**



# Benin | Satellite internet market

The satellite internet market seems to be at a nascent stage in Benin; Starlink has however recently entered the market to provide LEO satellite connectivity

## Key insights into the satellite internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>• <b>GEO/VSAT satellite</b> internet is <b>available</b> in Benin, but no information has been found to what extent it is being deployed and used</li> <li>• <b>Starlink launched</b> LEO satellite internet in Benin in <b>November 2023</b></li> </ul>	<p>Eutelsat's Konnect Ka-band coverage</p> 	<h3>Key takeaways</h3> <ul style="list-style-type: none"> <li>+ <b>Availability:</b> there are <b>various (international) GEO satellite internet service providers</b>, and <b>Starlink has recently been launched</b> in Benin</li> <li>- <b>Affordability:</b> <b>affordability</b> of LEO satellite internet is <b>expected to be a challenge</b> given the higher price and low GNI per capita</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>• There are several <b>international satellite ISPs</b> such as <b>BusinessCom, Vizocom and Spacecom</b> that offer GEO satellite services in Benin</li> <li>• With the launch of Starlink the company is the first provider of LEO satellite internet</li> </ul>	<p>“ We work with ISPs abroad to deliver satellite connectivity in the region. We have provided internet connectivity to a bank in Benin across its various sites. - <b>Nigerian satellite operator</b> ”</p>	
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>• With the <b>entrance of Starlink</b>, the country will have access to high-speed and low latency satellite internet, with prices around <b>\$55 USD per month</b> and <b>one-off equipment &amp; shipping price of ~\$700 USD</b></li> </ul>		
<b>Market trends</b>	<ul style="list-style-type: none"> <li>• <b>Starlink launched</b> LEO satellite internet in Benin in <b>November 2023</b></li> </ul>	<p><b>COMMS UPDATE</b> <i>November 2023</i> <b>Starlink launches satellite broadband service in Benin</b></p>	

Note: 1) Prices based on online available information on residential subscription price (source: Starlink Insider) and these have not been verified for school connectivity  
Sources: Company websites, Connecting Africa, Starlink Insider, GlobalTT, Commsupdate, TS2, Deloitte analysis

# Benin | Enabling environment

The government is making efforts to decrease connectivity prices, for instance by imposing price controls and supporting the industry by attracting private investments



## Regulations

- The telecommunications regulator ARCEP imposes **price controls** that **prevent companies** from **overcharging customers**, which is based on an analysis of service production costs and allowable profit margin. Although affordability remains a challenge, this regulation has led to **lower prices in Benin** and has **eased access to internet**
- Benin has also implemented a **Digital Code**, which prescribes the **conditions** for **access, confidentiality** and **neutrality** in the telecommunications industry
- The **taxation system** for the ICT sector underwent **simplification** through the implementation of the finance law. This law standardized the GSM communications fee at a fixed rate of 10% of the monthly turnover so that the **operators can increase their investments** and **promote growth**



Benin's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 2: 'early open markets'** <sup>1</sup>



## Access to finance

- **Interest rates in Benin** are low compared to other ECOWAS countries, which is positive for capital-heavy investments such as developing new connectivity infrastructure
- Benin's government continues efforts to **attract private investment** and has raised EUR 1.5 billion on the Eurostox market and XOF 86 billion (USD 138 million) on the WAEMU financial market
- The Investment and Exports Promotion Agency works with **foreign companies** to **facilitate new investments** and brings down processing time for new business registrations and construction permits

### Access to finance indicators



Exchange rate to USD: **0.0016** (2023)



Government Debt to GDP (% of GDP): **53%** (2022)



Interest rate: **5.25%** (2023)



Domestic Credit to private sector (% of GDP)<sup>2</sup>: **17.1%** (2021)

## Key takeaways

- + **Affordability:** the **government** has **imposed price controls** on telecommunication operators
- + **Funding security:** the **interest rate** in Benin is **low** compared to other assessed countries (**~5%**), which is **positive for high-CAPEX investments** such as telecommunication infrastructure
- + **Funding security:** the government continues efforts to **attract (foreign) private investments** into its economy

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation;

2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

Sources: ITU, World Bank Development Indicators, Worldbank, USA Bureau of Economic and Business Affairs, International Trade Administration, Trading Economics, S&P Global, OECD, University of Oxford, Interviews, Deloitte analysis

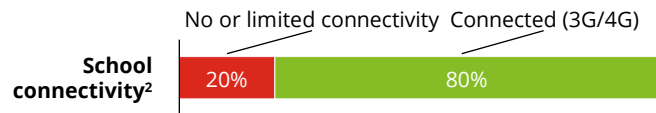
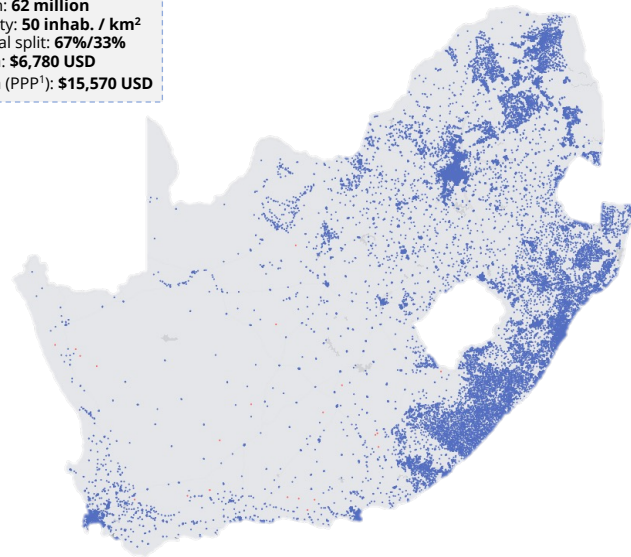
# South Africa | Broader context & status of school connectivity

School connectivity is relatively good in South Africa with around 80% of public schools being connected, but the stability of electricity and digital illiteracy form a barrier for further uptake

Out of a total of 32,925 schools, **only 0.1% schools** are reported with **no coverage**

**Overview**

- Population: **62 million**
- Pop. density: **50 inhab. / km<sup>2</sup>**
- Urban/rural split: **67%/33%**
- GNI/capita: **\$6,780 USD**
- GNI/capita (PPP<sup>1</sup>): **\$15,570 USD**



## Government support for school connectivity

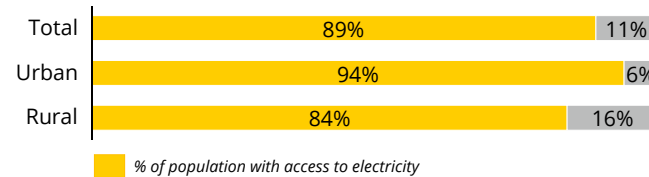


- In 2013, the South African government approved the SA Connect initiative, which aimed to connect 6,135 government facilities including schools
- The communications regulator, ICASA has mandated (through spectrum licenses) telecommunications companies to provide broadband services to 18,520 schools

## Electricity



- Access to **stable** electricity supply is a **major barrier**



## Digital literacy



- Digital literacy is relatively high in South Africa; with **72% of individuals** in South Africa using the internet
- South Africa scores a 4.4 on the Wiley 'Digital Skills Gap Index', **ranking 4<sup>th</sup> out of 26 countries** in Sub-Saharan Africa

## Key takeaways

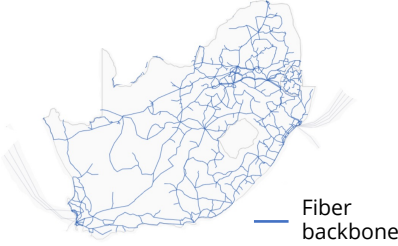

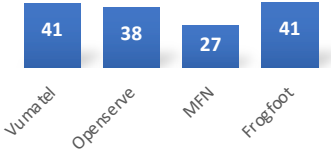

- Affordability:** South African has the **most unequal** income equality in the world, with the poorest living of \$2.15 per day
- Affordability: dedicated initiatives from the government** have been stymied by limited funding
- Delivery: stable electricity supply** is a major challenge due to constraints experienced at the national electricity provider Eskom
- Acceptability:** there is a **gap of digital skills** with 28% of individuals not using the internet

Notes: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production; 2) Connectivity of schools as found through desk research (source: IOL (2023) 'Angie Motshekga says 80% of public schools have internet connectivity'); please note that this is not aligned with Giga's connectivity map, as data on connectivity per school is largely unavailable (blue colour)  
Sources: Giga, ITU, World Bank, GSMA, IOL, Wiley, Deloitte analysis

# South Africa | Fiber internet market

The fiber market is competitive in South Africa, and while fiber broadband could be a viable solution for urban areas, affordability is a challenge

## Key insights into the fiber internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>There are <b>eight submarine cables</b> entering South Africa: the SAT-3/WASC, SAFE, SAT-3/WASC, EASSy, METISS, Equiano, 2Africa and West Africa cables</li> <li>The <b>fiber-optic backbone</b> in South Africa is extensive, with over 100,000 km of cables deployed</li> <li>As of March 2023 South Africa has around <b>1.5 million households</b> with fiber-to-the-home (FTTH) connectivity</li> <li>At the national level, about 90% of households do not have internet connection at home</li> </ul>	 <p>Fiber backbone</p>										
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>The <b>main</b> fixed network operators: <b>Vumatel, state co-owned company Openserve (Telkom), Metrofibre, Octotel, Frogfoot</b></li> <li>These fiber network operators (FNO's) own and manage their own fiber networks and provide <b>wholesale access</b> to other internet service providers (ISP's)</li> </ul>											
<p><b>Pricing</b></p>	<ul style="list-style-type: none"> <li>Having largely frozen prices since the Covid-19 pandemic, FNOs such as Telkom's Openserve, Vumatel and Frogfoot have begun raising the fees they charge ISPs for accessing their networks to bring them in line with inflation</li> <li>Aggregate fixed internet prices are around <b>\$17 USD per month</b> (20 Mbps down, 14 Mbps up, unlimited volume), but government subsidies through the E-Rate Tariff offer a 50% discount for schools.</li> </ul>	<p><b>20 Mbps Fiber prices of South African ISP's in USD</b></p>  <table border="1"> <thead> <tr> <th>ISP</th> <th>Price (USD)</th> </tr> </thead> <tbody> <tr> <td>Vumatel</td> <td>41</td> </tr> <tr> <td>Openserve</td> <td>38</td> </tr> <tr> <td>MTN</td> <td>27</td> </tr> <tr> <td>Frogfoot</td> <td>41</td> </tr> </tbody> </table>	ISP	Price (USD)	Vumatel	41	Openserve	38	MTN	27	Frogfoot	41
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<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>Vodacom e-learning equips educators with mobile technology to improve classroom experience. Educators and learners will be able to access content and lesson plans remotely</li> <li>Free internet for schools has partnered with Frogfoot, Vumatel and Octotel, offering fiber routers along with free data for school premises</li> </ul>											

## Key takeaways

- + **Availability:** the fiber-optic backbone covers over 100,000km
- + **Competition:** there are nine main FNO's **that own and operate their own network**, which contributes to healthy competition resulting in decreasing wholesale prices and increasing speeds
- **Affordability:** **affordability of fiber** connectivity is a challenge given the large low-income base in the country

Note: 1) Price per month based on retail prices from Orange and MTN for satellite internet and from MTN Benin and Moov for mobile internet  
 Sources: Giga, ITU, BusinessDay, GSMA, MyBroadband, ICASA, Interviews, Deloitte analysis



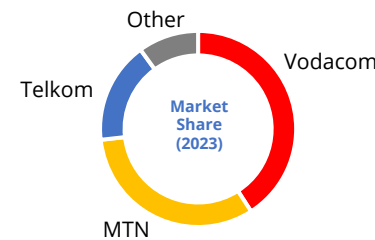
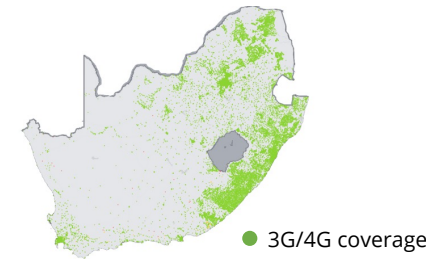


# South Africa | Wireless internet market

## Vodacom leads the mobile internet market with over 40% market share, while MTN has a denser network in the country

### Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>National population <b>coverage for 3G stood at 100%</b> in South Africa, 4G/LTE stood at 98% and 5G stood at 20% in 2022.</li> <li>In 2022, <b>6,088 schools were connected</b> to the internet based on universal service obligations imposed by ICASA.</li> <li>The South African mobile market supported approximately <b>180 mobile cellular subscriptions</b> per 100 inhabitants, inflated by multiple SIMs and inactive SIMs.</li> <li>In 2021, <b>69.4% of households nationally</b> had access to the internet using mobile devices. <b>Rural households made up 59.2%</b> nationally, accessing the internet through mobile devices in the same period.</li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>South Africa's market is competitive, with at least three strong mobile network operators and several mobile virtual network operators (MVNOs)</li> <li><b>Vodacom</b> is the <b>market leader</b> with a market share of <b>~40%</b>, followed by <b>MTN</b> with <b>~32%</b>.</li> <li><b>Telkom</b>, the largest operator in South Africa in terms of turnover and reach, is 51% government owned (including the Public Investment Corporations 12% shareholding).</li> </ul>
<p><b>Pricing</b></p>	<ul style="list-style-type: none"> <li>Price of prepaid mobile internet is <b>\$0.81-\$1.09 USD for 100MB</b> and, <b>\$33-\$38 USD for 20,480MB</b> (34.71 Mbps down, 6.79 Mbps up)</li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>At present, <b>4G is heavily underutilised</b>, leaving operators with plenty of opportunity to migrate subscribers over to these higher value plans, which should support growth</li> <li>The delayed spectrum auction in March 2022 raised over ZAR14.4bn (USD970.0mn) for ICASA (Independent Communication Authority of SA)</li> </ul>



“ If you look at urban areas, there is no reason not to have connectivity - MNO ”

### Key takeaways

- + **Availability:** the **4G network covers 98% of the population** in South Africa, with **6,088 schools connected**
- **Competition:** **MTN and Vodacom** are the **dominant market players** with a combined **market share of over 70%**
- **Competition:** The mobile market is **strongly concentrated** between MTN and Vodacom, while smaller players Cell C and Telkom have struggled to grow their market shares significantly



Sources: Giga, GSMA, World Bank, MyBroadband, CommsUpdate, BMI, ICASA, Deloitte analysis



# South Africa | Satellite internet market

GEO satellite internet is available in South Africa but LEO/MEO satellite internet is at a nascent stage, and satellite internet is considered more expensive than other connectivity options

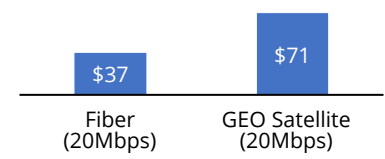
## Key insights into the satellite internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>• <b>GEO satellite internet is available</b> in South Africa. For example, Eutelsat’s satellite coverage is present across South Africa through 128 high-power spot beams, and YahClick by HughesNet has satellite coverage present in most of South Africa, except the North-West Province</li> <li>• LEO/MEO Satellite internet is at a <b>nascent stage</b> in South Africa</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>• <b>Eutelsat</b> and <b>HughesNet</b> offer satellite Internet to home users in South Africa through several ISPs — including <b>DSL Telecom Connect, MorClick, and Vox</b>.</li> <li>• The entry of <b>Starlink</b> in South Africa can boost satellite internet access in the country. However, the company <b>has not obtained an operating license yet</b></li> </ul>
<b>Pricing</b>	<ul style="list-style-type: none"> <li>• As satellite internet is <b>comparatively more expensive</b> than other internet solutions, it does not have any significant presence across schools in South Africa</li> <li>• Eutelsat offers <b>five different plans</b> with speeds ranging from 5 to 50 Mbps</li> <li>• Yahclick offers <b>two different plans</b> with speeds ranging from 10 to 20 Mbps</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li>• HughesNet offers <b>distance learning solutions</b> and internet connectivity for schools across the world</li> <li>• Internet Service Provider MorClick partnered with Yahclick, to provide <b>free internet to 15 schools in South Africa for three months</b></li> </ul>

“ LEO and MEO satellite solutions are great, but it is early days. There is not much regulations as well and there are political issues with having no ground stations in-country. **- Infrastructure provider** ”



Price of GEO satellite vs. Fiber



MYBROADBAND TRUSTED IN TECH March 2022  
**MorClick – Satellite internet that changes lives**

## Key takeaways

- **Availability:** for **rural areas** with no access to fiber or mobile connectivity, there are **not a lot of options available**, given that the **LEO/MEO satellite internet market is still nascent**
- **Affordability:** **GEO/VSAT** Satellite is comparatively **more expensive than fixed broadband**
- **Quality:** the available Mbps varies **starts at 5 Mbps**, which is sufficient for meaningful connection, however Satellite internet often has **high latency**

Sources: Company websites, MyBroadband, interviews, Deloitte analysis

# South Africa | Enabling environment

Multiple regulatory policies are in force to enhance internet access and drive down prices across the country, many of which focus specifically on school connectivity



## Regulations

- **The Independent Communication Authority of South Africa**, an autonomous regulatory body responsible for overseeing and regulating the communications sector in South Africa, established under the ICASA Act
- **E-rate tariff**, grants 50% discount on data usage to public schools, technical vocational education and training colleges. They are eligible to benefit from this E-rate tariff allowing them to access the internet at a reduced rate. Certain educational websites may avail zero-rated benefits from telecom providers, allowing the users to view or download content from those sites for free

“ To make universal school connectivity happen, there needs to be a major policy initiative from the state authorities who are responsible for education, whether provincial or national. This needs some serious resources to make this happen.  
- **Infrastructure provider** ”

G4

South Africa's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 4: 'integrated regulation'** <sup>1</sup>



## Access to finance

- **Interest rates in South Africa** are low compared to other SADC countries, which is positive for capital-heavy investments such as developing new connectivity infrastructure;
- **Universal Service and Access Obligations** mandates telecom operators, to connect a designated number of schools to the internet including institutions for persons with disabilities, within a five-year period. This facilitates enhanced educational resources, online learning, and research opportunities

### Access to finance indicators



Exchange rate to USD: **0.054** (2023)



Government Debt to GDP (% of GDP): **75%** (2022)



Interest rate: **8.25%** (2023)



Domestic Credit to private sector (% of GDP): **92.1%** (2022)

## Key takeaways

- + **Affordability:** the government has imposed **price controls** on telecommunication operators
- + **Funding security:** the **interest rate in South Africa is relatively high.** The Central Bank has raised interest rates by a total of 475 basis points since November 2021, which is unfavorable for high-CAPEX investments such as telecommunication infrastructure

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation;

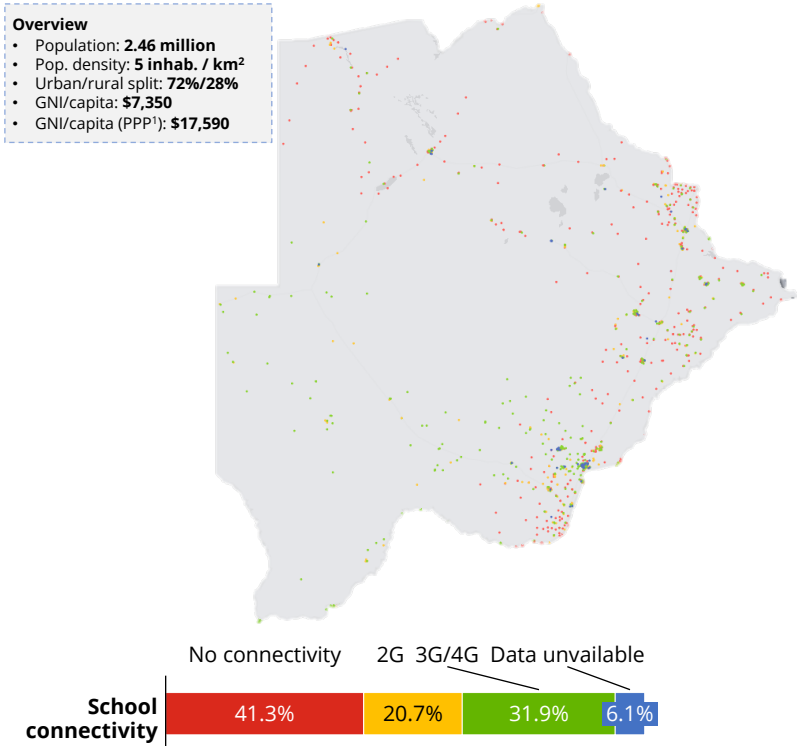
2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

Sources: ITU, World Bank Development Indicators, Trading Economics, S&P Global, OECD, University of Oxford, Interviews, Deloitte analysis

# Botswana | Broader context & status of school connectivity

Around 32% of schools in Botswana have meaningful connectivity; the sparse population as well as a lack of electricity are identified as barriers to connectivity

Of all >1,000 schools, 44% of schools are connected to the internet

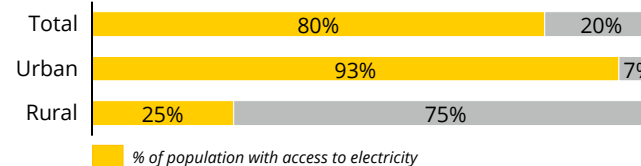


## Government support for school connectivity

- In 2019 BOCRA launched the **Schools Connectivity and Computerization Project**, which funded provision of broadband **internet connectivity** and **installation of computers** of 69 schools in **rural and remote villages**
- SmartBots** program by the **government continuously** aims to **digitize the country** and **plans to connect 500 villages** to the internet
- SmartBots** and **Giga** work together to **connect schools** to higher speed internet, which has so far benefited 400 schools

## Electricity

- In **rural areas**, access to electricity is **major barrier**



## Digital literacy

- Digital literacy is high in Botswana; **74% of individuals** in Nigeria are **using the internet**
- Botswana scores a 4.2 on the Wiley 'Digital Skills Gap Index', **ranking 4<sup>th</sup> out of 26 countries** in Sub-Saharan Africa

## Key takeaways

- + **Acceptability: Digital literacy is high**, and a large share of the population uses the internet
- **Delivery: in rural areas** there is a **lack of access to electricity** and very **low population density** increases price and risks of disruption, maintenance & security needs
- + **Affordability: there is clear commitment** from the government to **improve the internet connection** of villages

Note: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production

Sources: Giga, ITU, World Bank, GSMA, Wiley, BOCRA, Deloitte analysis



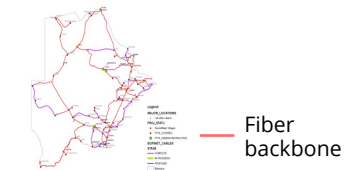
# Botswana | Fiber internet market

The fiber market in Botswana is concentrated amongst three big players; the network covers most towns, but transit charges for international bandwidth are significant

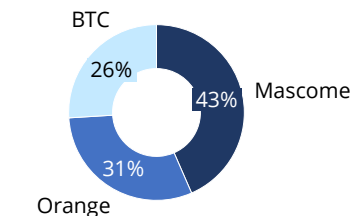
## Key insights into the fiber internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>BoFiNet has strategically invested in the <b>WACs and EASSy subsea cables</b> to ensure international bandwidth coming into Botswana.</li> <li>Botswana has <b>redundant national fiber backbone</b> networks, that connect most parts of the country. The network spans over <b>10.000 km nation wide</b> and aims to cover all towns by 2025. <b>BoFiNet operates the network</b> and serves as a wholesaler to other internet providers</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li>Organizations are free to deploy backbone infrastructure, but the infrastructure has to be provided to other operators on <b>Open Access Network Principles</b></li> <li>There are <b>three operators with public telecommunications operators licenses</b>: Mascom Wireless, Orange Botswana and Botswana Telecommunications Corporation (BTC)</li> <li>More than <b>40 ISPs</b> and <b>new players</b> have entered as a <b>result of government policies</b> and <b>open access backbone</b></li> </ul>
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>Costs for connecting Botswana to the EASSy and WACS cable systems remain significant: <b>transit charges</b> through Namibia and South Africa constitute between <b>43% and 68% of the total cost for bandwidth</b> from the Botswana border</li> <li><b>Slow speed</b> of 8 Mbps down, 7 Mbps up and 24 ms latency, with Botswana ranking <b>168<sup>th</sup> out of 181</b> countries by Ookla's Speedtest Global Index (ranking lowest out of 9 focus countries)</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li>The <b>U.S. Trade and Development Agency</b> awarded a grant to BoFiNet for a <b>feasibility study</b> to support <b>equitable and affordable broadband internet access</b> to nearly a half million people in Botswana's <b>most rural and hardest-to-reach communities</b></li> </ul>

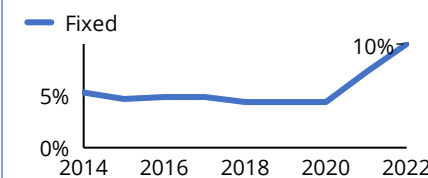
Fiber backbone in Botswana



Market share of fixed internet providers



Broadband prices as % of GNI per capita<sup>1</sup>



## Key takeaways

- **Availability:** investments in fiber in rural areas are **considered too expensive**, due to the low population density and high costs for maintenance and security
- + **Competition:** Competition in the middle-mile segment **amongst ISPs**
- **Affordability:** Price of **fixed broadband** relative to GNI per capita has **increased**, potentially due to **high transmission costs** through SA and Namibia
- **Quality:** **quality of fixed broadband is low** in Botswana (ranking lowest out of 9 focus countries)

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita;  
Sources: BOCRA, USTDA, Worldbank, Ookla, ITU, Interviews, Deloitte Analysis

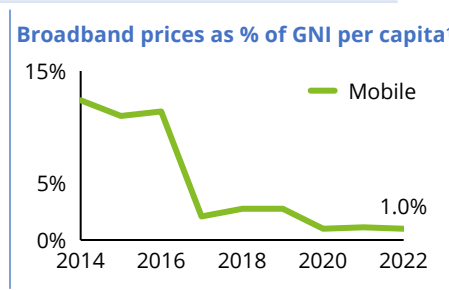
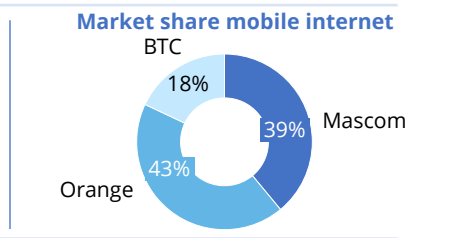
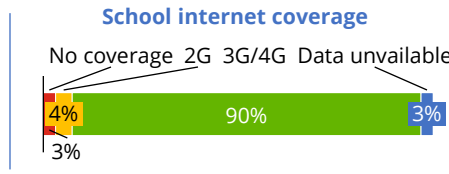


# Botswana | Wireless internet market

## The mobile internet market in Botswana is relatively competitive and affordability of mobile broadband is good

### Key insights into the wireless internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>Botswana has <b>strong mobile coverage</b>, following a good backbone infrastructure</li> <li><b>90% of schools</b> are in areas, which are covered by <b>3G or 4G</b> Mobile internet</li> <li>Overall, Botswana had 4.28 million <b>cellular mobile connections</b>, which is equivalent to <b>162% of the total population</b></li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li><b>BTC, Orange and Mascom</b> are also the <b>main providers</b> for mobile phone services</li> <li>As of November 2023 <b>Orange</b> has already launched <b>5G internet</b> for its customers and BTC plans to follow suit with optimising its 4G/ 5G network</li> <li>There are at least <b>10 internet service providers</b> in Botswana</li> </ul>
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li>The <b>price</b> of mobile subscriptions is <b>below the 2% of GNI per capita target</b> set by the Broadband Commission for the past few years</li> <li>Mobile broadband costs <b>\$1.99 USD per GB</b></li> <li>Connecting <b>smaller villages</b> (&lt;500 inhabitants) to high-speed internet is considered <b>not economically viable</b> (no viable business case)</li> <li>According to Ookla's Speedtest Global Index, the <b>median mobile internet connection speed</b> is 33 Mbps, which is more than <b>four times faster than median fixed internet</b> speed</li> </ul>
<b>Market trends</b>	<ul style="list-style-type: none"> <li><b>Orange</b> Botswana has <b>launched</b> the group's <b>first 5G network in Africa</b>. The new infrastructure covers 30% of the country's population, centered on greater Gaborone and Francistown, with other cities to follow in 2023. Despite these upgrades, the focus seems to remain on bigger cities, not including more rural areas of Botswana</li> </ul>



**COMMS UPDATE** November 2022  
**Orange Botswana launches the group's first African 5G network**

### Key takeaways

- **Availability: limited** availability in **rural areas** as the business case is low for connecting rural towns <5000 inhabitants
- + **Affordability:** mobile broadband is **affordable compared to the GNI** per capita
- + **Quality: mobile internet** connection speed is **faster** than fixed internet

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
 Sources: Giga, BOCRA, Reuters, Ookla, CommsUpdate, Interviews, Deloitte analysis



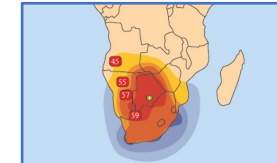
# Botswana | Satellite internet market

## There is a competitive satellite internet market in Botswana, but quality of the offered GEO satellite internet is relatively low

### Key insights into the satellite internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>The country has full <b>GEO satellite coverage</b> available via BTC VSAT Hub and Ku Band satellites</li> <li>Satellite internet is <b>available everywhere</b> in the country</li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>According to BOCRA, there are <b>several players offering satellite internet</b> connections, for example, Lenong Communications, Zebranet, GCSAT and BTC, among others</li> <li><b>BTC targets remote areas</b>, businesses and schools directly and has recently bought <b>more capacity</b> on the AMOS-7 satellite from Spacecom to <b>improve its offer</b> for rural customers</li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>Price of GEO internet is relatively high (e.g. <b>ranging from \$35 per month for 0.5 Mbps to \$525 per month for 10 Mbps</b> at GCSat, and <b>starting at ~\$60 per month</b> at BTC) <sup>1</sup></li> <li>Starlink is planning to provide LEO satellite internet for <b>\$48 USD per month</b> (for 150 Mbps internet) <sup>1</sup>, which would make a <b>relatively cheap &amp; high-quality option</b></li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>According to Starlink's website, the <b>satellite internet service planned to launch in Botswana in Q3 2023</b>. This has now been adjusted to Q3 2024 since, according to the Botswana Communications &amp; Regulatory Authority (BOCRA), <b>the company is yet to get the licensing</b> requirements needed to set up operations in Botswana.</li> </ul>

BTC satellite coverage



“ The population distribution is a challenge – some villages are 100s of kilometers away from the nearest fiber node  
- Infrastructure provider ”

“ The lifespan of telecom equipment is 7-10 years or 15 years if you push it, for 500 people it does not make economically sense  
- Infrastructure provider ”



September 2023

**Starlink Has Not Received License To Operate In Botswana, Says BOCRA**

### Key takeaways

- + **Competition:** there are **several providers of GEO satellite internet**
- + **Availability:** GEO satellite internet is available, and **LEO internet is expected to become available soon**
- **Quality:** **quality of GEO satellite internet is relatively low** and offered speed is often too slow for a meaningful internet connection

Note: 1) Prices based on online available information (source: BOCRA for GEO/VSAT and Guardian Sun for Starlink) and these have not been verified for school connectivity  
Sources: BOCRA, Guardian Sun, Amos-Spacecom, Interviews, Deloitte analysis

# Botswana | Enabling environment

There is significant commitment from the government to improve connectivity



## Regulations

- In 2019, the Botswana Communications Regulatory Authority (BOCRA) engaged with operators and **agreed to cut data prices by up to 46 %** making data prices competitive in the region
- Botswana Fiber Network (BoFiNet), the state-owned entity that provides wholesale national and international telecommunication infrastructure and services to the Botswana Telecommunications Corporation (BTC) **offered service providers Indefeasible Right of Use (IRU) contracts for connectivity, reducing prices in some cases to below \$0.86 per Megabits per second (Mbps)**

“In Botswana, connectivity has been designated as a basic amenity by the government, resulting in it being a requirement for all villages with a population of over 500 people  
- Infrastructure provider”

**G3** Botswana’s telecom regulation maturity is classified by ITU’s ICT Regulatory tracker as **Generation 3: “enabling investment & access”**<sup>1</sup>



## Access to finance

- Botswana’s financial system appears to be **mostly stable**, sound and **resilient to a wider range of shocks** relating to risks such as volatility in diamond prices, geo-political development and the tightening of global financial conditions
- The Botswana Pula, is the **strongest currencies in Southern Africa**, which **benefits the economic growth** of the country

“Infrastructure providers have very small margins, and all equipment is procured from outside the continent.  
- Infrastructure provider”

### Access to finance indicators

- Exchange rate to USD: **0.073**
- Government Debt to GDP (% of GDP): **26.1%** (2022)
- Interest rate: **2.65%** (2023)
- Domestic Credit to private sector (% of GDP)<sup>2</sup>: **29.76%** (2021)

## Key takeaways

- + **Funding security:** The **government provides funding for connectivity and digitization** of local government premises, which includes schools
- + **Funding security:** Botswana has a **stable and relatively strong economy**, which facilitates investments

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

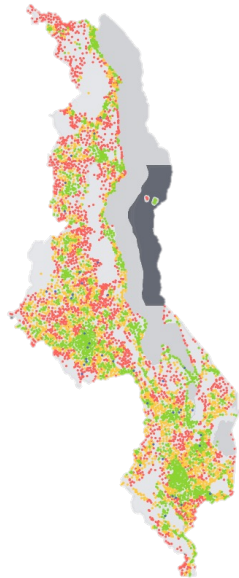
Sources: ITU, Trading Economics, XE, International Monetary Fund, Interviews, Deloitte analysis



# Malawi | Broader context & status of school connectivity

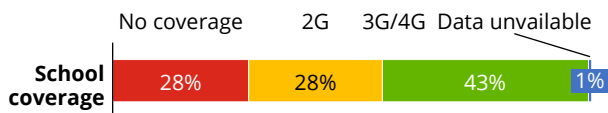
In Malawi, only 1.5% of schools are connected to the internet, although 43% of schools are covered by a good-quality network

Of all 8,000 public schools, only 1.5% are connected to the internet, although 43% of schools have good internet coverage (3G or 4G)



**Overview**

- Population: 20 million
- Pop. density: 122 inhab. / km<sup>2</sup>
- Urban/rural split: 18%/82%
- GNI/capita: \$640
- GNI/capita (PPP<sup>1</sup>): \$1,700

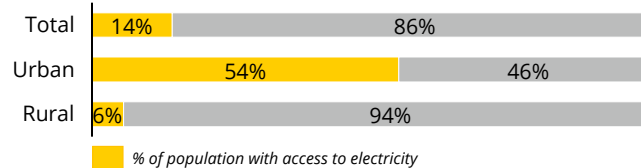


## Government support for school connectivity

- However, the **government** is **committed** to **digitalizing education** as outlined in its Malawi 2063 strategy; through the 'Connect-A-School' initiative, Malawi aims to **connect all schools by 2030**
- The **Connect-A-School** initiative is **supported with funding** by Malawi's Universal Service Fund as well as a recent partnership of **UNICEF** and **Airtel Malawi**

## Electricity

- In **rural areas**, access to electricity is **major barrier**



## Digital literacy

- Digital literacy is low in Malawi; **24% of individuals** in Malawi are using the internet
- Malawi scores a 2.2 on the Wiley 'Digital Skills Gap Index', **ranking 21<sup>st</sup> out of 26 countries** in Sub-Saharan Africa

## Key takeaways

- **Acceptability:** Low uptake of internet in communities, due to **digital illiteracy**
- **Delivery:** while in urban areas there is some access to electricity, **in rural areas there is almost no access to electricity**
- + **Funding security:** the **government is committed to connect every school by 2030 to the internet**, illustrated by the Connect-A-School initiative
- **Availability:** lack of business viability for expanding due **to lack of general road infrastructure**, low **population density** and low **ability to pay**

Note: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production

Sources: Giga, ITU, World Bank, Wiley, Deloitte analysis

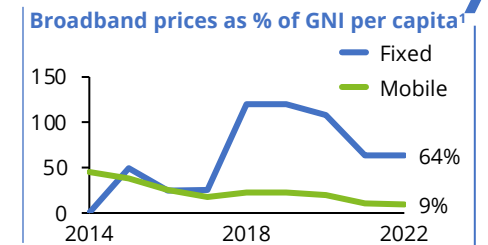
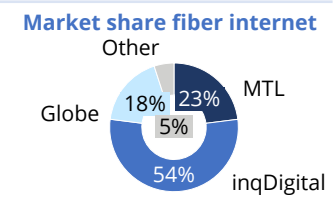
# Malawi | Fiber internet market

The national fiber backbone in Malawi is gradually expanding, and competition has increased, but affordability remains a major challenge

## Key insights into the fiber internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>Malawi is connected to the national telecom networks of Tanzania. Through Tanzania and its neighbouring countries, Malawi has created <b>multiple optic fiber gateways</b> to the landing stations of the <b>SEACOM</b> and <b>EASSy sea cables</b></li> <li>Malawi has a <b>national fiber backbone</b> connecting all 28 districts in the country. The first phase covered over <b>1.300 km of fiber</b>. The second phase, which is currently deployed, will cover an <b>additional 1.500 km</b></li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>Open Connect Limited (as 100% subsidiary of MTL) used to have a monopoly on the optic fiber backbone, but <b>new backbone operators have entered</b> the market, including inqDigital, Globe, and SimbaNet</li> <li>This has <b>stimulated additional connections</b> to <b>different undersea fiber networks</b> in neighboring countries and therefore <b>lower connectivity prices</b> for consumers</li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>The <b>price</b> for a <b>fixed broadband</b> is <b>64% of the GNI per capita</b> and has not improved in the past year</li> <li>Despite international gateways broadband <b>capacity remains low</b> and as a result the <b>wholesale price for bandwidth is high</b></li> <li>Ookla's Speedtest Global Index indicates that Malawi has a <b>download speed of 14 Mbps</b>, which ranks it <b>146<sup>th</sup> out of 181</b> countries</li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>Malawi signed a memorandum of understanding with the Chinese government for a loan of ~\$23 million, which will be used for the <b>construction of a national fiber optic network</b> to improve internet connectivity. The project is <b>financed through a soft loan from China's Export-Import Bank</b> and is <b>implemented by Huawei Technologies</b></li> </ul>

“ Fixed Wireless Access shoots far, it is a technology that is now mature in the market. In Kenya, Poa! Internet is using it to service remote areas. ”  
**- Infrastructure provider**



### Key takeaways

- + **Competition:** new operators have entered the **middle-mile fiber market**, which has increased competition
- + **Competition:** backbone operators provide an **open access network** which enables competition among ISPs
- **Affordability:** high prices for fixed bandwidth because the country is **landlocked**, has limited bandwidth usage and lacks adequate **long-term agreements**
- **Quality:** average speed of the **fixed internet is low**

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
 Sources: Giga, ITU, World Bank, Ookla, Interviews, Deloitte analysis



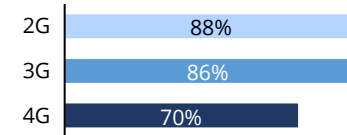
# Malawi | Wireless internet market

## The mobile internet market in Malawi is dominated by two major players; affordability is a major challenge

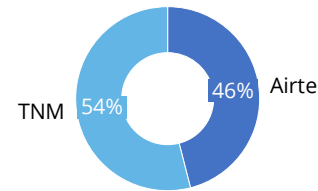
### Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>Most of the country is <b>covered in 2G or 3G mobile network</b> and <b>4G covers</b> mostly <b>urban areas</b></li> <li>At the beginning of 2022 the <b>mobile penetration rate was 61%</b>, which is still behind the average penetration rate of 66% in SADC</li> <li><b>20% of the population</b> in Malawi has <b>access to the internet</b></li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>The <b>two major mobile network operators</b> are Airtel Malawi and Telekom Networks Malawi (TNM)</li> <li><b>TNM is the biggest operator</b> and is currently the only operator that <b>provides 5G</b> and also holds two licenses for fixed network services</li> <li>A <b>third mobile network operator, Malcel, received an operating licenses in 2022</b> and the operator is <b>planning to go live in October 2023</b></li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>There are currently <b>high taxes on devices</b> (17.5%)</li> <li><b>Prices for mobile connectivity are lower than for fiber</b>, but still is at <b>9% of GNI per capita</b> (which is significantly above Broadband Commission's 2% target)</li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>Earlier in 2023 Telkom Networks Malawi (TNM) has <b>started a pilot for 5G internet</b>, following approval from the Malawi Communications Regulatory Authority (MACRA). The 5G base stations are based in Blantyre and Lilongwe. Additional sites will be added in Mzuzu and Zomba. TNM has <b>partnered with Huawei</b> for the rollout of its 5G pilot</li> </ul>

% of population covered (2022)



Market share (2023)



“ The biggest challenge for creating meaningful internet connectivity is the availability of smartphones - **MNO** ”



May 2023

Telekom Networks Malawi pilots 5G

### Key takeaways

- **Availability:** most of the country is covered, but **4G** is mainly in **urban areas**
- **Competition:** **Duopoly** in mobile broadband market, can result in **limited competition** and keep prices high
- **Affordability:** **high taxes** are imposed on **devices**, which is reflected in the price



Sources: ITU, Connecting Africa, Company websites, Interviews, Deloitte analysis



# Malawi | Satellite internet market

The satellite market in Malawi seems to be nascent, but Starlink's entrance into the market could provide a new connectivity solution for rural areas

## Key insights into the satellite internet market

<b>Coverage</b>	<ul style="list-style-type: none"> <li>The country is <b>covered by GEO and LEO/VSAT satellites</b> that can provide internet to people in Malawi</li> </ul>	<p>“ Satellite internet is developing and would be the ideal technology. [...] I see that as the future. - MNO ”</p>	<h3>Key takeaways</h3> <ul style="list-style-type: none"> <li>- <b>Competition: limited number of satellite internet providers</b> could result in increased prices</li> <li>+ <b>Availability:</b> LEO satellite can <b>offer new connectivity solutions</b> for rural areas</li> <li>- <b>Affordability:</b> satellite internet tends to sit at a <b>higher price point</b>, but offers an alternative for connectivity solutions with high CAPEX (e.g. fiber)</li> </ul>
<b>Market players</b>	<ul style="list-style-type: none"> <li><b>GEO/VSAT satellite internet</b> is provided by the <b>ISP Vizocom</b> and by <b>Liquid Technologies</b></li> <li>Since <b>Starlink</b> launched in August 2023, the country has access to <b>LEO satellite internet as well</b></li> </ul>		
<b>Pricing &amp; quality</b>	<ul style="list-style-type: none"> <li><b>GEO internet provided</b> by Vizocom and Liquid Technologies, but the <b>prices</b> for those services are <b>not readily available</b></li> <li>The <b>price of Starlink's LEO satellite internet</b> is <b>\$49 USD per month</b> with a <b>one-off equipment &amp; shipping price</b> of <b>~\$550 USD</b> <sup>1</sup></li> <li>Starlink promises that the <b>internet speed is high</b> and with <b>low-latency</b> and <b>short maintenance periods</b></li> </ul>	<p>“ Starlink is selling at ~\$700 at one-off cost and then \$50 dollar per month. That could work for rural areas - MNO ”</p>	
<b>Market trends</b>	<ul style="list-style-type: none"> <li>At the end of <b>2022 Starlink</b> was <b>granted a license to operate satellite broadband services</b> in Malawi from MACRA. Starlink became the first licensed high-speed, low-latency broadband satellite service in the country</li> <li><b>Liquid Telecom provides VSAT connectivity services to mbora</b>, a social FinTech enterprise in Malawi, through community hubs. Each hub is serviced with <b>broadband speed of up to 36 Mbps</b>. Liquid Telecom is using satellites of its long-term partner <b>Intelsat</b> and providing an <b>uncapped data service</b> to mbora</li> </ul>		

Note: 1) Prices based on online available information (source: Connecting Africa) and these have not been verified for school connectivity  
Sources: IT Web, IT News Africa, Connecting Africa, Company websites, Interviews, Deloitte analysis



# Malawi | Enabling environment

The government has just set up the Universal Service Fund which may boost network coverage in rural areas, but access to finance remains a challenge



## Regulations

- Malawi recently adopted the **convergence licensing framework** that focuses on **technological neutrality of communication services** in the country. With this framework in place, **operators are not constrained** by the **technology they deploy** to offer these services.
- MACRA plans to **construct 75 ICT labs in collaboration with Ministry of Education** across the country. Currently, only 241 out of 1,610 secondary schools offer computer studies due to the lack of technological and physical infrastructure. Macra, through the Universal Service Fund, will construct **100 ICT Labs annually** for the next five years under Phase 1 of the ministry's 'Connect-a-School Project.

“ The government and regulator set up a Universal Service Fund where all operators bid to take the network in the rural areas. The fund will help subsidize these projects. The first tenders have just been issued and we are in the midst of preparing for that. ”  
- MNO



Malawi's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 4: 'integrated regulation'** <sup>1</sup>



## Access to finance

- The **interest rate is high**, which means that the **cost of capital** is very high **for potential investors**
- The **local currency is weak** in comparison to the USD, which makes **importing of raw materials, equipment** and license fees (which have to be paid in USD) **very expensive** for market players

“ The government will not have funding every year, so doing an IRIU (Indispensable Right of Use) model is an opportunity. We sell it for five or ten years and get paid in advance for that time period. ”  
- Infrastructure provider

### Access to finance indicators

- Exchange rate to USD: **0.00088**
- Government Debt to GDP (% of GDP): **67%** (2022)
- Interest rate: **24%** (2023)
- Domestic Credit to private sector (% of GDP)<sup>2</sup>: **10%** (2016)

## Key takeaways

- **Affordability:** suppliers experience high costs, due to **exchange rates, taxes and duties**, which increases the prices of connectivity for end-users
- + **Funding security:** the government set up a Universal Service Fund (USF) and **issued tenders for increasing the connectivity** in rural areas
- **Funding security:** the high interest rate makes **capital investments expensive**
- **Funding security:** the government **budget for connectivity fluctuates** from year to year

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)

Sources: ITU, World Bank Development Indicators, Trading Economics, Interviews, Deloitte analysis

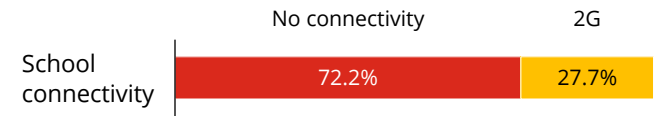
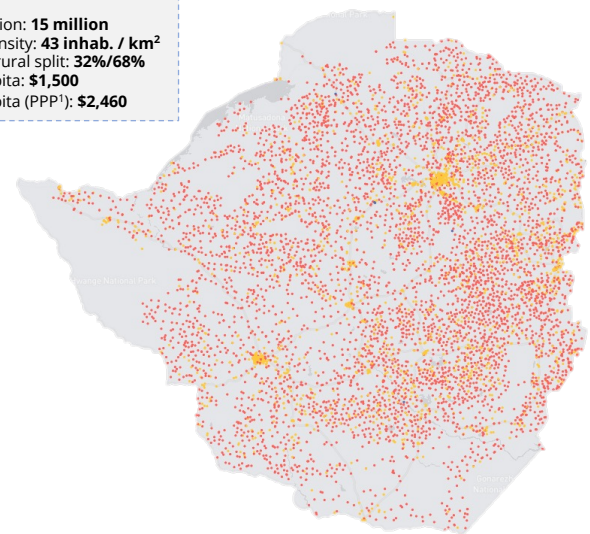
# Zimbabwe | Broader context & status of school connectivity

In Zimbabwe, ~28% of schools are connected to the internet; but all these schools have internet with speeds of less than 5 Mbps

**Around 76% of schools in Zimbabwe are covered by mobile broadband, but less than a third are connected to the internet**

**Overview**

- Population: 15 million
- Pop. density: 43 inhab. / km<sup>2</sup>
- Urban/rural split: 32%/68%
- GNI/capita: \$1,500
- GNI/capita (PPP<sup>1</sup>): \$2,460



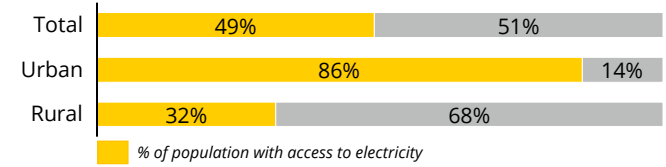
### Government support for school connectivity

- Telecom operators in Zimbabwe are obligated to allocate 1.5% of their annual turnover to the Universal Service Fund (USF). This fund is managed by POTRAZ to offer free internet facility in rural schools. As of 2021, over **400 schools have benefitted from free internet through the USF fund**
- Broadband plan, adopted by Zimbabwean government for the period of 2023 – 2030, aims to reduce internet costs to 2% of average monthly income. The initiative aims to **encourage schools to integrate technology into teaching methods, promote ICT education and digital literacy**



### Electricity

- In **rural areas**, access to electricity is **major barrier**



### Digital literacy

- Digital literacy is low in Zimbabwe; **35% of individuals** in Zimbabwe are using the internet
- Zimbabwe scores a 2.8 on the Wiley 'Digital Skills Gap Index', **ranking 15<sup>th</sup> out of 26 countries** in Sub-Saharan Africa



### Key takeaways

- **Acceptability: low digital literacy** and internet usage limits the uptake of connectivity
- **Availability: the low population density** diminishes the business viability and profitability for internet in rural areas
- **Delivery: overall lack of electricity** with 51% of the population having no access to electricity
- **Quality: 28% of schools are connected to the internet; but all these schools have low-speed internet (<5 Mbps)**

Note: 1) Gross national income at Purchasing Power Parity (PPP), with gross national income defined as the gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production

Sources: Giga, World Bank, Wiley, Deloitte analysis

# Zimbabwe | Fiber internet market

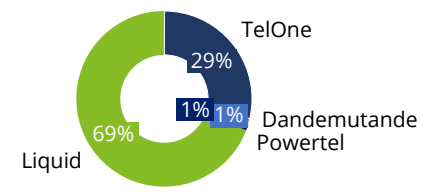
The fiber internet market in Zimbabwe is shaped by two major players; coverage of the fiber network is expanding throughout the country

## Key insights into the fiber internet market

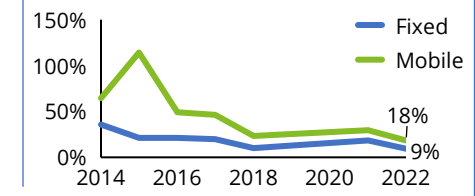
<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>Zimbabwe's <b>National Broadband Backbone</b> (NBB) brings international broadband to Zimbabwe and <b>interconnects major cities and towns</b> across the country</li> <li>The <b>backbone</b> was built by the Posts and Telecommunications Corporation of Zimbabwe (PTC), which was <b>commercialized in 2000</b> into three companies</li> <li>The <b>population</b> with a <b>fixed internet</b> connection is <b>below 2%</b></li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li><b>TelOne and Zol Zimbabwe</b> (part of Liquid Home) are the <b>largest fixed internet providers</b> in Zimbabwe.</li> <li>Apart from TelOne, <b>Dark Fibre Africa</b> (a subsidiary of Vodacom) was granted a license to operate as an <b>open-access-connectivity provider</b> in Zimbabwe</li> <li>Zimbabwe has a <b>several ISPs</b> including TelOne, Zimbabwe Online (ZOL), Liquid (a subsidiary from Econet Wireless), Africom and PowerTel. Most (smaller) <b>ISPs buy their bandwidth from TelOne</b></li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>Price of <b>fixed broadband</b> is at <b>9% of GNI per capita</b>; although more affordable than mobile broadband, it is still significantly above Broadband Commission's target of 2% of GNI per capita</li> <li>The average <b>price for 100GB</b> of fixed internet is <b>\$85 USD</b> per month with a speed of 3 – 15 Mbps</li> <li>Zimbabwe ranks <b>165<sup>th</sup> out of 181</b> countries in terms of quality of fixed broadband in <b>Ookla's Speedtest Global Index</b> (2<sup>nd</sup> lowest rank of 9 focus countries)</li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>In January 2023, Vodacom-owned <b>Dark Fibre Africa</b> announced plans to use Zimbabwe's <b>major rail network to lay 2,000km of fiber</b> across the country. The project has laid down <b>1,180km of fiber</b> in its first phase</li> </ul>



Equipped International Internet Bandwidth Capacity (2023)



Broadband prices as % of GNI per capita<sup>1</sup>



## Key takeaways

- **Competition: limited number of market players** in the middle-mile, which can lead to high prices
- **Affordability: price** for fixed broadband is **significantly above the 2% of GNI per capita** target set by the Broadband Commission
- **Quality: quality** of fixed broadband is **low** in Zimbabwe
- + **Availability: market players are investing in infrastructure**, which increases coverage and connectivity,

Note: 1) Broadband prices as found in ITU's 'ICT prices dashboard', in which the yearly price for the cheapest offer by the market leader is compared with GNI per capita  
Sources: Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), Ookla, African Wireless, Interviews, Deloitte analysis

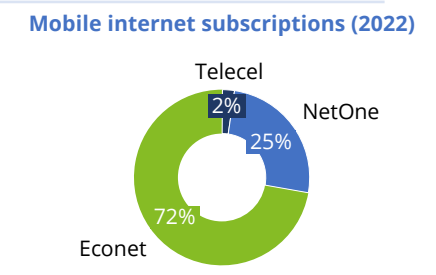
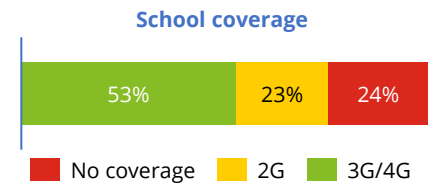


# Zimbabwe | Wireless internet market

## The mobile internet market in Zimbabwe is dominated by one player and affordability is a major challenge

### Key insights into the wireless internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>Roughly <b>84%</b> of the country is covered by mobile broadband (3G and/or 4G)</li> <li><b>76% of the schools are covered by mobile broadband connection</b>, but only <b>53% receive coverage</b> that is fast enough for meaningful internet connectivity</li> <li>In 2022 Econet Wireless has deployed 22 base stations in Harare for <b>5G connectivity</b></li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>There are <b>three Mobile Network Operators</b>; NetOne (one of the other companies founded after the commercialization of the PTC), Telecel Zimbabwe, and Econet Wireless Zimbabwe</li> <li>Each MNO has their <b>own base stations</b>, providing <b>different levels of coverage across Zimbabwe</b></li> <li>Econet is currently the <b>only mobile network operator with 5G infrastructure</b></li> <li>The <b>spectrum</b> that is <b>available for mobile service providers</b> by the government is <b>limited</b> and <b>companies</b> do not to <b>sell their unused spectrum</b></li> </ul>
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>Price of data-only <b>mobile broadband</b> is at <b>18% of GNI per capita</b>, being the least affordable out of all 9 focus countries</li> <li>The average retail price for <b>50 GB</b> of mobile internet sits at <b>\$38 USD</b> at a download speed between <b>2 - 8 Mbps</b></li> <li><b>Prices for handheld devices</b> start at <b>\$80 USD</b></li> </ul>
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>POTRAZ has granted Dolphin Telecoms the <b>first mobile virtual network operator (MVNO) license</b>. This means <b>Dolphin Telecoms will compete</b> with Econet, Telecel and NetOne <b>as a mobile service operator</b> without having their own base stations</li> <li><b>Dolphin telecom specializes in capacity wholesale and internet bandwidth</b> for other ISPs</li> </ul>



“The cheapest handset is currently \$80 USD, which is out of reach for communities - MNO”

**Connecting Africa** March 2022  
Dolphin Telecoms gets MVNO license in Zimbabwe

### Key takeaways

- **Availability:** in rural areas, coverage is limited
- **Competition:** low level of competition and dominance of one market player
- **Competition:** there is limited spectrum available, creating barriers for new entrants or community networks
- **Affordability:** high prices of mobile connectivity (at 18% of GNI per capita)

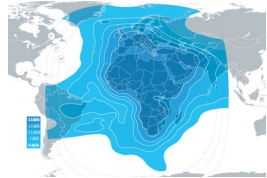


Sources: Company websites, Connecting Africa, Interviews, Deloitte analysis



# Zimbabwe | Satellite internet market

The market for satellite internet is growing, but affordability of GEO satellite internet is a barrier

## Key insights into the satellite internet market

<p><b>Coverage</b></p>	<ul style="list-style-type: none"> <li>• <b>VSAT/ GEO internet</b> satellite connections are <b>available everywhere</b> in Zimbabwe</li> <li>• <b>LEO satellites are not available</b>, but as the government is considering Starlink's application this might change in 2024</li> </ul>	<p>Example Eutelsat satellite coverage</p> 	<p><b>Key takeaways</b></p> <ul style="list-style-type: none"> <li>+ <b>Competition:</b> there is a market for satellite connectivity in Zimbabwe with <b>several players</b></li> <li>+ <b>Availability: GEO satellite internet providers</b>, that focus on providing internet in rural areas</li> <li>- <b>Availability: LEO satellite internet is not available</b> in Zimbabwe as of 2023</li> <li>- <b>Affordability:</b> GEO satellite internet in Zimbabwe is <b>considered not affordable</b> due to the high monthly subscription and installation price</li> </ul>
<p><b>Market players</b></p>	<ul style="list-style-type: none"> <li>• Most <b>major ISPs offer VSAT internet to schools</b> in rural areas</li> <li>• <b>TelOne, ZOL</b> (Liquid Home), and Utande are the main VSAT internet providers</li> <li>• <b>TelOne</b> has created a <b>strong presence</b> in Zimbabwe's VSAT internet market by <b>leveraging Eutelsat</b> and <b>Avanti</b> satellites</li> <li>• The second largest provider ZOL offers <b>discounted broadband connectivity</b> to a few <b>selected schools</b> in Zimbabwe</li> <li>• <b>Utande</b> is still <b>expanding its operations</b> but <b>offers faster speed</b> than the other two market players</li> </ul>	<p>“ Starlink might be too expensive as of now, but it could help school connectivity and perhaps there are ways to bring down the price - MNO ”</p>	
<p><b>Pricing &amp; quality</b></p>	<ul style="list-style-type: none"> <li>• GEO satellite internet price ranges from <b>\$180 USD</b> to <b>\$300 USD per month</b> and download speed varies from <b>5 to 25 Mbps</b></li> <li>• Initial <b>installation prices</b> of GEO satellite internet are <b>approx. ~\$1,500 USD</b></li> </ul>	<p>TelOne VSAT offer</p> 	
<p><b>Market trends</b></p>	<ul style="list-style-type: none"> <li>• Zimbabwe's minister of information, publicity, and broadcasting services, has confirmed that <b>POTRAZ</b> has <b>received an application</b> for an <b>operating license from Starlink</b>. The application is currently being reviewed, while <b>Starlink plans to launch</b> in Zimbabwe in <b>Q2 2024</b></li> </ul>	<p><b>TEKEDIA</b> September 2023</p> <p>Zimbabwe Government Makes U-turn on Starlink Approval, Reviews License Application</p> 	

# Zimbabwe | Enabling environment

## Access to finance and foreign currencies is a major challenge in Zimbabwe



### Regulations

- In 2018, the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ) was established, which is responsible for **regulating** and **promote competition** and **investment in the telecom sector**
- **Operating licenses for mobile phone services** are **\$137.5 million**, which hinders new **players** from **entering the market**
- Suppliers indicate that **license fee requirements can be stringent** for privately owned businesses
- PORTAZ has **increased tariffs related to broadband** and associated services for all telecommunications operators, because of the **volatility in its national currency**. Telecom operators may pass on these additional costs to customers, including schools

“ Because of the price controls, we cannot differentiate on price and therefore the focus is on optimizing costs. This has been one of the reasons why we have barely invested in infrastructure between 2014 and 2022 ”  
- MNO

**G3** Zimbabwe's telecom regulation maturity is classified by ITU's ICT Regulatory tracker as **Generation 3: 'enabling investment & access'**<sup>1</sup>







### Access to finance

- An estimated **\$36 million** of upfront **capital expenditure** is needed to provide **last mile connectivity** to all underserved schools in Zimbabwe<sup>2</sup>
- The government also seeks to **attract Foreign Direct Investments** (“FDI”) and has implemented the Zimbabwe Investment Authority (ZIA) to **promote and facilitate foreign direct investment**
- The amount of **FDI has risen to \$342 million in 2022** from \$250 million in 2021 but is still low compared to before the Covid-19 pandemic

“ Shortage of foreign currencies (mostly USD) is a major challenge. This limits investments and also results in high equipment costs, as equipment needs to be sourced from abroad and paid in dollars. ”  
- MNO

**Access to finance indicators**

-  Exchange rate to USD: **0.00276** (2023)
-  Government Debt to GDP (% of GDP): **93%** (2022)
-  Interest rate: **130%** (2023)
-  Domestic Credit to private sector (% of GDP)<sup>3</sup>: **12%** (2022)

### Key takeaways

- **Availability:** government **price controls** may hinder investments in expanding coverage
- **Funding security:** **inadequate foreign currency reserves** reduces market players' profitability and limits investments
- **Funding security:** **hyperinflation** and **high interest** rates lead to a lack of access to finance for investments into network expansion

Notes: 1) The ITU ICT Regulatory Tracker distinguishes four generations in telecom regulation maturity: G1 – Command & control approach, G2 – Early open markets, G3 – Enabling investment & access, G4 – Integrated regulation; 2) As estimated by Dalberg in 2020 based on Giga mapping and modelling data; 3) Domestic Credit to Private Sector refers to the financial resources provided to the private sector (such as through loans or purchases of non-equity securities) that establish a claim for repayment (source: OECD)  
Sources: Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), Giga, ITU, Trading Economics, Interviews, Deloitte Analysis

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