BUSINESS AND TARIFF MODELS FOR BROADBAND CONNECTIVITY IN RURAL AREAS OF AFRICA

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PART A

Universal Broadband Connectivity in Rural Areas in Africa Challenges and Opportunities

This report is structured into seven main sections, each with detailed subsections to ensure a thorough analysis of rural broadband challenges, opportunities, and strategic solutions.

1.0 Executive Summary

This study explored the development of sustainable business and tariff models for broadband connectivity in rural areas across fifteen (15) African countries listed below, with the aim of identifying scalable and context-specific strategies to bridge the digital divide. The study benchmarked Africa's rural broadband efforts against India, Brazil, and Hungary, drawing from global best practices and leveraging insights from key organizations including the World Bank, International Telecommunication Union (ITU), GSMA, African Union Commission (AU), World Broadband Association (WBBA), and the African Development Bank (AfDB).

The fifteen (15) African Countries by their Sub-Regions:

Sub-Regions	Countries
SADC	**Angola, Eswatini, South Africa and Zimbabwe**
AMU	**Egypt**
EACO	**Kenya, Rwanda and Tanzania**
ECCAS	**Cameroun, Central Africa Republic, DRC and Gabon**
ECOWAS	**Cote D' Ivoire, Ghana, and Nigeria**

Despite growing mobile penetration and digital ambition, rural broadband in much of Africa remains underdeveloped due to high deployment costs, limited infrastructure, affordability barriers, and insufficient demand stimulation. Existing universal service frameworks and investment incentives have yielded uneven results, calling for a re-evaluation of current models and a deeper understanding of what works under African realities.

Bridging this divide requires targeted investment, innovative delivery models (including satellite and solar-powered networks), and effective use of universal service funds and public-private partnerships. Aligning infrastructure rollout with affordability, skills development, and climate resilience is key to accelerating inclusive rural connectivity.

The benchmarking highlighted three complementary international perspectives:

- India demonstrates the impact of state-led infrastructure (BharatNet), ultra-low mobile data pricing, and community-centric Wi-Fi models (PM-WANI).
- Brazil offers lessons in leveraging universal service funds (FUST) and hybrid deployment (fiber + fixed wireless) to reach remote communities.
- Hungary shows how EU digital policy and public funding can achieve near-universal rural broadband in developed settings.

The study synthesized policy, regulatory, financial, and operational insights from across the fifteen (15) African countries and overlayed them with global benchmarks to identify feasible pathways. The analysis was also informed by extensive reviews of rural broadband performance

metrics and frameworks from the World Bank's Digital Economy Moonshot for Africa, ITU's Broadband Commission, GSMA Mobile Connectivity Index, and the AfDB Digital Economy Strategy.

Preliminary findings suggest that business and tariff model innovation must balance affordability, service viability, and localized partnerships.

This report provides tailored business and tariff model recommendations for rural Africa, including financial projections, implementation strategies, and risk mitigation measures. These recommendations are expected to guide policymakers, regulators, and investors toward cost-effective, inclusive, and sustainable rural broadband development across Africa.

Below is a summary of common standards and categorization to be used for rural areas.

1.1 Common Standards & Categorization Criteria for Rural Areas

To enable targeted, scalable broadband interventions across Africa's diverse rural landscapes, we have developed a harmonized framework of criteria and standards for classifying villages and rural communities. This categorization informs policy, investment, and deployment strategies by aligning network solutions with local needs and constraints.

S/N	Common Standards & Categorization	
1	**Population Density & Settlement Size**	• **Micro-Hamlets** (≤500 residents): Limited demand, low ARPU; prioritize ultra-low-cost, low-power solutions (e.g. solar-powered micro-cells). • **Small Villages** (500–2,000): Emerging demand; leverage cost-shared tower sites, community Wi-Fi. • **Large Villages & Towns** (2,000–10,000): Sufficient scale for mixed models (FWA, mobile broadband), may justify fiber backhaul.
2	**Geographic & Topographic Profile**	• **Flat Plains & River Valleys**: Favorable for fiber and microwave links; lower civil-works costs. • **Hilly/Mountainous Terrain**: Requires high-gain antennas, wireless relays, or satellite backhaul; higher installation complexity. • **Remote/Isolated Outposts**: Accessible only by foot or track; prioritize solar-driven, self-contained nodes (e.g. VSAT + edge cache).
3	**Land Area & Spatial Dispersion**	• **Compact Settlements** (<2 km²): Dense clusters; efficient tower placement serves multiple communities.

S/N	Common Standards & Categorization	
4	**Economic Activity & Commercial Viability**	• **Dispersed Populations** (>5 km²): Use multi-site networks or mesh architectures; consider community co-op models to share costs. • **Agricultural Hubs**: High seasonal traffic; integrate e-agriculture services, partner with cooperatives for revenue. • **Market Towns & Trade Centers**: Steady demand; standard MNO rollouts and SME-focused VAS bundles. • **Resource Extraction Zones**: Private-sector anchor tenancy; cost-recovery via corporate partnerships.
5	**Existing Infrastructure & Access**	• **Grid-Electrified Areas**: Support higher-power base stations, fiber PoPs, and 5G readiness. • **Off-Grid Communities**: Deploy solar/battery hybrid power; low-maintenance sites with remote monitoring. • **Road Network Quality**: Affects site-build logistics and OPEX; poor roads necessitate modular, air-transportable equipment.
6	**Digital Literacy & Social Indicators**	• **High Literacy & ICT Training Centers**: Bundle broadband with e-learning platforms; stimulate local digital ecosystems. • **Low Literacy Regions**: Emphasize voice/SMS-based services, community-driven training programs before full broadband rollout.
7	**Policy & Regulatory Context**	• **Universal Service Obligations**: Align categories with USF eligibility tiers to unlocked subsidies. • **Spectrum & Licensing Incentives**: Map category types to spectrum fee discounts or license-rollout obligations.

Table 1: Common Standards & Categorization Criteria for Rural Areas

Recommended Next Steps when implementing the Criteria in Table 1 above:

Pilot Classification: Apply the framework to a representative sample of villages to validate cost models and service uptake.

Stakeholder Alignment: Engage regulators, USF managers, and operators to codify categories into national broadband plans and licensing conditions.

Dynamic Updates: Integrate GIS and real-time demand data to refine classifications, enabling adaptive resource allocation and performance monitoring.

This standardized categorization empowers governments and private sector partners to design optimized, context-aware broadband strategies, maximizing impact, financial sustainability, and digital inclusion in rural Africa.

1.2 Overview of the Study

Purpose and objectives of the consultancy

The purpose of the study was to analyze and develop business and tariff models for broadband connectivity in rural areas of Africa. The report includes recommendations resulting from the study that was undertaken as enumerated in the terms of reference.

Scope of the study (15 African countries, plus India, Hungary, and Brazil)

This study covers an in-depth analysis of broadband connectivity challenges and opportunities across 15 African countries, as well as selected case studies from India, Hungary, and Brazil, as well as data from international organizations such as ITU, AU, World Bank, AfDB, GSMA, Broadband Commission and WBBA to provide comparative insights and global context.

Key Research Methodologies Used

Methodology Overview

This study applied a multi-pronged methodology to assess viable business and tariff models that can expand broadband connectivity in rural Africa. The approach was designed to support informed decision-making by ATU member states, regulators, operators, policymakers, and investors.

Scope

The study focused on 15 African countries, selected for their diversity in geography, telecom maturity, and rural connectivity challenges. Comparative insights were also drawn from India, Brazil, and Hungary to identify scalable models and policy best practices.

Data Collection

Both primary and secondary data sources were used:

- **Primary Data:** Structured questionnaires for National regulators and Operators, from 15 African countries.
- **Secondary Data:** National broadband strategies, tariff policies, reports from ITU, GSMA, World Bank, and telecom market data.

Analytical Framework

The study combined:

- Techno-economic modeling to estimate CAPEX, OPEX, breakeven points, and investment viability for various access technologies.
- Business model analysis including mobile, fixed wireless, community networks, and shared infrastructure models.
- Tariff simulations reflecting affordability thresholds, user demand, and subsidy impacts.

Evaluation Criteria

Models were assessed based on financial viability, affordability, scalability, policy alignment, and social impact.

Tools Used

Analytical tools included Excel-based financial models, and visualization infographics.

Limitations

Data inconsistencies across countries and limited rural data presented some constraints. Assumptions were applied where granular cost data was unavailable.

This rigorous methodology ensures the findings and recommendations are practical, evidence-based, and relevant for stakeholders committed to bridging the digital divide in Africa.

1.3 Key Findings

Current state of rural broadband in Africa

Rural broadband connectivity across Africa remains limited, marked by low internet penetration, high costs, insufficient infrastructure, and significant urban-rural disparities. While mobile broadband has made considerable inroads in urban areas, rural regions often lack adequate backhaul, power infrastructure, and affordable access options.

Globally, internet penetration rates[9] reveal a clear tiered structure in digital development. The most developed regions **(above 90% penetration rates)** are termed ***"Near-Universal Access Tier"*** which excludes the African continent.

Southern Africa belongs to the "*Advanced Adoption Tier*" with 75-90% penetration rates, while the *Northern Africa region belongs to the* "*Developing Digital Tier*" with 50-75% penetration rates, where internet adoption has reached the majority but remains far from universal due to infrastructure challenges, affordability concerns, and digital literacy barriers.

Finally, the ***"Early Digital Development Tier" (below 50% penetration)*** includes ***Western Africa*** (42.5%), ***Middle Africa*** (33.6%), and ***Eastern Africa*** (28.5%), where most of the population remains offline, reflecting fundamental challenges in connectivity infrastructure, affordability, and competing development priorities.

Africa exhibits the widest intra-continental digital divide, with penetration rates ranging from 77% in Southern Africa to just 28.5% in Eastern Africa. This nearly 50-percentage-point gap highlights the influence of colonial legacies, economic conditions, and geographic challenges that have created vastly different digital development trajectories. Southern Africa's relatively high penetration rate reflects South Africa's more developed economy and infrastructure, whereas significantly lower rates in Eastern, Middle, and Western Africa reveal persistent barriers to infrastructure deployment and digital access.

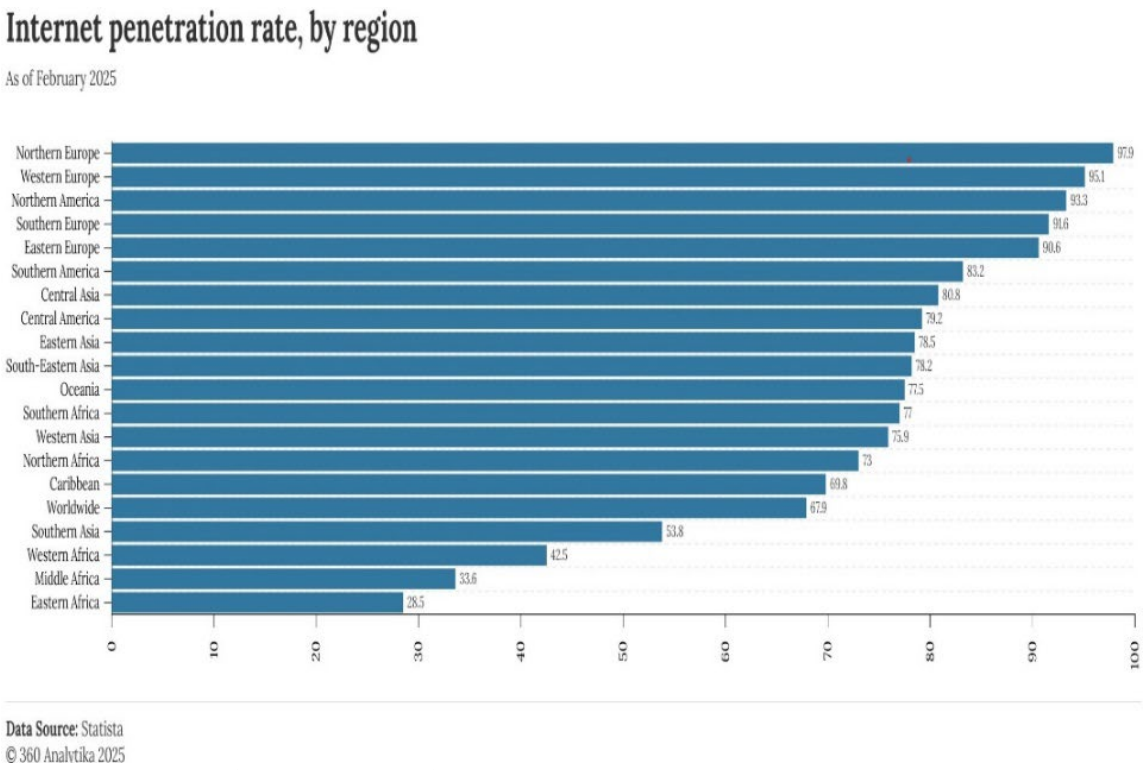

Figure 1: Internet penetration rate, by region, Feb 2025

Source: Statista. (2025). Global Internet Penetration by Region, As of February 2025 (360 Analytika, Ed.) [Dataset].

Internet penetration rate refers to the percentage of a population that has access to and uses the internet within a specific geographic area. This metric is calculated by dividing the number of internet users in a region by the total population of that region and expressing the result as a percentage. Internet penetration serves as a key indicator of digital development and connectivity, offering insights into how widely the internet has been adopted across different societies. A high penetration rate suggests widespread access to digital resources, services, and information, while a low rate may indicate limited digital infrastructure, affordability challenges, or other barriers to access. This measurement helps governments, businesses, and organizations understand digital divides both between and within regions, informing policy decisions, business strategies, and development initiatives aimed at increasing connectivity. Internet penetration is distinct from related metrics like broadband penetration or mobile internet penetration, as it encompasses all forms of internet access regardless of connection type or device used.

A large portion of rural populations rely on 2G/3G networks with minimal data capacity, and fixed broadband is virtually absent in most rural zones. Additionally, policy and regulatory gaps, coupled with a lack of investment incentives, continue to hinder the expansion of broadband services in these underserved areas.

According to a 2024 data obtained from ITU Facts and Figures[2], only 23% of Africa's rural population are using the internet, compared to 57% in urban areas. These indices are quite low when compared to the world average of 48% and 83% for Rural and Urban populations respectively **(see Figure 2)**.

This disparity underscores the need for targeted policies, investment strategies, and innovative business and tariff models that can extend the benefits of broadband to marginalized and remote populations.

Despite these challenges, there is growing interest in leveraging low-cost technologies, public-private partnerships, universal service funds, and innovative business models to bridge the connectivity gap, with several pilot projects and initiatives underway across the continent.

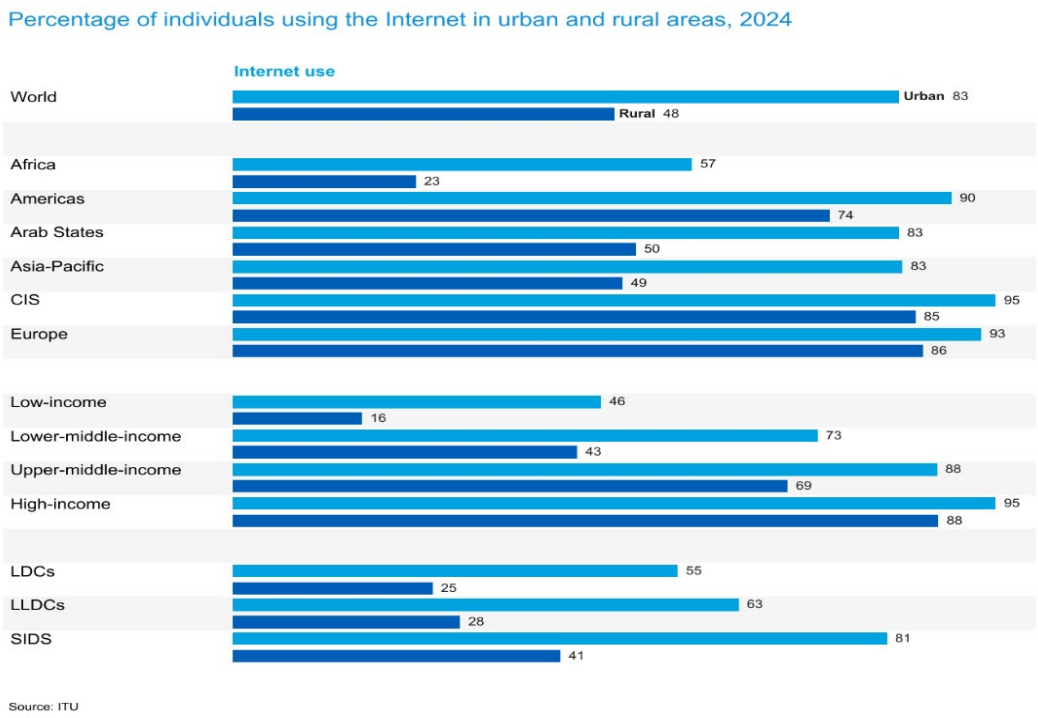

Figure 2: Percentage of Individuals using the internet in urban and Rural areas, 2024 *Source: ITU Facts and Figures 2024*

Below is a heat map (Figure 3) showing the comparative broadband readiness of 15 African countries. The countries were assessed using ten broad dimensions to determine their broadband readiness. It visually emphasizes their relative performance across the 10 readiness dimensions, using a 1–5 scoring scale.

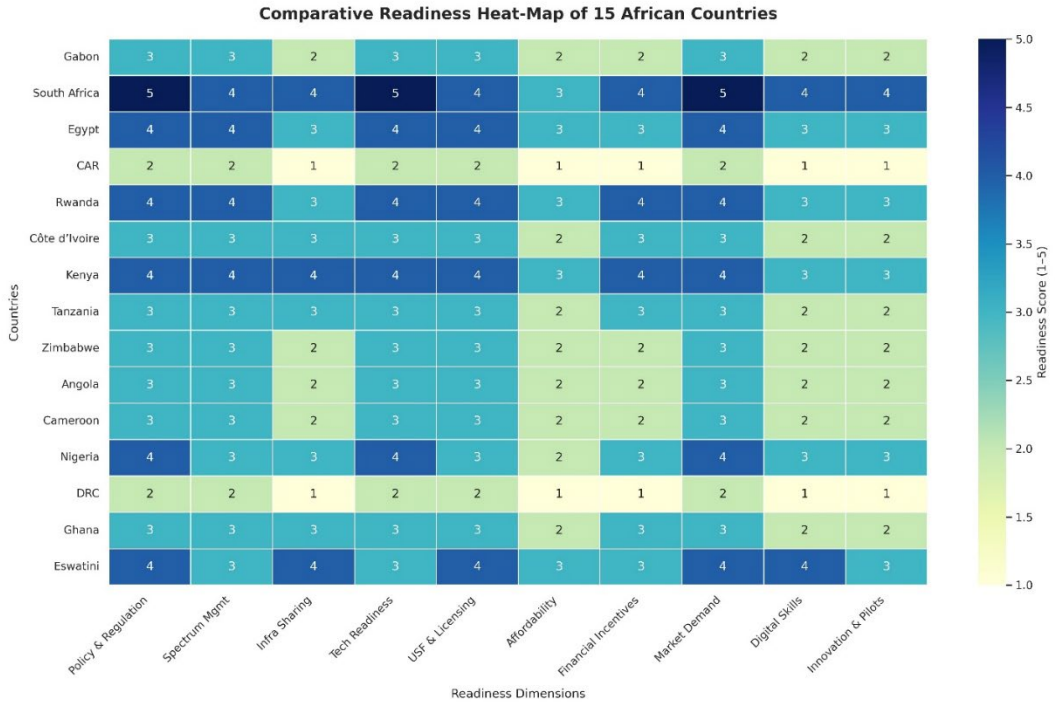

Figure 3: Comparative Readiness Head-Map of 15 African Countries

- Leaders like South Africa, Kenya, and Rwanda stand out with **darker blue-green tones**, reflecting strong policies, infrastructure, and demand readiness.
- Mid-tier countries such as Egypt, Nigeria, and Eswatini show **moderate** performance but have clear improvement areas.
- Lagging countries like CAR and DRC display **lighter tones**, signaling significant gaps in policy, infrastructure, and affordability.

Challenges: Notwithstanding growing efforts to expand broadband access, rural areas across Africa continue to face major challenges. These include a lack of affordable and reliable infrastructure, high deployment costs, and limited incentives for private sector investment.

Regulatory and policy bottlenecks, such as inefficient spectrum management and underutilized universal service funds, further slow progress. Additionally, low digital literacy, unreliable energy access, and a scarcity of relevant local content limit user demand. These challenges collectively hinder the achievement of inclusive digital connectivity across the continent.

Opportunities: Regardless of the challenges, significant opportunities exist to transform rural broadband connectivity across Africa. These include the growing availability of low-cost wireless and satellite technologies, renewed interest in infrastructure sharing, and emerging public-

private partnerships. Enhanced use of Universal Service and Access Funds (USAFs), coupled with supportive policy and regulatory reforms, can accelerate investment in underserved areas.

Additionally, the expansion of community networks, digital literacy programs, and localized content development offers a path toward more inclusive and sustainable rural connectivity.

1.4 Summary of Recommendations

Business models: To drive sustainable rural broadband connectivity, we recommend flexible and inclusive business models that leverage both public and private sector strengths. Key approaches include public-private partnerships, open access infrastructure sharing, and community-based networks. Emphasis is placed on affordable service models, innovative financing mechanisms—such as targeted use of Universal Service Funds—and wholesale-retail separation to encourage competition. These models should be context-specific, scalable, and aligned with national digital strategies to ensure long-term viability and inclusion.

Tariff models: To enhance affordability and accessibility, it is recommended that flexible and tiered tariff models that cater to different segments of the rural population be implemented. Key strategies include pay-as-you-go pricing, data-sharing plans, and subsidized tariffs for low-income users. Additionally, progressive pricing structures based on usage and affordability, as well as bundled service offerings that combine data, voice, and digital services, can improve adoption. Governments should also explore cross-subsidization models to reduce costs for rural users while ensuring financial sustainability for service providers.

Investment and regulatory reforms: To achieve sustainable rural broadband growth, key investment, and regulatory reforms are necessary. These include enhancing private sector participation through public-private partnerships, offering incentives such as subsidies and tax breaks, and ensuring efficient use of Universal Service Funds (USFs).

Regulatory reforms should focus on streamlined spectrum management, promoting infrastructure sharing, and simplifying licensing processes for rural networks. Additionally, affordable tariff regimes and the development of innovative financing models, such as impact investments, will help bridge funding gaps. Finally, capacity building for local operators and local content development should be prioritized to ensure that broadband investments meet the specific needs of rural populations.

Digital Literacy Programs: Many rural populations have low levels of digital literacy, coupled with scarcity of local-language and culturally relevant content thereby discouraging and limiting effective use of broadband. Training initiatives are needed to equip citizens with the necessary skills to utilize digital services effectively.

Table 2 below shows a concise, action-oriented synthesis of what should be done to accelerate rural and nationwide broadband, drawing on all analysis, tools, visuals (heat-maps/radar), and comparative reviews completed in this study. It spells out key actions to be taken, the roles of stakeholders, including timeframes and KPIs as a summary of recommendations.

Pillar	Key Actions	Timeframe	Primary Stakeholders	Headline KPIs
Governance & Delivery	• Stand up a Rural Broadband Delivery Unit (RBDU) with a one-stop RoW/permits desk • Monthly blocker-clearing with public minutes • Publish a quarterly national broadband scorecard	Quick wins (0–6months); ongoing thereafter	Presidency/PM; Comms Ministry; Regulator; State/Local Govts	RoW SLA ≤30 days; 4× yearly scorecards; blockers cleared/month
Spectrum & Licensing	• Prioritise sub-1 GHz (700/800 MHz) with enforceable rural rollout obligations • Introduce fee rebates/credits for verified rural sites; tech-neutral renewals • Enable shared/dynamic access (TVWS/coordinated 3.5 GHz) under light licensing	0–12months for policy changes; ongoing enforcement	Regulator; Spectrum Council/NFMC; MNOs/ISPs	% sub-1 GHz rural sites; No. of TVWS/3.5 GHz shared deployments; license turnaround time
Infrastructure Sharing & Open Access	• Mandate passive sharing (towers/ducts/poles) with reference offers • Permit guided active sharing (MOCN/MORAN) and neutral-host in low-demand clusters • Open access to publicly funded fiber with transparent wholesale price list	6–18months to implement; ongoing compliance	Regulator; MNOs; Towercos; FiberCos; PPP Unit	≥60% rural sites co-located; reference offers published; wholesale price benchmarks live

Pillar	Key Actions	Timeframe	Primary Stakeholders	Headline KPIs
USF & Blended Finance	• Shift USF to output-based aid (OBA): competitive lots; milestone payments tied to uptime/latency/throughput • Blend DFI/IFI capital (40–70% CAPEX) + time-bound OPEX support (≤36m) • Publish USF dashboard (commitments, leverage, connected sites) • Extend fiber/IXP reach via common-duct/dig-once on roads/power/rail projects	Announce OBA Window 1 in 0–6months; awards in 6–18months	USF; Ministry of Finance; DFIs/IFIs; PPP Unit	USF disbursement ≥80%; leverage ≥3×; No. of schools/clinics/sites connected; uptime ≥99%
Backhaul, Power & Sites	• Target rural PoPs within ≤25 km of communities; upgrade microwave where fiber is uneconomic • Standardize solar-hybrid power; grow power-as-a-service with SLAs	6–36months staged rollout	Infra Ministries; Utilities; MNOs/ISPs; FiberCos	≥90% rural wards ≤25 km to PoP; site power uptime ≥99%; No. of new PoPs/backhaul links
Devices, Affordability & Tariffs	• Reduce duties/VAT on entry 4G/5G smartphones and FWA CPEs; fast-track certification • Launch device vouchers/micro-finance for teachers/students/health workers/SMEs • Retail forbearance with affordability monitoring; publish wholesale reference prices	0–12months policy + program launch	Ministry of Finance/Customs; Regulator; MNOs; OEMs; Fintechs	2 GB basket ≤1–2% GNI pc; entry smartphone affordability (≤Y weeks income); 4G/5G device penetration +Z%

Pillar	Key Actions	Timeframe	Primary Stakeholders	Headline KPIs
Digital Skills, Content & Demand	• Fund Community Digital Centres (schools/clinics) with public Wi-Fi and device libraries • Zero-rate priority public portals (education/health/agri) under clear rules • Stimulate local content/services for agri, tele-health, learning, and payments	6–24months program scale-up	Education/Health Ministries; USF; NGOs; Local Govts	No. of CDCs live; No. of users trained; portal usage growth; rural data ARPU uplift
Innovation & Technology Options	• Scale TVWS for schools; pilot satellite-FWA hybrids and Open RAN for rural cells • Enable community networks with simplified licensing; neutral-host corridors on highways • Create regulatory sandboxes to accelerate trials	Pilots 0–12months; scale 12–36months	Regulator; MNOs/ISPs; OEMs; DFIs	No. of pilots -> production; cost/site reduction; coverage uplift in pilot zones
Standards, Quality & Security	• Enforce QoS SLAs with independent audits and crowdsourced measurement • Adopt cybersecurity baselines and data-protection compliance • Require acceptance testing and remedial plans aligned to ITU-T/national standards	Immediate & ongoing	Regulator; Operators; Standards bodies	Rural DL ≥10–25 Mbps; latency ≤60–80 ms to national IXPs; outage rates ↓

Pillar	Key Actions	Timeframe	Primary Stakeholders	Headline KPIs
Regional Integration & Resilience	• Secure cross-border fiber corridors; expand regional IXPs and CDN caches • Embed climate resilience (routing, elevation, fire/flood risk) in builds and USF tenders • Harmonize cross-border spectrum use along corridors	12–36months	Regional bodies; Regulators; Infra Ministries; IXPs	Transit cost ↓; No. of new cross-border links; resilience incidents ↓

Table 2: Summarized Table of Recommendations

1.5 Conclusion

Our study across African markets including case studies of India, Brazil and Hungary supported by the heat-map, radar analysis, and country profiles shows a consistent pattern: **policy ambition is no longer the constraint; execution is**. The bottlenecks are practical and solvable; fragmented RoW/permitting, backhaul and site-power gaps, under-deployed USF, uneven adoption of sharing/open-access, device affordability, and limited demand stimulation (skills, local content). Where governments align **governance + spectrum incentives + blended finance + sharing/open access**, coverage and usage accelerate together.

The path forward is therefore less about drafting new strategies and more about **institutionalizing delivery**: a government-backed Rural Broadband Delivery Unit; time-bound RoW SLAs and common-duct rules; sub-1 GHz coverage obligations **with fee credits**; USF shifted to **output-based aid** and blended with DFI capital; neutral-host/active sharing where demand is thin; and device/skills programs that convert coverage into real usage. Leaders should target the **"last 10%"** with neutral-host and 5G-FWA; emerging markets must lock in enforcement and scale OBA; lagging markets can move fastest through **quick-win bundles** (neutral-host + satellite/LEO backhaul + simplified licensing + power resilience).

If these measures are executed with public scorecards and strict QoS, the next 36 months can deliver visible, measurable change:

- **Coverage & Reach:** ≥95% population on 4G; ≥80% rural communities covered; ≥90% rural wards within **≤25 km** of a fiber/IXP PoP.
- **Affordability & Adoption:** 2 GB basket ≤1–2% of GNI per capita; meaningful rise in 4G/5G device penetration; entry smartphones affordable within **Y** weeks of income.
- **Institutions & Service Quality:** Thousands of schools/clinics connected with ≥99% uptime; rural median downlink **≥10–25 Mbps**, latency **≤60–80 ms** to national IXPs.
- **Financing & Efficiency:** USF disbursement **≥80%** with **≥3×** private/PPP leverage; ≥60% rural sites co-located; ≥20% using active/neutral-host models.

- **Resilience & Trust:** Transparent wholesale reference prices, independent QoS audits, and climate-resilient routes and sites.

In short, the combination of **accountable delivery, targeted incentives, and open, shared infrastructure** will crowd-in private capital, cut time-to-service, and translate network expansion into inclusive socio-economic outcomes. This is execution risk we can manage—and impact we can measure.

2.0 Introduction

Access to affordable and reliable broadband connectivity is essential for social and economic development in today's digital world. In rural areas of Africa, however, broadband access remains limited due to infrastructure challenges, low population density, and high deployment costs. These gaps have hindered digital inclusion and economic opportunities for millions of people.

This report presents the findings of a study focused on developing sustainable business and tariff models to support the expansion of broadband connectivity in rural areas across Africa. It aims to identify solutions that balance affordability for users with commercial viability for service providers.

The study draws on existing literature, input on broadband status from fifteen (15) African countries, and analysis of case studies from different regions covering India, Brazil and Hungary. The recommendations presented are intended to support policymakers, regulators, and private sector actors in designing models that can accelerate broadband rollout and ensure long-term impact.

2.1 Background

Broadband connectivity is a cornerstone of modern development, enabling access to essential services, participation in the digital economy, and inclusion in global knowledge systems. In Africa, and particularly in rural areas, broadband offers a transformative pathway to address entrenched disparities in education, healthcare, and economic opportunity. However, despite the promise of digital connectivity, rural communities across the continent remain largely underserved due to infrastructure gaps, high costs, and regulatory and market challenges. Addressing these issues through appropriate business and tariff models is essential to unlocking the full development potential of broadband.

Broadband and Education

Digital connectivity is increasingly vital for inclusive and quality education. Broadband enables access to e-learning platforms, digital libraries, teacher training programs, and virtual classrooms. It is especially crucial in rural areas where schools often face a shortage of teachers, learning materials, and basic infrastructure.

During the COVID-19 pandemic, millions of students across Africa were excluded from remote learning due to the absence of reliable internet and digital devices. According to UNESCO[1], the pandemic affected more than 1.6 billion students and youth globally, with the most vulnerable learners being hit hardest. This highlights the urgent need for digital solutions in education. In Africa, 57% of the urban population uses the internet[2], and internet costs are almost five times higher[2] than the global average, exacerbating the digital divide in education.

Broadband and Healthcare

Broadband is an enabler of resilient and inclusive healthcare systems. In rural Africa, where health facilities are few and often distant, broadband supports the delivery of telemedicine services, remote diagnostics, electronic health records, and real-time health surveillance. These capabilities help address the shortage of medical personnel and improve response to diseases and public health emergencies.

However, only 36% of Africa's population currently has broadband internet access as at 2022[3], with a profound disparity between urban and rural areas. The coverage gap remains much higher in Central

Africa (36%) than in Western, Eastern and Southern Africa (where it ranges from 11% to 14%)[4]. This lack of connectivity hampers the implementation of digital health solutions in rural areas.

Broadband and Economic Development

Broadband access fuels economic empowerment by enabling digital inclusion, entrepreneurship, and access to markets. In rural areas, where formal employment opportunities are scarce, broadband connectivity provides access to online income-generating activities such as e-commerce, mobile banking, and freelance services. It also improves agricultural productivity by providing farmers with market information, weather forecasts, and digital extension services.

Internet penetration rates strongly correlate with economic development indicators[9]. The highest penetration regions, such as Northern Europe, Western Europe, and Northern America, tend to have the highest GDP per capita. Conversely, regions with the lowest penetration rates, including Eastern, Middle, and Western Africa, correspond to areas with lower GDP per capita and higher poverty rates. However, some regions defy strict economic expectations—Central Asia's 80.8% penetration rate, for instance, suggests successful digital inclusion strategies despite moderate income levels.

Internet access also serves as a broader indicator of human development. The five highest-penetration regions consistently rank high on human development indices[9], underscoring how digital connectivity both reflects and contributes to economic and social progress. Conversely, the lowest-penetration regions face multiple challenges, including lower life expectancy, education levels, and income. Meanwhile, regions in the middle penetration tier (75-90%) often experience rapid socio-economic transformations, with internet access both driving and reflecting these changes.

Enhanced broadband infrastructure contributes to the growth of the digital economy, fostering innovation and entrepreneurship. In countries like Nigeria and Tanzania, exposure to internet coverage over three or more years has led to a decline in extreme poverty[7] by about 7%, alongside increases in labor force participation and wage employment by up to 8%.

Africa's digital economy grew from 1.1% of GDP in 2012 to 4.5% in 2020 and is expected to reach 5.2% by 2025 and 8.5% by 2050[5]. However, only 23% of rural dwellers in Africa are connected to the internet, compared to 57% in urban areas as at 2024[2]. This disparity underscores the need for targeted policies, investment strategies, and innovative business and tariff models that can extend the benefits of broadband to marginalized and remote populations.

Broadband and Public Service Delivery

In addition to enhancing access to educational and health services, E-governance initiatives rely on broadband to provide citizens with online access to services such as civil registrations, tax filings, and public information, enhancing transparency and efficiency.

The United Nations E-Government Knowledgebase has developed an E-Government Development Index (EGDI) which presents the state of E-Government Development of the United Nations Member States. This index assesses the website development patterns in a country, the access characteristics such as the infrastructure and educational levels, to reflect how a country is using information technologies to promote access and inclusion of its people.

EGDI is a composite measure of three important dimensions of e-government, namely: *provision of online services, telecommunication connectivity and human capacity*. The EGDI is not designed to capture e-government development in an absolute sense; rather, it aims to give a performance rating of national governments relative to one another.

Figure 4 below shows an extract of the EGDI from the United Nations E-Government Knowledgebase[6] for 2024. Out of the twenty countries of Africa that have been identified for the purpose of this study, Tanzania which should have been the twentieth African country is not captured in the UN knowledgebase.

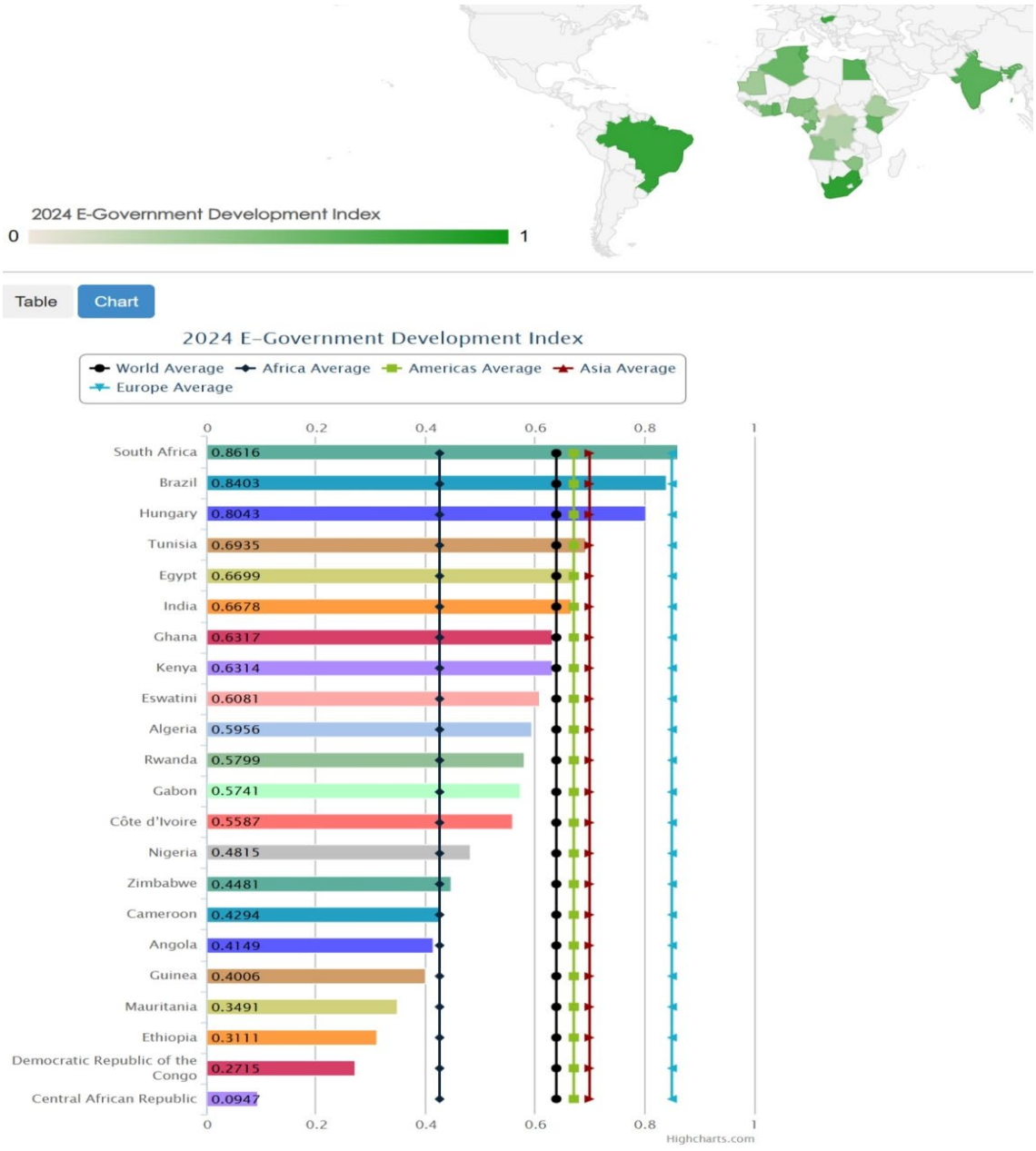

Figure 4: EGDI 2024 Extract

Source: UN-EGDI E-Government Knowlegdebase 2024

The chart also includes the index for India, Brazil and Hungary that have also been identified for benchmarking and comparative purposes in this report.

It can be seen in figure 4 that there are five average indices with the **European region (0.8493)** being the highest ahead of the **Asia (0.6990)**, **Americas (0.6701)**, **World (0.6382)** and **African (0.4247)** average respectively on a scale of **0 - 1**.

Out of the nineteen African countries considered by the UN-EGDI in figure 4 above, six countries (Angola, Guinea, Mauritania, Ethiopia, DRC and CAR) fall below the African average index in descending order.

South Africa, Tunisia and Egypt have surpassed the World Average index with South Africa (scoring 0.8616 on a scale of 0-1) exceeding the European average which is the highest. This places it above Brazil, Hungary and India. These regional statistics and examples underscore the critical role of broadband connectivity in enhancing public service delivery across Africa. They also highlight the ongoing challenges and the need for targeted investments and policies to bridge the digital divide, especially in rural areas.

Challenges in Broadband Deployment

Broadband deployment in rural Africa faces significant structural and economic challenges that limit access and affordability. High capital costs, driven by difficult terrain, low population density, and limited existing infrastructure, make rural areas commercially unattractive for operators. Inadequate electricity supply further complicates deployment, increasing reliance on costly off-grid power solutions.

Affordability remains a critical barrier, with many rural households unable to pay for broadband services or internet-enabled devices. Low digital literacy and the scarcity of relevant local content also suppress demand, even where infrastructure exists.

Regulatory hurdles, including high spectrum fees, limited incentives, and underutilized Universal Service Funds (USFs), restrict investment. In addition, weak coordination between telecom, energy, and infrastructure sectors slows progress.

Operators often consider rural broadband investment risky with minimal returns, and financing options like blended capital or public-private partnerships are rarely utilized. Security issues and a shortage of skilled technical personnel further complicate network rollout and sustainability.

Overcoming these challenges will require targeted policy reforms, innovative financing, shared infrastructure approaches, and stronger collaboration across sectors and stakeholders.

2.2 Objectives and Scope of the Study

This study is aimed at supporting the design and implementation of sustainable and inclusive broadband connectivity models in rural Africa. It responds to the urgent need for evidence-based strategies that address the persistent challenges of rural broadband deployment, affordability, and adoption across the continent.

Objectives

The key objectives of the study are as follows:

- To analyze the current state of rural broadband across 15 African countries, including infrastructure coverage, service affordability, policy frameworks, and market dynamics.
- To benchmark rural broadband models in Africa against global examples—specifically India, Brazil, and Hungary—to identify relevant lessons and adaptable practices.
- To identify and evaluate viable business and tariff models that can support scalable and commercially sustainable broadband deployment in low-income rural areas.
- To examine the role of public policy, regulation, and financing mechanisms, including Universal Service Funds (USFs), public-private partnerships, and blended finance in accelerating rural connectivity.
- To develop practical recommendations tailored to rural Africa, outlining model options, investment considerations, implementation pathways, and risk mitigation strategies.

Scope of the Study

The scope of this study includes:

Assessing and developing practical, sustainable business and tariff models to enhance broadband connectivity in rural areas across 15 African countries, with additional comparative insights drawn from India, Hungary, and Brazil. The scope of the work includes a comprehensive analysis of infrastructure readiness, policy environments, regulatory frameworks, market dynamics, service affordability, and digital inclusion gaps specific to rural settings.

Geographic Coverage:

Fifteen African countries representing distinct regions and connectivity levels were selected to reflect a range of rural broadband conditions across the five sub-regions of Africa.

Comparative Benchmarking:

International case studies from India (BharatNet, PM-WANI), Brazil (FUST, community networks), and Hungary (EU-supported rural broadband expansion) are examined to draw applicable insights.

Model Development:

Business and tariff models will be assessed based on commercial viability, affordability, scalability, and alignment with rural development goals towards the recommendation of suitable models for rural broadband connectivity in Africa.

Strategy Framework Development:

The study also reviews the enabling environment, including spectrum policies, infrastructure-sharing regulations, digital inclusion strategies, and funding mechanisms in developing a strategy framework for broadband connectivity in rural areas of Africa.

The study is intended to inform governments, regulators, investors, development agencies, and service providers, serving as a practical guide for designing interventions that bridge the digital divide and promote inclusive digital economies in Africa.

2.3 Methodology

This section outlines the methodology employed in conducting the study, detailing the approaches and processes used to gather, analyze, and interpret the data.

i. **Methodology Objectives**

The methodology was designed to assess the commercial viability of broadband services in rural Africa by examining current market conditions, identifying cost drivers, analyzing stakeholder input, and developing context-appropriate business and tariff models.

ii. **Scope of the Study**

a. The study covered 15 African countries representing a diversity of:
b. Geographic zones (ECOWAS, EACO, ECCAS, SADC, and AMU)
c. Broadband penetration levels
d. Regulatory maturity
e. Infrastructure availability
f. Socioeconomic and demographic contexts

Additionally, three international case studies; India, Brazil, and Hungary, were included to extract relevant lessons on rural broadband deployment, policy interventions, and inclusive tariff structures.

The rationale for the selection of the fifteen (15) African countries was based on the need to have the whole continent of Africa covered in line with the economic sub-regions already in place. India, Hungary and Brazil were also chosen based on similarities with Africa in terms of geographic coverage, topographical diversity, varying telecom maturity, regulatory environments, or socioeconomic indicators across Asia, Europe and the Americas.

iii. Data Collection Methods

a. Primary Data

Questionnaire Surveys

Unique questionnaire surveys which focused on broadband related policies, deployment technology and challenges, economic impact, coverage footprint, rural deployment experiences, sustainability (adoption and usage), business and tariff models, etc. were designed. The survey was given to the key stakeholders- Ministries/Regulators and Operators in all the fifteen (15) identified African countries. The responses from National Regulators and Operators were used for quantitative data analysis and qualitative observations.

b. Secondary Data

i. **Desk Research:** Analysis of reports from ITU, GSMA, World Bank, national regulators, and academic literature.
ii. **Benchmarking:** Comparative analysis with countries like India, Hungary, and Brazil for learnings.
iii. **Market Data:** Pricing trends, network rollout costs, penetration rates, population density, and ARPU levels.

iv. Analytical Framework

a. Cost Modeling:

i. CAPEX and OPEX components for various broadband delivery technologies (fiber, fixed wireless, mobile, satellite).
ii. Use of tools like cost calculators or Excel-based financial models.

b. Business Model Analysis:

i. Frameworks such as Business Model Canvas applied to different stakeholders (e.g., local ISPs, infrastructure sharing consortia).

c. Tariff Modeling:

ii. Affordability thresholds (e.g., <2% of GNI per capita).
iii. Pay-as-you-go vs. prepaid vs. community shared models.
iv. Scenario analysis for pricing (subsidy vs. no subsidy, data caps vs. unlimited, etc.).

v. Criteria for Evaluation

a. Economic viability (e.g., ROI, payback period).
b. Social impact (e.g., digital inclusion, gender equity).
c. Scalability and sustainability.
d. Policy and regulatory alignment.
e. User affordability and satisfaction.

vi. Tools and Software Used

a. Excel or other financial modeling tools.
b. Data visualization tools for dashboards and infographics.

1. Methodology Limitations

c. Data access constraints for rural areas.
d. Non-standardized reporting formats across countries.
e. Possible underrepresentation in survey responses from regulators and operators from the 15 countries.
f. Assumptions made in the modeling due to incomplete data.

3.0 Rural Broadband Landscape: Status and Trends

The rural broadband landscape is marked by a widening digital divide between urban and rural populations. While global internet penetration continues to rise, rural communities, particularly in developing regions such as Sub-Saharan Africa, remain significantly underserved. In 2024 only 38 % of Africa's population used the Internet, the lowest rate of all the ITU regions[10] and significantly below the global average of 68 %. This disparity is not only a technological gap but a socio-economic one, limiting access to education, healthcare, e-commerce, and digital government services.

Several factors contribute to this imbalance. High capital expenditure requirements for infrastructure deployment in low-density, hard-to-reach areas make rural broadband commercially unattractive for private investors.

Affordability is a major barrier to digital inclusion. In 2024 the median price of an entry-level mobile broadband plan (for 2 GB per month) was 4.2% of gross national income (GNI) per capita, down from 4.6% the previous year yet still the highest of any region and well above the UN Broadband Commission's affordability target of 2%. Fixed broadband is even less affordable, with a median price of 15% of GNI per capita. These high costs disproportionately impact lower-income groups, exacerbating digital inequalities[10]. Energy deficits, limited access to backhaul infrastructure, and high taxation on ICT equipment further discourage expansion.

Beyond coverage, price now defines practical access to high-quality broadband. As of February 2025, median fixed-broadband prices vary dramatically, from roughly US$0.01 per Mbps (Romania) to over US$4 per Mbps (UAE) as seen in figure 5 below.

Such dispersion means two countries with similar coverage can deliver very different user experiences and economic outcomes: high recurring prices suppress data-intensive activities (remote work, cloud adoption, digital-services uptake) and slow AI readiness, whereas low prices amplify usage and spillovers into education, health, and SME productivity.

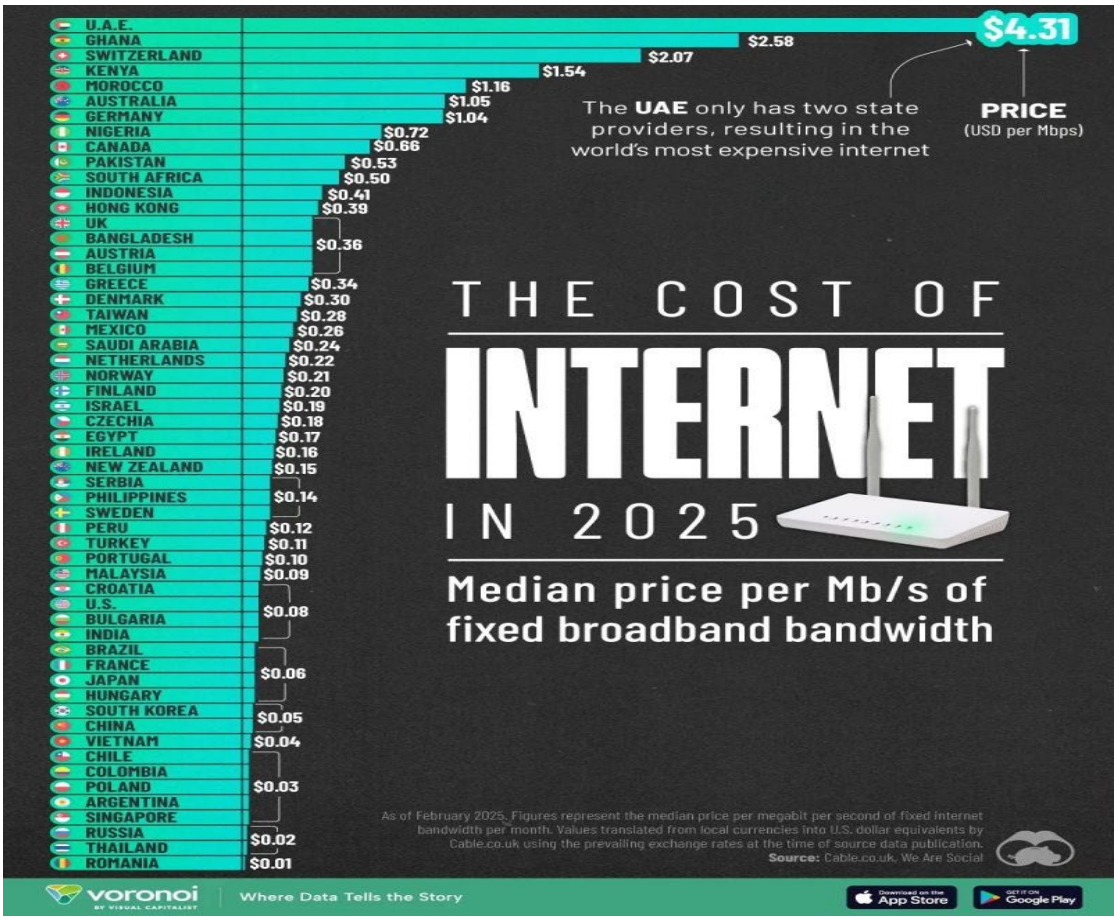

Figure 5: The Cost of Internet 2025 *Source: Cable.co.uk 2025*

For African markets, affordability relative to income is as decisive as availability. Where price per Mbps is high, operators face lower average usage and slower ARPU growth; where it is lower (or subsidized for priority segments), networks monetize via volume and value-added services. Accordingly, this report treats affordability not only as a consumer-welfare metric but as a competitiveness lever, informing the tariff and policy recommendations in Sections 5.3 (Tariff Models) and 6.2 (Policy Measures).

Over the past decade, many African countries have strengthened their ICT regulatory frameworks, with a shift towards more competitive and investment-friendly policies. However, regulatory maturity in the region still lags global trends. Only 18 % of African countries have reached the most advanced stage of ICT regulation "Integrated telecommunication regulation (G4)[10], compared to a global average of 38 %. Strengthening digital governance and regulatory frameworks is crucial for accelerating digital transformation. The region needs a continuing focus on robust digital policies that drive infrastructure investment, targeted initiatives in digital identity and skills, and cross-sector collaboration to bridge the regulatory divide[10].

Despite these challenges, there are signs of progress. Countries like Nigeria, Kenya, and South Africa are revising broadband plans to target underserved regions. Innovations in satellite internet, TV white space technologies, and low-cost community networks are emerging as

viable complements to traditional infrastructure. With the right mix of investment, policy reform, and technology, rural broadband connectivity can be accelerated to support inclusive digital transformation across Africa and similar regions.

Below in Table 3, is a heat map showing snapshot of the status / trend of ten (10) broadband dimensions deduced from the 15 African countries that responded to questionnaires for this study (issued to telecommunication regulators and network services providers).

Country	Policy & Regulation	Spectrum Mgmt.	Infra Sharing	Tech Readiness	USF & Licensing	Affordability	Financial Incentives	Market Demand & Adoption	Digital Skills & Literacy	Innovation & Pilots
Gabon	🟢	🟡	🟢	🟢	🟢	🟠	🟢	🟡	🟠	🟡
South Africa	🟢	🟢	🟢	🟢	🟡	🟠	🟡	🟢	🟡	🟢
Egypt	🟢	🟡	🟡	🟢	🟢	🟠	🟠	🟡	⚪	🟡
CAR	🟡	🟡	🟠	🟠	🟡	🟠	🟠	🟠	🟠	🟡
Rwanda	🟢	🟡	🟡	🟢	🟢	🟢	🟢	🟠	🟢	🟢
Côte d'Ivoire	🟢	🟡	🟢	🟢	🟢	🟠	🟠	🟡	🟢	🟡
Kenya	🟢	🟢	🟡	🟢	🟢	🟠	🟡	🟡	🟢	🟡
Tanzania	🟢	🟢	🟢	🟢	🟢	🟠	🟡	🟡	🟡	🟡
Zimbabwe	🟡	🟡	🟠	🟡	🟡	🟡	🟡	🟡	🟠	🟠
Angola	🟡	🟡	🟠	🟡	🟢	🟠	🟡	🟠	⚪	🟡
Cameroun	🟡	🟡	🟠	🟡	🟡	🟠	🟠	🟡	🟠	🟠
Nigeria	🟢	🟢	🟡	🟢	🟡	🟡	🟠	🟢	🟡	🟢
DRC	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠
Ghana	🟢	🟡	🟡	🟢	🟢	🟡	🟡	🟡	🟡	🟡
Eswatini	🟡	🟡	🟡	🟡	🟡	🟡	🟠	🟡	🟡	🟡

Legend: 🟢 strong / established 🟡 emerging / partial 🟠 limited / early ⚪ not reported

Table 3: Rural Broadband Landscape: Heat-Map

3.1 Broadband Connectivity in Africa: Overview of mobile, fixed, satellite, and alternative broadband solutions.

a. Mobile Broadband (3G/4G/5G)

Mobile broadband, which encompasses 3G, 4G, and 5G technologies serves as the primary means of internet access across Africa, particularly in rural and underserved areas where fixed-line infrastructure is limited. The continent is rapidly moving from 3G to 4G, while 5G coverage is starting in a few countries and currently reaches only 11% of the population. However, Africa has the lowest active mobile broadband subscriptions of 52 per 100 inhabitants amongst the regions of the world as of 2024, as shown in figure 6 below.

Coverage: As of 2024, mobile broadband networks covered approximately 86% of Africa's population, leaving 14% without any possibility of connecting (that proportion reached 25% in rural areas). While 70% of the population was covered by 4G, 16% still relied on 3G, with its lower speeds and limited online experience. However, actual internet usage stood at 38%, highlighting a substantial usage gap influenced by factors such as affordability, digital literacy, and device accessibility[10].

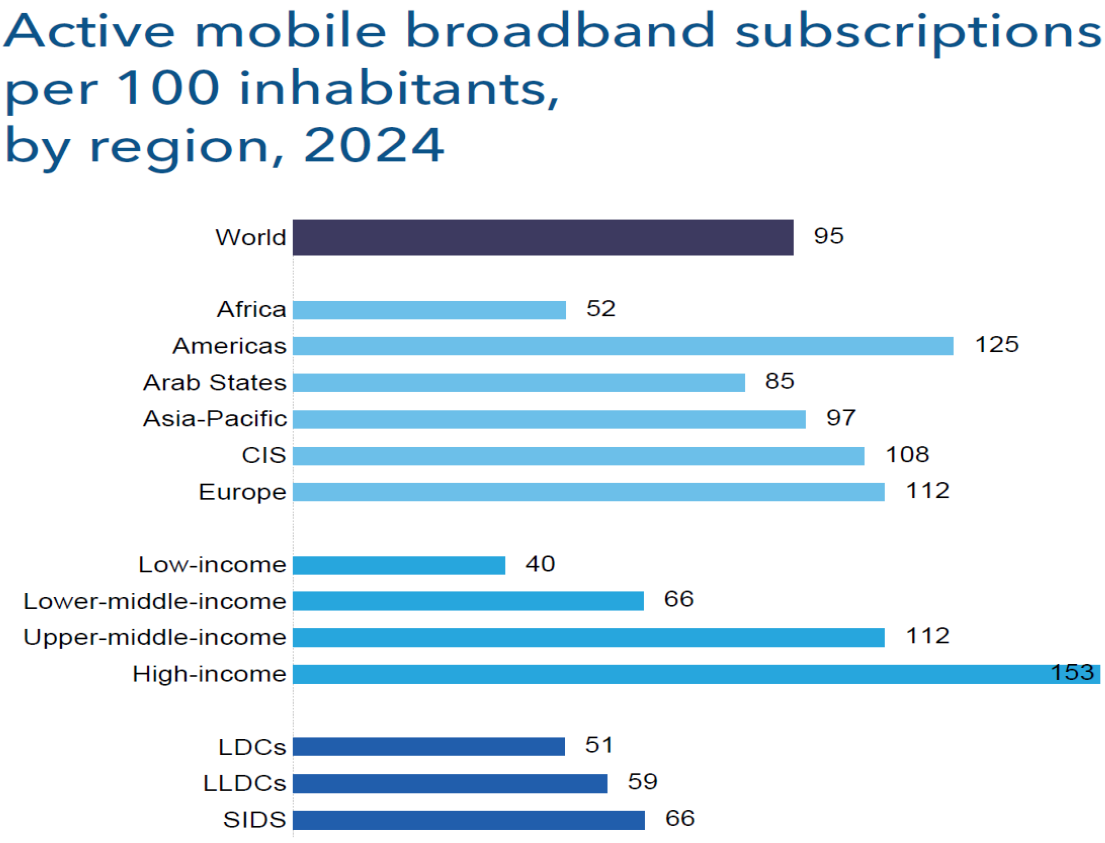

Figure 6: Active Mobile Broadband Subscriptions/100 inhabitants

Source: ITU Facts and Figures 2024

b. Fixed Broadband (Fiber and DSL)

Fixed broadband in Africa is primarily delivered via fiber-optic and DSL (Digital Subscriber Line) technologies, it remains limited in reach, largely constrained to urban and economically vibrant regions. However, several countries are making strides to expand infrastructure and promote digital access. DSL infrastructure exists primarily in North African countries (Algeria, Egypt, Tunisia), often as a legacy of earlier telecom rollouts. Its use is declining globally and in Africa, replaced by fiber and mobile broadband alternatives.

Fixed broadband plays a negligible role in Africa[10], with less than 1 (one) subscription per 100 inhabitants (see figure 8 below)[10]. However, there is currently a rapid urban-focused deployment of FTTx networks across major cities of Africa.

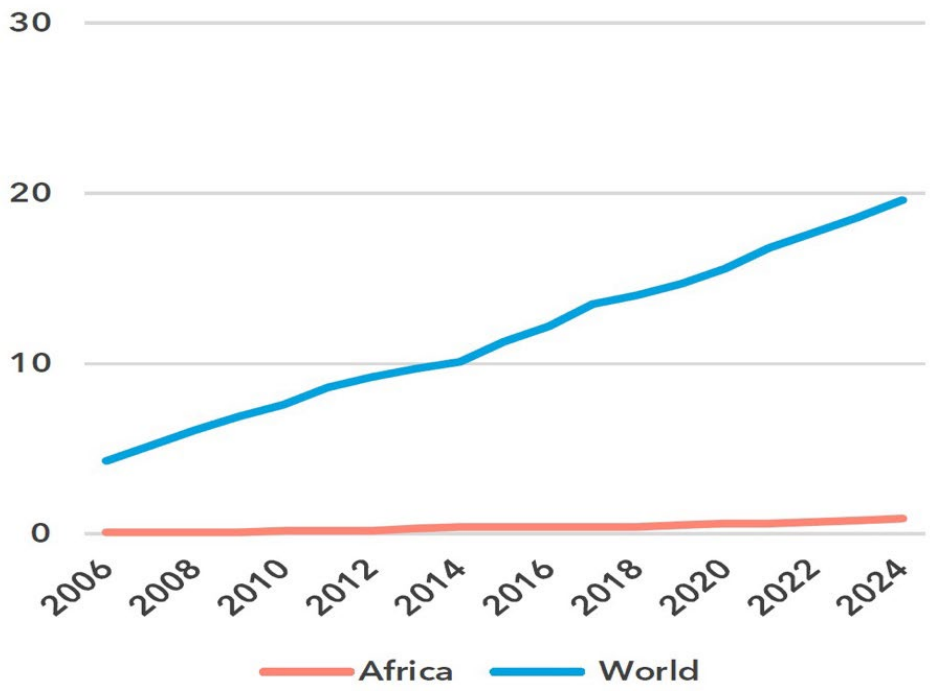

Figure 7: Fixed Broadband Subscriptions/100 inhabitants *Source: ITU Publication: State of BB and Trends 2025*

c. Satellite Broadband (GEO, MEO, LEO)

Satellite broadband is playing an increasingly vital role in bridging Africa's digital divide, especially in remote and underserved regions. Three primary satellite technologies—Geostationary Earth Orbit (GEO), Medium Earth Orbit (MEO), and Low Earth Orbit (LEO) are being deployed across the continent to enhance internet connectivity.

Satellite Broadband Technologies in Africa

- Geostationary Earth Orbit (GEO) Satellites have an approximate altitude of 35,786km above Earth, with a latency of 500–600ms. It has a wide-area footprint, suitable for broadcasting and rural coverage.

- Medium Earth Orbit (MEO) Satellites with an altitude of 2,000 km - 36,000km and moderate latency of 27–500ms. It is primarily used for regional connectivity and enterprise solutions.
- Low Earth Orbit (LEO) Satellites usually within an altitude of 160–2,000km above Earth with latencies between 2–27ms. They are suitable for high throughput real-time applications. While LEO satellites offer enhanced connectivity, they also pose environmental challenges due to increased rocket launches and space debris.

Satellite coverage spans nearly 100% of the African continent, with its key strength of Immediate coverage over wide areas which makes it viable for connectivity to cover unserved rural areas, including remote schools, health centers, and emergency communications. Its major drawbacks are high equipment and subscription costs. As of 2024, detailed statistics on satellite broadband subscriptions in Africa are limited.

Collaborations between governments and private entities are accelerating satellite broadband deployment in Africa. Partnerships are increasingly evolving between satellite service providers and mobile network operators in a complementary manner to meet backhaul needs and extension of services to bridge urban – rural connectivity gaps.

3.2 Regulatory and Policy Environment in Africa

This section presents the regulatory and policy environment of 15 identified African countries listed below:

Sub-Regions	Countries
SADC	**Angola, Eswatini, South Africa and Zimbabwe**
AMU	**Egypt**
EACO	**Kenya, Rwanda and Tanzania**
ECCAS	**Cameroun, Central Africa Republic, DRC and Gabon**
ECOWAS	**Cote D' Ivoire, Ghana, and Nigeria**

The study finds that Africa's regulatory and policy environment for rural broadband is diverse but shaped by a consistent set of strengths, gaps and practical opportunities. Across the 15 countries surveyed there are clear signs of policy ambition, national broadband plans, universal service frameworks, and infrastructure-sharing rules are widespread, but execution bottlenecks (permitting, finance, spectrum practice and demand stimulation) limit their impact in rural areas.

Key themes and patterns

- Regulatory maturity is uneven. A small group of countries show advanced, coordinated approaches (clear national broadband strategies, active use of USFs, and permissive spectrum regimes), while many others have partial or nascent frameworks (policies exist

but lack rural targets, clear incentives or fast execution). This pattern is visible in the cross-country readiness and heat-map analysis.

- Spectrum policy is being adapted for rural needs but remains underutilized. Common measures include sub-1 GHz assignments, administrative assignment of rural spectrum and limited pilots for TV White Spaces / dynamic access; however, tiered rural fee structures, longer rural licenses and operational DSA pilots are not yet widespread.
- Universal Service Funds (USFs) are present and often cited as a key instrument, but governance, disbursement delays and an emphasis on CAPEX (rather than OPEX or device subsidies) reduce their effectiveness for sustainable rural services. Several countries have meaningful USF activity (backbone, towers, institutional connectivity) but struggle to convert that into long-term last-mile uptake.
- Infrastructure sharing and open access are accelerating as priority levers. Passive sharing is commonly mandated; where regulators allow or incentivize active sharing (MORAN/MOCN) and neutral-host models, site rollout costs fall, and small-operator models become feasible.
- Demand-side and affordability levels are inconsistent. Most countries track affordability and have tariff-forbearance approaches, but targeted measures (device vouchers, micro-financing, zero-rating public services, and school/clinic anchor tenancy) are still patchy. Digital literacy and local content programmes are present in a few markets but lack scale in many.

Principal barriers observed

- High effective deployment costs (backhaul, power, RoW/permitting, and security) make deep-rural sites commercially unattractive.
- Low ARPU and weak demand stimulation (skills, content, devices) impede operator business cases once CAPEX is funded.
- Fragmented incentives: spectrum fees, tax regimes and USF rules are applied unevenly across agencies, slowing implementation and reducing predictability for investors.

High-impact policy priorities (country-agnostic)

1. Re-orient USFs toward output-based aid (OBA) and short-term OPEX support (e.g., power, maintenance, device vouchers) to improve sustainability.
2. Pair rural spectrum obligations with fee credits or longer license terms and fast-track DSA/TVWS pilots for schools and community networks.
3. Mandate and incent both passive and guided active infrastructure sharing; require open access for publicly funded fiber with published wholesale reference prices.

4. Create one-stop digital RoW/permits portals and adopt "dig-once" rules to reduce civils costs and accelerate fiber spur deployment.
5. Scale demand-side interventions (device financing/vouchers, community ICT centres, zero-rating education/health portals) to turn coverage into sustainable uptake.

Detailed country readiness scores, regulator and operator perspectives, and tailored recommendations for each of the 15 respondents can be accessed in Annex 1. Readers who require country-level diagnostics and scoring rationale should consult those country profiles.

Country	Spectrum allocation for rural broadband	Licensing & regulatory frameworks	Government-led broadband initiatives & incentives
Angola	• IMT bands 700 MHz, 800 MHz, 2.3 GHz licensed for rural use • TV White Spaces under managed-access model • 20–50% spectrum-fee discounts in underserved areas	• Spectrum via administrative assignment or auction • No rural-only License; roll-out obligations in MNO Licenses • Passive infrastructure sharing mandated • Rural tariffs subject to regulatory approval	• USF subsidizes last-mile capex & opex • Angosat-2 satellite extends coverage (National Space Programme) • PPPs (e.g., "Iluminar Angola") for new roaming sites • Tax-incentive proposals pending at Assembly
DRC	• National IMT: 800/900/1800/2100 /2600 MHz used incl. rural • TVWS pilot in planning	•Spectrum allocated administratively • License conditions include coverage targets • Infrastructure-sharing policy under revision • Tariff approval managed by regulator	• USF supports fiber backbones & last mile • National fiber expansion ("Réseau National Fiber Optique") • Exploring tax reliefs & capex-matching grants for rural sites
Côte d'Ivoire	• No rural-specific bands; national IMT (800/900/1800/2100/2600 MHz) • TVWS/dynamic sharing not yet authorized	• Same spectrum process for rural/urban (auction/beauty contest via ARTCI) • Coverage obligations: 99% mobile, 95% data pop. Coverage • Active & passive sharing mandated • Tariff freedom with transparency/consumer-protection rules	• RNHD 5,200 km national fiber (ANSUT) • PNCR rural-connectivity (QoS-penalty reinvestment) • PSNDEA: 160 towers for 175+ localities (FSU-funded) • Incentives chiefly via PPP/FSU (no end-user subsidies)
Kenya	•IMT 700/ 800/ 900/ 1800/2100/2600/3500 MHz incl. rural • TVWS pilots; dynamic sharing under review	• USF-supported rural spectrum via admin assignment; commercial via auction/admin • Rural/underserved roll-out obligations in MNO licenses	• USF subsidies for un/underserved areas • Digital Superhighway Phases I–II (backbone + last-mile to >3,800 institutions) • GDAP (World Bank PPP) rural broadband

Country	Spectrum allocation for rural broadband	Licensing & regulatory frameworks	Government-led broadband initiatives & incentives
		• Active & passive sharing mandated (2016; 2025 regs pending) • Tariffs free but affordability/competition monitored	• Next-Gen InfraCo shared 5G infra
Zimbabwe	•Light-licensing: 2.4 & 5 GHz unlicensed •All IMT bands deployable in rural areas under full License	• Spectrum via administrative assignment • Passive sharing mandated • Roll-out targets & USF levy obligations in Licenses •Cost-based tariffs; no rural/urban split	• USF capex subsidies; tax holidays for rural towers • MORAN multi-operator RAN • Community Wi-Fi/info centres • Lower wayleave charges pursued
Eswatini	• TVWS allocated; IMT 700–2600 MHz usable in rural	• Admin spectrum assignments • Mobile Licenses include rural coverage conditions • Active & passive sharing required • Tariffs require regulator's approval	• UASF subsidizes rural roll-out & community Wi-Fi • PPPs on fiber backbones (Eswatini Communications) • Routine USF capex/opex grants
Tanzania	• IMT 700/800/900/1800/2100/2300/2600/3500/3800 MHz fully assigned • TVWS pilots was permitted but did not give an impactful results hence not commercialized; active spectrum sharing allowed	• Licensed spectrum via admin assignment & auction; unlicensed also available • Mandatory rural-coverage targets in Licenses • 2018 Sharing Regs (amended 2022) allow active & passive sharing • Tariff rules (2018/2021) ensure affordability	• UCSAF capex subsidies for towers • NICTBB fiber backbone to all districts • Digital Tanzania Project: first-time mobile access in 713 wards • Embedded rural roll-out obligations
Nigeria	• National IMT 800–2600 MHz incl.	• NCC awards via admin & auction	• USF grants for backbone & last-mile

Country	Spectrum allocation for rural broadband	Licensing & regulatory frameworks	Government-led broadband initiatives & incentives
	rural; TVWS trials in select states	• National coverage/License -of-right with milestones • Active/passive sharing promoted (enforcement uneven) • Deregulated tariffs with competition oversight	• Digital Nigeria PPP towers/fiber • Tax waivers on broadband gear; CBN concessional loans for rural ISPs
Cameroun	• IMT 800/900/1800/2100 /2600 MHz for national incl. rural • No formal TVWS regime	• Spectrum via auction or direct award (ANFR) • Annual rural-coverage targets in Licenses • Passive sharing encouraged • Tariff free-setting with regulator notification	• USF subsidies for rural towers • National DFN fiber backbone (PPP) • PPP extensions to schools & health centres
Gabon	• IMT 700/800/900/2.3 GHz licensed for rural use • TVWS/dynamic sharing not permitted	• National IMT assignments used for rural (no separate rural License) • Passive & active sharing mandatory with regulated tariffs • Spectrum-fee discounts for rural areas; 2% USF levy • Tariffs freely set; regulatory approval for novel offers	• FSU (2% levy) funds capex/opex subsidies • Integrated rural comms (community Wi-Fi/basic telephony) • Customs-duty exemptions on rural deployments
Ghana	• No rural-only bands; national IMT covers rural • TVWS/dynamic sharing under consideration	• Admin assignment for GIFEC/USF rural projects; general bands via auction • License roll-out obligations for rural/underserved • 2008 ECA mandates co-location; NGIC to drive active sharing • Un-capped tariffs; NCA monitors affordability/competition	• GIFEC towers & community ICT centres; MNO rural upgrades subsidized • National Fiber Backbone & e-Gov network • GDAP (World Bank PPP) last-mile • Tax exemptions on inclusion-scheme equipment

Country	Spectrum allocation for rural broadband	Licensing & regulatory frameworks	Government-led broadband initiatives & incentives
South Africa	• Licensed IMT incl. 450, 700/750, 800, 900, 1500, 1800, 2100, 2600 MHz nationwide incl. rural • TVWS permitted (2018 regs); unlicensed 2.4/5 GHz widely used	• Spectrum mainly via auction (e.g., 2022) with rural obligations • Draft Dynamic Spectrum Access regs in innovation spectrum • Active sharing enabled; facilities-leasing/open-access policies • USF contributions; License conditions mandate public-institution connections	• SA Connect (Phase 2): open-access base stations & 33k+ community Wi-Fi hotspots • Planned State Digital Infrastructure Company (Broadband Infraco + SENTECH) • USAF subsidies; municipal free-Wi-Fi (e.g., Project Isizwe)
Egypt	• Same national IMT bands for rural & urban; 4G coverage targets on populated areas	• No rural-specific spectrum process (NTRA assignment) • Fixed: active sharing via open-access; Mobile: passive sharing • MNO Licenses include rollout plans • Operator-proposed tariffs subject to NTRA approval	• Decent Life (Hayah Karima): large-scale rural connectivity & infrastructure • USF-funded mobile coverage & selective FTTH support • USF subsidies to bridge rural gaps
Rwanda	• IMT 700/800 MHz prioritized for rural coverage • TVWS allowed under managed access	• Administrative spectrum assignment; rollout plans in Licenses • Passive sharing policy; PPPs supported • Tariff freedom; device-affordability programmes	• Rural Fiber Initiative & Community Wi-Fi for last-mile • USF grants for last-mile & public-access sites • Tax exemptions; CAPEX/OPEX support; free-smartphone programme
Central African Republic (CAR)	• IMT 700/800/2.3 GHz for rural 4G/FWA • TVWS/dynamic sharing under consideration	• Administrative spectrum assignment ("first-come, first-served") • Passive infrastructure-sharing framework; 4G Licenses (15-year terms) • Spectrum-fee reductions/License -fee	• Rural Fiber Initiative to extend backbone/spurs • FSU (USF) to co-fund last-mile; PPPs for shared towers/backhaul • Engagement with LEO backhaul (e.g., Starlink) for remote areas

Country	Spectrum allocation for rural broadband	Licensing & regulatory frameworks	Government-led broadband initiatives & incentives
		exemptions in underserved zones	

Table 4: Regulatory and Policy Environment from 15 Responding African Countries

3.3 Case Studies: Global Best Practices (India, Hungary, and Brazil)

This report draws three in-depth country case studies from India, Hungary and Brazil into a common set of insights on what to consider when deploying sustainable broadband in rural Africa.

India

Programmes & policy: BharatNet (publicly funded national fiber backbone to rural localities) and the National Broadband Mission provided the strategic umbrella for scale. PM-WANI (public Wi-Fi access network interface) created a regulated franchise model for local Wi-Fi providers and street-level kiosks to monetize last-mile access.

- Delivery model: Government built the core/backbone (fiber to village/Gram Panchayat) + private-sector franchisees and ISPs provide last-mile Wi-Fi and managed services, a clear "public backbone + private last-mile" pattern.
- Business/tariff notes: Low-cost public Wi-Fi bundles and vendor financing for CPE were paired with demand stimulation (digital literacy and e-services) to accelerate take up rates. Measures to enable many small entrepreneurs to run hotspots improved sustainability in thin-ARPU areas.

Hungary

- Programmes & policy: The Superfast Internet Programme (SZIP / SZIP2) was an EU-backed, nation-level effort tied to the National Digitalization Strategy to push full-fibre migration and rapid rural fibre deployment. The programme combined national planning with EU structural funds and clear rollout targets.
- Technical/operational approach: Emphasis on fiber-first builds supported by targeted use of fixed wireless and satellite where terrain made fibre uneconomic; explicit energy-efficiency and future-proofing (green networks) were part of procurement requirements.
- Financing & impact: Direct public investment blended with EU funds and supplier contracts reduced the cost of capital and enabled fast measurable household coverage gains in low-density areas.

Brazil

- Programmes & policy: Regulatory reforms combined with USF-style instruments (FUST) and national programmes such as the Wi-Fi Brazil rollout and "Internet Popular" offerings to expand affordable public access. Regulatory allowance for service resale and community Wi-Fi models expanded local supply options.
- Delivery & business model: Mixed approaches — public funding for key anchors (schools, municipal Wi-Fi) plus incentives for private providers to deploy to low-income neighborhoods. Community networks and resale models (plus pilot subsidies) were used to reach marginalized communities.
- Policy debates / lessons: Brazil's experience highlights the trade-offs in zero-rating and resale rules, and shows that regulatory flexibility (permitting resale, neutral-host corridors, school connectivity targets) materially widens feasible business models.

Below are some cross-cutting actionable points:

- Public backbone + enabled private last-mile (India); scalable if paired with local franchise rules (PM-WANI), device/CPE financing and anchor tenancy.
- EU-style, target-driven fibre programmes (Hungary's SZIP); accelerate full-fiber migration when combined with grant/EU finance and energy-efficiency procurement.
- Flexible regulatory instruments (Brazil: FUST, Wi-Fi programmes, resale); expand supply-side options and allow community/neutral-host models to operate viably.

The full case-study reports for India, Hungary and Brazil can be accessed in Annex 3.

Comparative Analysis

Below, are comparative analysis tables for Africa, India, Brazil and Hungry based on some key indicators for a global overview of these demographics. Recall that India, Brazil and Hungary have been identified for global perspective in this report.

Table 5.1: Comparative Analysis Table (Africa, India, Hungary & Brazil)

Category	Africa (General)	India	Hungary	Brazil
Rural Broadband Access	~28% rural internet penetration (varies by country; lower in Sub-Saharan Africa)	Over 65% of rural internet access (growing rapidly)	Over 90% broadband coverage, including rural	~75% of rural internet access, driven by national programs
Affordability	High relative cost (2–5% of monthly income for 1GB in many countries)	Low-cost mobile data (~$0.20/GB); affordable rural plans	Generally affordable due to EU-regulated markets	Moderate affordability: universal service funds help mitigate costs
Infrastructure	Sparse infrastructure; heavy reliance on mobile networks and VSAT	Extensive 4G coverage; BharatNet fiber backbone to 250,000 villages	Advanced fixed and mobile networks; rural fiber expansion supported by EU funds	Mix of fiber and wireless networks in rural areas, with government support
Digital Literacy & Devices	Low in many regions; smartphone penetration rising slowly	Improving due to national digital literacy campaigns	High literacy; strong device access and public ICT programs	Moderate; public internet centers and affordable device initiatives
Government Initiatives	Patchy implementation; some Universal Service Fund (USF) efforts and World Bank projects	BharatNet, Digital India, PM-WANI (Wi-Fi for All)	EU-funded broadband rollouts; Digital Hungary strategy	"Internet for All," FUST (telecom fund), and national broadband plan
Challenges	Power issues, low investment, fragmented markets	Spectrum pricing, last-mile connectivity	Aging rural populations, low demand in remote areas	Regulatory delays, vast territory with logistical hurdles

Table 5.2: Further Comparative Analysis based on Global Indicators

Indicator	Africa	India	Brazil	Hungary
GDP per capita (2025)	$1,930 IMF	$2,880 IMF	$9,960 IMF	$24,800 IMF
GNI per capita (Atlas method) 2024	$1,800–$2,000 (est.)**	**$2,650** (data.worldbank.org)	**$9,950** (data.worldbank.org)	**$20,690** data.worldbank.org
Population (2025)	**1,550.417m** Worldometers.	**1,454.607 m** (imf.org)	**213.362m** (imf.org)	**9.556m** (imf.org)
Mobile-broadband (active cellular or wireless BB)	**~800 million (52 per 100)** (2024) ITU Facts and Figures 2024	**1,163.76 million** subs (Mar'25) **82.42%** Tele-density TRAI	266.1m subs (May'25) **101.7 %** Anatel	**1,545** subs/**1000** inhabitants **154.5%** (2024) Hungarian Statistical Office
Fixed-broadband	**<1 per 100 (approx. 0.9)** (2024) ITU Facts and Figures 2024	**37.04 million** subs (Mar'25) **2.62%** TRAI	52.7 m subs (May'25) **≈ 24.8%** Anatel	**381** subs/**1000** inhabitants, **38.1%** (2024) Hungarian Statistical Office
Internet penetration – urban	**57%** (2024) ITU Facts and Figures 2024	**110.0 %** of population* (2023) TRAI	**94.1 %** of households (2023) (ibge.gov.br)	**93.3 %** of population (2024) ITU DataHub
Internet penetration – rural	**23%** (2024) ITU Facts and Figures 2024	**41.7 %** of population* (2023) TRAI	**81 %** of households (2023) (ibge.gov.br)	**87.3 %** of population (2024) ITU DataHub)

India's TRAI reporting expresses urban/rural penetration as subscribers per 100 inhabitants; values above 100 % reflect multi-SIM use in dense urban zones.

Exact 2024 figures for the full continent are not yet published, but Sub-Saharan Africa stood at $1,621 in 2023. Including North Africa raises the average, hence the estimated $1,800–$2,000 range. The source is extrapolated from World Bank data.

Table 6: A Review of Global Government Broadband Policies and Regulatory Filings.

Pillar	What Global Evidence Shows	Illustrative Results & Data	Key Take-aways
1. Universal, Funded National Broadband Plans (NBPs)	The Broadband Commission's first 2025 target calls for every country to have a **funded** NBP or to include broadband in Universal Access & Service (UAS) rules (broadbandcommission.org)	*155* economies had c current NBP in 2022, down from 165 the year before. Countrie with active plans report faster fiber roll-out and higher rural coverage than those without (broadbandcommission.org)	• Keep NBPs live, funded, and measurable • Embed rural targets (speed, latency, % villages covered) and publish annual scorecards. Include Climate targets such as green energy, e-waste carbon footprint etc.
2. Multi-stakeholder digital-transformation strategies	The **AU Digital Transformation Strategy 2020-2030** aligns continental, regional and national infrastructure master-plans, IXPs and data-centre growth (38507-doc-DTS_for_Africa_2020-2030_English.pdf)	AU members agreed that each country should have at least **two independent international links** to raise resilience, a benchmark now in several national filings	• Treat broadband as critical infrastructure inside wider digital, energy and transport planning • Use regional backbones & IXPs to cut transit costs for landlocked rural areas
3. Affordability & Inclusive Tariff Benchmarks	The Broadband Commission's affordability goal: entry-level broadband < **2 % GNI-pc** in LMICs by 2025 (broadbandcommission.org)	Only 71 of 178 economies meet the fixed-broadband price target; 114 meet the mobile-broadband basket (broadbandcommission.org)	• Tie License renewals to affordable "lifeline" packages • Zero rate essential public service sites, bundle devices + data, and monitor retail/wholesale price caps
4. Smarter, Transparent Universal Service & PPP Financing	ITU/World Bank "Digital Infrastructure Moonshot" estimates **US $100 bn** needed to connect all Africans by 2030, stressing PPPs and targeted subsidies (broadbandcommission.org)	World Bank's DE4A has channeled **US $2.8 bn** into last-mile projects across 23 African states since 2019 (worldbank.org)	• Modernize USFs—disburse quickly, publish dashboards, align with NBPs (GSMA notes many African USFs are underperforming) (gsma.com) • Blend concessional debt, guarantees, and risk sharing

Pillar	What Global Evidence Shows	Illustrative Results & Data	Key Take-aways
			with local currency revenue streams
5. Pro-investment Spectrum & RoW Reform	Broadband Commission policy guidance urges "technology-neutral Licenses, affordable spectrum, rapid RoW" to unlock rural capex (broadbandcommission.org)	Countries cutting average RoW approval times to **≤ 30 days** (e.g., India's NBM 2 .0) attract more fiber trench-kilometres per year than peers	• Publish one-stop RoW portals, fee caps, dig-once rules • Offer longer, cheaper rural spectrum Licenses in exchange for coverage obligations
6. Open-access & Infrastructure-sharing Models	World Bank & ITU highlight open-access wholesale fibers and towers as the fastest way to de-risk low-density areas (worldbank.org)	East Africa's national backbones lease dark fiber at regulated rates; independent tower-cos now carry **> 70 %** of rural BTSs in Nigeria	• Mandate non-discriminatory wholesale tariffs; publish reference offers • Encourage community networks and neutral hosts where fiber backhaul exists
7. Device & Power Affordability Programmes	The Handset Affordability Coalition was launched to address one of the key barriers to mobile internet usage. By year-end 2024, 23 organizations, including World Bank and ITU etc., had joined the coalition which aims to drive innovative solutions to boost handset affordability for some of the world's most under-served populations. (gsma.com)	Handset duties removal in countries will cut average rural smartphone prices with data use jumping accordingly	• Pair rural broadband with handset-financing schemes and solar-powered CPE kits
8. Green & Future-Proof Networks	WBBA 2024 recommends **full-fiber migration** to slash energy use and sustain bandwidth growth[14]	OECD fiber share rose from 38 % to 42 % of fixed lines in 2023; DSL fell to 20 % (oecd.org)	• Incentivize copper switch-off, energy-efficient equipment, and remote-power solutions for off-grid rural sites

Crosscutting Lessons from table above:

Policy coherence beats piecemeal projects – Best-in-class regulators align universal-service rules, spectrum road-maps, RoW processes and climate targets (green energy, carbon footprints etc.) inside one broadband policy matrix.

Demand stimulation matters – Digital-skills budgets, local-language content and e-government services raise rural uptake, ensuring networks reach commercial break-even sooner.

Data transparency drives accountability – Open, geo-referenced coverage maps and price dashboards (as mandated in EU/Hungary filings) keep operators, fund managers and citizens aligned on progress.

Multi-level financing – Blending development-finance capital (AfDB, World Bank), national USFs and private equity lower weighted cost of capital and stretches coverage into the toughest villages.

Conclusion

These case studies demonstrate that a combination of robust policy frameworks, targeted funding, regulatory reforms, and inclusive business and tariff models are essential for successful rural broadband deployment. India's comprehensive approach, Hungary's strategic planning with EU support, and Brazil's regulatory reforms offer valuable lessons for other countries aiming to bridge the digital divide.

These evidenced practices provide a menu that African policymakers can tailor, mixing capital subsidies, policy reform and private-sector innovation to accelerate universal, affordable rural broadband.

4.0 Challenges and Opportunities in Rural Broadband Expansion

Key Challenges

High Deployment & Operational Costs	• *Infrastructure Investment:* Building towers, fiber backbones, and gateway sites in low-density areas yields poor economies of scale. • *Power Supply:* Many rural sites lack reliable grid electricity, forcing use of diesel generators or expensive solar hybrids. • *Right-of-Way & Permitting Delays:* Complex, multi-agency approvals for tower siting and fiber trenching drive up costs and timelines.
Limited Commercial Viability	• *Low ARPU (Average Revenue per User):* Sparse populations with lower income levels translate into smaller revenue streams, deterring private investment. • *Uncertain Demand:* Digital literacy gaps and limited local content dampen user uptake, creating a "chicken-and-egg" barrier.
Regulatory & Policy Barriers	• *Spectrum Constraints*: High spectrum fees and lack of rural-targeted bands increase operator costs. Pilot dynamic-sharing or TVWS regimes often remain uncommercialized. • *Inconsistent Infrastructure-Sharing Enforcement*: While most countries mandate passive sharing, active/RAN sharing is unevenly regulated and enforced. • *Ambiguous "Rural" Definitions*: Varying government definitions complicate eligibility for incentives and regulatory obligations.
Logistical & Environmental Hurdles	• *Terrain & Access:* Poor road networks, mountainous or forested areas hinder equipment transport and site maintenance. • *Security Risks:* Vandalism and theft of equipment can raise O&M costs and undermine service reliability.
Funding & Coordination Gaps	• *Fragmented USF Deployment*: Universal Service Funds often suffer governance, transparency, or disbursement delays. • *Weak PPP Frameworks*: Public-private partnership models sometimes lack clear risk-sharing mechanisms or predictable funding commitments.

Table 7: Key Challenges in Rural Broadband Expansion

Opportunities for Rural Broadband Growth

Alternative Technologies	• *Solar-Hybrid and Mini-Grid Power Solutions*: De-risk site power costs and improve sustainability. • *Low-Cost Wireless Relays & Meshed Networks*: Reduce fiber backhaul needs by leveraging microwave or High-Altitude Platform Systems (HAPS).
Enhanced Infrastructure Sharing	• *Active RAN & National Roaming*: Pooling radio networks among operators can slash capex and opex by as much as 40%[33]. • *TowerCo and Infrastructure-Co Models*: Independent tower companies and neutral-host providers unlock new financing and scale efficiencies.
Targeted Regulatory Incentives	• *Rural-Focused Spectrum Fees*: Tiered pricing or waivers for under-utilized bands in low-density zones. • *Tax Holidays & Import Duty Exemptions*: Lower upfront equipment costs for infrastructure and customer-premises devices. • *Fast-Track Permitting:* One-stop clearance processes for rural telecom projects.
Demand Stimulation & Local Content	• *Digital Literacy Programs*: Community ICT centres and school-based training boost adoption and ARPU. • *Localized Services & Apps*: Agriculture, health, and micro-enterprise platforms directly address rural needs and generate traffic. • *Micro-Financing for Devices*: Pay-as-you-go smartphones and routers expand the addressable market.
Strengthened Public-Private Partnerships	• *Blended Finance Models*: Combining USF grants, concessional loans, and commercial investment to de-risk projects. • *Multi-Sectoral Coordination*: Align broadband rollout with rural electrification, road construction, and social-service initiatives for shared infrastructure corridors. • *Outcome-Based Contracts*: Tying disbursements to coverage or quality milestones fosters accountability and performance.
Data-Driven Planning	• *High-Resolution Coverage Mapping*: Identify unserved/underserved clusters to prioritize investments. • *Real-Time QoS Monitoring*: Use crowd-sourced speed tests to ensure service levels and guide remedial action. • Impact Metrics: Track socio-economic benefits (e.g., increased farm incomes, telehealth adoption) to justify continued funding.

Table 8: Opportunities for Rural Broadband Growth

By addressing these challenges through a combination of innovative technologies, smarter regulation, stronger partnerships, and demand stimulation, African countries can unlock the untapped potential of rural broadband—bridging the digital divide and catalyzing inclusive socio-economic development.

PART B

A Strategy Framework for Broadband Connectivity in Rural Areas with a Set of Recommendations on Best Business and Tariff Models to Accelerate Universal Broadband Connectivity in Africa.

5.0 Business and Tariff Models for Rural Broadband

5.1 Comparative Analysis of Existing Business Models

To understand which approaches most effectively deliver rural broadband in Africa, we compared six predominant business models across four pillars: **operational model, financing structure**, **strengths**, and **limitations**.

S/N	Model	Operational Model	Financing Structure	Strengths	Limitations
1	Cross-Subsidization	Operator uses a single nationwide network; urban ARPU funds rural expansion	Profitable urban services underwrite below-cost rural tariffs	• Rapid scale-up without new funding sources • Leverages existing cash-flows	• Relies on continued urban profitability • Masks rural cost drivers, delaying targeted reforms
2	USF-Supported Deployment	Operators bid for capex/opex support to build rural towers, last-mile networks	Competitive grants/subsidies from Universal Service Funds, financed by levies on all operators	• Direct stimulus for investments • Transparent, market-based allocation • Can draw in smaller operators	• Often under-funded; slow disbursement • Administrative complexity in tendering
3	Public-Private Partnerships	Co-owned network assets (backbone fiber, shared towers); roles & revenues split per contract	Joint capex contributions: government/co-finance via grants, operator equity, sometimes donor loans	• Aligns public policy goals with commercial incentives • Access to government-owned rights of way and sites	• Complex negotiations and governance • Political and fiscal risks; may require high public sector capacity
4	Community Networks	Cooperative ownership and management of Wi-Fi clusters or micro-towers	Local fundraising, microcredit, small grants; often supported by NGOs or development agencies	• Deep local buy-in and cost control • Can use volunteer labor for O&M; highly affordable for users	• Limited technical capacity and scale • Challenges securing sustainable

S/N	Model	Operational Model	Financing Structure	Strengths	Limitations
5	TowerCo / Infra-as-a-Service	Operators deploy active gear on third-party towers; Opex billing per colocation	Independent tower companies raise debt/equity to build passive sites; operators lease on a per-site basis	• Lowers operator capex; promotes multi-operator colocation • Specialized O&M enhances uptime	backhaul and spectrum • TowerCo needs scale to be financially viable • Lease rates may still be prohibitive for very remote sites
6	Demand-Aggregation & Vouchers	Users purchase discounted broadband; operators commit to serve voucher-holders at set prices	End-user subsidies/vouchers distributed by government or NGOs; operators redeem for guaranteed minimum revenues	• Stimulates take-up and ensures ARPU floor • Targets the most vulnerable households	• Over-head of voucher administration • Risk of resale/fraud; supply-side capex gap remains unaddressed

Table 9: Comparative Analysis of Existing Business Models

Key Insights

1. **Blended Approaches Win**
   No single model fully resolves rural broadband's capex & opex challenges. Leading initiatives layer USF grants, TowerCo leasing, and demand vouchers—unlocking both supply and demand levers.
2. **Institutional Strength Matters**
   USFs and PPPs can inject significant funding, but only where procurement, financial controls, and regulatory oversight are robust.
3. **Demand-Side Stimuli Are Critical**
   Vouchers and community-led networks ensure built capacity translates into actual usage, improving ARPU and long-term operator viability.
4. **Total Cost of Ownership Drives Sustainability**
   Opex, particularly for backhaul and power—often eclipses capex in lifetime cost. Models must account for hybrid energy systems, low-cost backhaul (e.g., microwave sharing), and maintenance regimes.
5. **Local Context Shapes Success** Community networks excel with robust local governance; PPPs work where public bodies can co-invest and ensure contracts; TowerCo models succeed when multi-operator demand is concentrated in certain areas.

Recommendations for Policy & Industry

- **Incentivize Multi-Stakeholder Blends**
  Structure USF tenders to require TowerCo participation and community engagement, ensuring funds cascade through proven business channels.

- **Simplify Administrative Processes**
  Streamline USF disbursements, permit approvals, and PPP contracting to reduce project delays and overhead.

- **Support Demand Stimulators**
  Allocate dedicated voucher budgets for schools, health clinics, and low-income households, paired with operator performance incentives.

- **Undertake Cost-Reduction Pilots**
  Trial renewable-powered micro-sites and wholesale backhaul sharing in high-cost regions to empirically validate total cost savings.

5.2 Recommended Business Models for Rural Broadband in Africa

Building lessons from existing models and regional contexts, we propose six hybrid, scalable business models tailored to Africa's diverse regulatory, geographic, and economic landscapes. Each model combines financing, operational efficiencies, and demand-stimulation to drive sustainable rural connectivity.

S/N	Proposed Business Model	Structure		
		Financing	**Operations**	**Rationale**
1	USF + TowerCo + Voucher Hybrid	• Universal Service Fund grants cover up to 70% of rural tower capex and part of opex for 3–5 years. • Independent TowerCos raise commercial debt/equity to co-finance passive site rollout.	• TowerCo builds and maintains towers; multiple MNOs collocate active RAN equipment. • Operators redeem vouchers against minimum revenue commitments.	• Leverages public funds for hard assets, private capital for scale, and demand subsidies to ensure take-up. • Reduces each party's risk and aligns incentives for long-term network viability.

S/N	Proposed Business Model	Structure		
		Financing	Operations	Rationale
		• End-user vouchers (means-tested) subsidize household CPE and data plans.		
2	Cooperative Community Networks with Anchor Tenants	• Seed grants from NGOs/donors for community broadband co-ops. • • Anchor tenants (schools, clinics, community centers) pay discounted subscription fees.	• Local co-op owns last-mile Wi-Fi clusters or micro-towers. • • Anchor tenants guarantee baseline revenue; MNOs or ISPs provide wholesale backhaul.	• Ensures local buy-in, minimizes opex via volunteer maintenance, and guarantees revenue through anchor tenants.
3	Revenue-Sharing PPP "Rural InfraCo"	• Government/USF equity stake in a dedicated Rural Infrastructure Company. • Private operators contribute equity + debt to the remaining capex.	• Rural InfraCo builds fiber and towers; operating companies lease capacity under long-term concessions. • Revenues shared per usage—InfraCo recovers debt service, operators earn service margin.	• Bundles backbone and last mile under one entity to optimize network design and share risk. • Transparent revenue flows encourage private investment while safeguarding public interests.
4	Mobile Network "As-a-Service" for SMEs	• MNO offers turnkey site deployment for agribusinesses, mining companies, and large farms	• MNO installs micro-base stations dedicated to SME clusters, with spectrum and	• Unlocks commercial demand to underwrite rural network costs, while retaining

S/N	Proposed Business Model	Structure		
		Financing	Operations	Rationale
		under OPEX contracts. • SMEs pay monthly site service fees; USF covers marginal cost for non-commercial anchor uses (e.g., clinics).	power solutions bundled. • Public-private usage quotas ensure community access outside business hours.	social objectives through shared access.
5	Digital Kiosk Franchise Model	• Micro-financing or lease-to-own CPE and solar kits to local entrepreneurs. • Operators provide bulk data plans at wholesale rates.	• Franchisees run solar-powered digital kiosks offering pay-as-you-go Internet, printing, e-services. • Operators share revenue on data sales and enable mobile money commissions.	• Stimulates grassroots demand, creates local economic opportunity, and establishes recurring revenue for operators.
6	"Demand Aggregator" Platform Model	• Digital platform aggregator raises seed funding to pre-sell broadband subscriptions to rural cooperatives and SMEs. • Operators partner to serve aggregated orders with bulk-discounted capex commitments.	• Aggregator handles customer onboarding, billing, and first-mile logistics; operators focus on network delivery. USF and local government may underwrite minimum subscriber thresholds.	• Reduces sales/marketing opex for operators, ensures predictable revenue streams aligned to actual community demand.

Table 10: Recommended Business Models

Implementation Roadmap

1. **Regulatory Enablers:**
   - Institute flexible licensing for shared-infrastructure entities (TowerCo, InfraCo).
   - Mandate USF tenders require multi-stakeholder participation.
   - Authorize voucher schemes and streamlined permit processes for community networks.
2. **Pilot & Scale:**
   - Launch multi-model pilots in diverse terrains (savanna, highlands, coastal).
   - Evaluate total cost curves, uptake rates, and ARPU evolution over 24 months.
   - Refine financing mixes (capex vs. opex support) based on empirical data.
3. **Capacity Building:**
   - Train local entrepreneurs for kiosk franchises and community co-ops.
   - Build TowerCo/InfraCo governance and financial management capabilities.
   - Promote PPP best-practice toolkits and standard concession templates.
4. **Monitoring & Adaptation:**
   - Track key KPIs: cost per connected household, subsidy leverage ratio, network uptime, and user satisfaction.
   - Adjust subsidy levels, revenue-share formulas, and service offerings to optimize sustainability.

By deploying these blended business models—each calibrated to local context and leveraging public-private synergies—African countries can accelerate rural broadband access, stimulate digital inclusion, and build commercially viable networks for the long term.

5.3 Tariff Model Analysis: Current Pricing Strategies

Rural broadband operators across Africa employ a variety of pricing strategies to balance affordability for low-income users with commercial sustainability. Below is a typology of the most common models, illustrative examples, and key considerations.

S/N	Tariff Model	Structure	Pros	Cons	Example
1	Prepaid Bundles and Daily/Weekly Passes	Small, time-limited or data-capped bundles sold via scratch cards or USSD menus (e.g. 100 MB for 24 hours).	Low entry cost aligns with irregular income cycles. Users can top up as needed, avoiding bill shock.	Per-unit cost often higher than larger bundles. It is difficult to predict usage and budget for consumers.	In Kenya, MNOs offer "Daily Data" packs (e.g. 20 MB for KES 10) under the Rural Digital Inclusion Program.

S/N	Tariff Model	Structure	Pros	Cons	Example
2	Tiered Flat-Rate Plans	Fixed monthly fee for unlimited or high-cap (~5–10 GB) data allowance. Often segmented into Bronze/Silver/Gold tiers.	Predictable costs and higher perceived value for heavy users. Simplifies billing and reduces customer churn.	High upfront costs may exclude lower-income households. Risk of network congestion if caps are poorly enforced.	Some Côte d'Ivoire's ISPs offer 5 GB for CFA 5 000 and 10 GB for CFA 8 000, with both urban and rural customers on the same plan.
3	Usage-Based (Pay-As-You-Go)	Per-MB charging, often with a minimum daily spend. No bundle commitments.	Maximum flexibility: users pay strictly for what they consume. Appeals to very light or sporadic users.	Cost per MB can be prohibitive beyond small volumes. Complex to communicate and for users to track	Some Tanzanian micro-ISPs meter data in 1 KB increments at TZS 0.02/KB
4	Lifeline or Subsidized Tariffs	Deeply discounted "social" plans for students, low-income households, or public institutions, funded by USF or donor grants.	Targets digital inclusion mandates; drives uptake in marginal areas. It can be tied to digital literacy or e-services programs.	Requires robust means-testing or voucher distribution to prevent leakage. May distort market if not time-limited or capped.	Ghana's GIFEC-subsidized school connectivity packages offer 100 GB/month at 90% discount.
5	Seasonal or Event-Based Promotions	Temporary discounts around harvest seasons or community events to stimulate demand.	Aligns connectivity investment with peak income periods (e.g. post-harvest).	Difficult to sustain network economics off-peak. Can create "subscription churn" around	Nigeria's MNOs have offered "Harvest Bundles"—50 GB for ₦2 000—during the planting and

S/N	Tariff Model	Structure	Pros	Cons	Example
			Drives trial and word-of-mouth in rural communities.	promotion end-dates.	harvesting windows.
6	Community-Shared Access Models	A single shared connection (e.g. Wi-Fi hotspot at the village square), with usage split by small fees per user or per MB.	Lowers per-household capex and opex. Social pooling drives wider local coverage and digital literacy.	Potential for free-riding or conflict over usage. Requires local governance and maintenance arrangements.	Eswatini's "Tinkhundla Community Wi-Fi" pilots charge E 0.50 per MB at village centers.

Table 11: Tariff Model Analysis

Key Takeaways and Considerations

• **Affordability vs. Sustainability**	Lower-income users need small, low-commitment packs, but these often carry high unit costs. Blended models (e.g. prepaid + subsidized tiers) can mitigate this tension.
• **Demand Stimulation**	Bundling data with digital literacy training, e-agriculture or telehealth services increases perceived value and uptake.
• **Regulator's Role**	Enabling flexible pricing approval, granting "social tariffs," and ensuring transparent interconnection charges can catalyze innovation in rural pricing.
• **Technology Levers**	Leveraging off-peak spectrum, dynamic data throttling, and zero-rating essential services (e-government portals, educational content) can stretch the value of limited data bundles.

By understanding and combining these strategies, stakeholders can craft tariff frameworks that both drive rural broadband penetration and maintain the financial health of network operators.

5.4 Recommended Tariff Models for Rural Broadband

Designing effective tariffs for rural contexts requires tailoring to local affordability, usage patterns, and infrastructure cost structures. Below are four recommended models—each with implementation guidance and expected impact:

S/N	Recommended Tariff Models	Description	Key Features	Implementation Tips	Expected Impact
1	Tiered "Rural Essentials" Bundles	• Offer three clearly differentiated bundles (Small, Medium, Large) at price points aligned with rural incomes and average usage. • Example tiers: ▪ **Small:** 500 MB / month ▪ **Medium:** 2 GB / month ▪ **Large:** 5 GB / month	• **Transparent Unit Pricing:** Display cost per MB so users understand value. • **Renewable Monthly:** Automatically renews unless the subscriber opts out. • **Grace Period:** Allow carryover of unused data up to 20% to build trust and reduce waste.	• Anchor "Medium" tier at local average consumption; price "Small" at ≤ 1 % of average monthly rural income. • Use USSD and SMS reminders when clients approach their cap to prevent bill shock.	• Balances entry-level access with sustainable ARPU. • Simplifies choices, reducing confusion among first-time broadband users.
2	Voucher-Backed "Social Access" Model	• Distribute prepaid data vouchers—free or highly subsidized—to targeted demographics (students, health workers, smallholder farmers). • Redemption via USSD code	• **Means-Tested Allocation:** Use existing social registers (school enrolment, agricultural extension lists) to validate eligibility. • **Time-Bound Validity:** Vouchers expire in 30–	• Partner with Ministries of Education, Health, and Agriculture for distribution. • Digitally track redemptions to monitor uptake and adjust funding.	• Accelerates adoption among critical user groups. • Drives digital literacy and catalyzes demand for paid service.

S/N	Recommended Tariff Models	Description	Key Features	Implementation Tips	Expected Impact
		or mobile money.	60 days to encourage timely usage. • **Top-Up Option:** Users can top up at regular rates once vouchers are exhausted. • **Micro-Payments:** Low-denomination payments eliminate the need for device-level subscriptions. • **Local Agent Management:** Village-based entrepreneurs operate and maintain hotspots, earning a commission. • **Usage Tiers:** Offer free basic access (e-government portals) and paid "premium" portals.		
3	Community Hotspot "Pay-Per-Access" Model	• Deploy shared solar-powered Wi-Fi hotspots in village centers, schools, or clinics. • Charge per session (e.g. E 0.50 for 30 minutes) or per MB via mobile money.		• Leverage Universal Service Funds to capex-subsidize equipment. • Train local operators on basic maintenance and mobile-money collection.	• Spurs communal digital hubs that drive social and economic activities. • Spreads fixed costs across multiple users, boosting financial viability.
4	Time-Of-Use "Off-Peak" Pricing Model	• Offer deep discounts (up to 50 %) for data	• **Automated Rate Application:** Network flags	• Communicate off-peak windows clearly via	• Improves network utilization,

S/N	Recommended Tariff Models	Description	Key Features	Implementation Tips	Expected Impact
		consumed during non-peak hours (e.g. 10 pm–6 am). • Maintain standard rates for peak-hour usage.	off-peak traffic; users see two balance buckets. • **Incentivized Bulk Usage:** Heavy downloads (e.g. software updates, video lectures) scheduled overnight. • **Combined Bundles:** Medium and Large bundles include an additional off-peak data allotment.	SMS and point-of-sale materials. • Track network load shifts to evaluate uplift and adjust pricing differentials.	lowering per-bit cost. • Provides low-cost options for data-intensive use cases (e-learning, e-health).

Table 12.: Recommended Tariff Models for Broadband

Cross-Cutting Enablers

1. Mobile Money Integration
   - Seamless top-up via USSD and e-wallets reduces cash-handling barriers.
2. Digital Literacy Support
   - Bundling basic training or "how-to" content with first-time activations enhances uptake.
3. Transparent Communication
   - Clear labelling of speeds, caps, and overage charges builds trust and reduces disputes.
4. Periodic Review and Iteration
   - Use usage analytics to refine bundle sizes, price points, and promotional triggers.

By combining these models—and adapting them to local economic and cultural contexts—stakeholders can substantially boost rural broadband penetration, while maintaining the financial health of network operators.

6. Financial and Policy Recommendations

6.1 Financial Modelling for Rural Broadband

A robust financial model is critical to assess viability, guide investment decisions, and structure financing for rural broadband projects. Below are the key components and considerations for building and using such models:

<table>
<tr><th colspan="3">Financial Modelling</th></tr>
<tr><td>1</td><td>Model Objectives</td><td>• Investment Appraisal: Determine project Internal Rate of Return (IRR), Net Present Value (NPV), payback period, and debt service coverage. *
• Financing Structure: Optimize mix of equity, debt, grants, and subsidies.
• Affordability Analysis: Align tariffs to both cover costs and meet local ability to pay.
• Scenario Planning: Evaluate impacts of cost overruns, uptake rates, and subsidy changes.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Key Inputs & Assumptions</td><td><table>
<tr><th>Category</th><th>Typical Inputs</th></tr>
<tr><td>CapEx</td><td>• Site build (tower, shelter, power) costs
• Fiber/backhaul installation.
• Radio equipment
• Civil works & permits</td></tr>
<tr><td>OpEx</td><td>• Power (diesel, solar O&M)
• Site rental & lease
• Maintenance (spares, tower climb)
• Network operations (staff, monitoring)
• Backhaul capacity fees</td></tr>
<tr><td>Take-up & Usage</td><td>• Subscriber penetration (% population)
• ARPU (average revenue per user/month)
• Data usage per user (MB/month)</td></tr>
<tr><td>Tariffs & Revenues</td><td>• Retail tariffs (prepaid bundles, flat rates)
• Wholesale/leasing revenues (e.g. tower co-location)
• Non-data services (voice, SMS)</td></tr>
<tr><td>Financing Terms</td><td>• Equity cost (% required return)
• Debt rate and tenure
• Grant/subsidy amounts and disbursement schedule
• Tax rates and holiday periods</td></tr>
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<table>
<tr><th colspan="3">Financial Modelling</th></tr>
<tr><td>3</td><td>Cost Structure Analysis</td><td>a. Initial CapEx Breakdown
Radio access network (RAN) equipment: ~30–40%
Backhaul/fiber: ~20–30%
Civil works & site construction: ~20%
Power infrastructure (solar/diesel backup): ~10–15%
b. Recurring OpEx
Energy (fuel vs. solar O&M)
Site lease or tower-co fees
Maintenance & support
Network operations centre</td></tr>
<tr><td>4</td><td>Revenue Projections</td><td>Subscriber Growth Curve: model adoption ramp-up—e.g., 5% of addressable market in Year 1, rising to 30–50% by Year 5.
ARPU Evolution: anticipate gradual ARPU increases as usage grows; factor in promotional discounts early on.
Non-Data Revenue Streams: consider value-added services (e-finance, e-health) or wholesale leasing of infrastructure.</td></tr>
<tr><td>5</td><td>Financing Options & Structure</td><td>Equity: Sponsor contributions targeting a return of 12–20% IRR.
Debt: Local commercial loans or development-finance term debt at 7–10% over 7–10 years; ring-fence project cashflows.
Grants/Subsidies: Universal Service Funds (capex subsidies), donor grants to bridge viability gap.
Blended Finance: Combine layered tranches (senior debt, mezzanine, equity) to optimize WACC and risk sharing.</td></tr>
<tr><td>6</td><td>Sensitivity & Scenario Analysis</td><td>Key Variables: penetration rate, ARPU, power costs, CapEx overruns.
Stress Testing:
Worst-case: 50% lower uptake, 20% cost overrun → assess viability.
Best-case: 20% higher ARPU, accelerated uptake → gauge upside.
Break-Even Analysis: identify minimum subscription level or ARPU to cover OpEx and debt service.</td></tr>
<tr><td>7</td><td>Risk Assessment & Mitigation</td><td><table><tr><th>Risk</th><th>Mitigation</th></tr><tr><td>Low demand/uptake:</td><td>Pilot demand stimulation (community ICT centers); tiered tariffs</td></tr><tr><td>Cost overruns:</td><td>Fixed-price EPC contracts; contingency buffers (10–15%)</td></tr><tr><td>Power reliability:</td><td>Hybrid solar-diesel, battery storage, O&M contracts</td></tr></table></td></tr>
</table>

Financial Modelling			
8	Best Practices	**Regulatory change:**	Engage regulator early; lock-in incentives via MOUs
		Currency/devaluation:	Hard-currency financing; hedging where available
		• **Bottom-Up Build:** Cost and revenue lines detailed at site and service level. • **Local Data Calibration:** Use actual local power, labor, and site-lease rates. • **Dynamic Updating:** Refresh model annually or when major inputs change. • **Stakeholder Alignment:** Share model insights with investors, regulators, and grant providers to secure buy-in.	

Table 13: Financial Modelling

A well-structured financial model quantifies the economic trade-offs of rural broadband deployment, informs subsidy needs, and underpins sustainable business plans. Rigorous sensitivity analysis and conservative assumptions are key to de-risking investments and achieving universal connectivity goals.

Note: The following are formulas for calculating Internal Rate of Return (IRR) and Net Present Value (NPV).

Internal Rate of Return (IRR) and Net Present Value (NPV) are defined and calculated as follows:

IRR is the discount rate at which the NPV of all cash flows (positive and negative) from a project **equals zero**. In other words, it is the breakeven cost of capital for the investment.

Mathematical Condition:

$$0 = \sum_{t=0}^{T} \frac{C_t}{(1 + IRR)^t}$$

where,

- C_t = cash flow at time t (with C_0 often the initial investment, a negative outflow)
- r = discount rate
- T = total number of periods

Interpretation:

- If IRR > required rate of return (hurdle rate), the project is acceptable.
- If IRR < required rate of return, the project should be rejected.

Usage: IRR provides a single percentage metric that investors can compare directly to their minimum acceptable return. However, it can be misleading for projects with non-conventional cash flows or mutually exclusive options, so it is often used alongside NPV.

NPV is the sum of the present-day values of all future cash flows (both positive and negative) associated with a project or investment, discounted back to today using a specified discount rate (often the project's cost of capital).

Formula:

$$NPV = \sum_{t=0}^{T} \frac{C_t}{(1+r)^t}$$

Interpretation:

- NPV > 0: The project is expected to generate value above its cost of capital and is financially worthwhile.
- NPV < 0: The project is expected to destroy value and should be rejected.
- NPV = 0: The project breaks even (returns exactly the cost of capital).

6.2 Policy Recommendations for Regulators

To accelerate rural broadband deployment and ensure sustainable and affordable connectivity, regulators should consider the following policy measures:

S/N	Recommended Policy	Measures
1	Incentivize Infrastructure Sharing	• **Mandate passive and active sharing** Require tower-owners and mobile operators to open existing passive (towers, ducts, poles) and active (RAN, backhaul) infrastructure to competitors under cost-oriented rates. • **Standardize commercial terms** Publish clear guidelines on pricing, SLAs, and dispute resolution to reduce negotiation delays and encourage new entrants. • **Fast-track shared-infrastructure roll-outs** Prioritize license approvals for neutral-host or tower-company models that can serve multiple operators.
2	Allocate and Price Spectrum for Rural Needs	• **Reserve sub-1 GHz bands** Dedicate blocks of 700/800 MHz spectrum for rural use—either via set-aside auctions or administrative assignment—to maximize coverage. • **Offer rural discounts** Apply tiered or geographic spectrum fees (e.g. 20–50% discounts) for licenses covering low-density areas.

S/N	Recommended Policy	Measures
		• **Permit flexible usage** Authorize dynamic spectrum sharing (e.g. TVWS, LSA) under managed-access frameworks to allow opportunistic use in rural regions.
3	Streamline Permitting and Wayleave Processes	• **One-Stop Shop** Establish a single window for all site permits (environmental, land access, tower construction) with statutory processing timelines. • **Harmonize local fees** Work with municipal and county governments to cap right-of-way, wayleave and permit fees for telecom infrastructure. • **Digitize approvals** Enable online applications and real-time tracking to reduce administrative bottlenecks.
4	Strengthen Universal Service Mechanisms	• **Refocus USF priorities** Tie Universal Service Fund disbursements to clear rural coverage or service quality milestones, with competitive bidding for subsidies. • **Expand eligible uses** Allow USF funds to support not only tower build-out but also community access centers, digital literacy training, and renewable power installations at sites. • **Increase transparency** Publish USF allocations, project statuses, and impact metrics to ensure accountability.
5	Encourage Public–Private Partnerships (PPPs)	• **Model PPP frameworks** Develop standard concession or build-operate-transfer agreements for national broadband backbones, last-mile networks, and community Wi-Fi. • **Risk-sharing mechanisms** Offer viability gap funding or output-based subsidies for projects whose financial returns alone would not attract private investment. • **Leverage co-funding** Facilitate co-investment by development partners and impact investors alongside commercial operators.

S/N	Recommended Policy	Measures
6	Promote Affordable End-User Pricing	• **Regulate non-discriminatorily** Maintain operators' tariff flexibility, but set clear affordability targets (e.g., <2% of monthly income) and require reporting on rural average revenues per user (ARPU). • **Support means-tested vouchers** Introduce targeted voucher schemes or digital literacy coupons for low-income rural households to reduce the barrier to adoption. • **Enable community networks** Simplify licensing for small, locally managed "community ISP" models and allow them access to wholesale capacity on fair terms.
7	Foster Digital Skills and Local Content	• **Mandate digital literacy programs** Include digital skills training as a condition in USF or PPP contracts, ensuring communities can effectively use broadband services. • **Encourage local apps and services** Offer grants or hackathon prizes for rural-focused content (e-agriculture, telemedicine, education) that drive meaningful uptake. • **Partner with NGOs and academia** Align with educational institutions to embed ICT curricula and support "train-the-trainer" models in rural districts.
8	Continuous Learning & Adaptation	• **Technology Watch:** Monitor emerging solutions—TV White Spaces, low-earth orbit satellite, Direct- to -Device (D2D), Open RAN—that may further drive down costs or enhance coverage.

Table 14: Policy Recommendation for Regulators

By adopting these recommendations, regulators can create a predictable, cost-effective environment that attracts investment, lowers barriers to entry, and brings affordable broadband to rural communities across Africa.

Implementation Checklist for Regulators

1. **Review and amend sector regulations** to incorporate sharing, spectrum discounts, and digital permitting.
2. **Publish updated USF guidelines** with explicit rural coverage targets and transparent funding criteria.
3. **Launch pilot PPPs** in two or more underserved regions, documenting lessons for broader rollout.
4. **Establish inter-agency working groups** (ICT, environment, finance, sub-national governments) to streamline approvals and harmonize fees.
5. **Monitor and report** progress quarterly on rural coverage, service quality, and affordability metrics, adjusting policies as needed.

6.3 Investment Strategies for Governments and Private Sector.

To sustainably expand rural broadband, coordinated investment strategies are needed that leverage both public resources and private capital. Below are key approaches and best practices for governments and private-sector actors.

S/N	Recommended Investment Strategy	Suggested Actions
1	Public–Private Partnership (PPP) Frameworks	**Co-Financing Models** • **Capital Grants & Matching Funds**: Governments allocate Universal Service Funds or multilateral grants to match operator investments 1:1 or 2:1 in rural network rollout, reducing the upfront CAPEX burden on operators. • **Performance-Based Subsidies**: Disbursements tied to coverage milestones (e.g., per-tower activation or per-household connected) ensure accountability and cost-effectiveness. **Risk-Sharing Mechanisms** • **Revenue Guarantees**: Governments guarantee a minimum revenue floor or traffic volume for early-stage rural deployments to de-risk investments for operators. • **Viability Gap Funding (VGF)**: Time-limited subsidies bridge the gap between commercial returns and network OPEX/CAPEX in low-ARPU areas.
2	Blended Finance and Multilateral Support	**Blended Finance Vehicles** • Combine concessional loans (from development banks) with private equity to lower the overall cost of capital for rural broadband projects. • Example: A 20% grant from a development fund plus an 80% commercial loan at below-market interest rates. **Use of Guarantees & Credit Enhancements**

S/N	Recommended Investment Strategy	Suggested Actions
		• **First-Loss Guarantees**: Donor agencies or sovereign entities cover initial losses, enhancing bankability for private lenders. • **Political Risk Insurance**: Mitigates expropriation, currency inconvertibility, and regulatory risk—critical for attracting foreign direct investment. **Government Bonds** • A Government issued "Broadband Bond" raised from institutional and private investors to co-finance infrastructure in remote districts, with yields of single/double digit percentages over 10 years for example. **Accelerated Depreciation** • Tax codes that allow operators to write off network assets over 1–2 years rather than the standard 5–10 years improve short-term cash flow. **Duty-Free Imports** • Exemptions on import duties and VAT for network equipment (towers, antennas, routers) can reduce CAPEX by 5–15%.
3	Tax and Regulatory Incentives	**Spectrum Fee Discounts** • Tiered or reduced spectrum license fees for rural bands (e.g., 50% discount for blocks covering underserved regions), incentivizing private investment. **Tax Credit Scheme** • Operators payable tax due to Government be used to fund rural infrastructure projects by them instead of paying the tax to Government.
4	Community and Cooperative Financing Models	**Local Ownership Structures** • **Co-operative ISP Models:** Rural communities invest equity alongside operators under shared-ownership agreements, ensuring both local buy-in and supplemental capital. • **Micro-Equity Schemes:** Micro-investments (USD 10–100) by residents collectively raise funds for community Wi-Fi or fiber backhaul, often coupled with micro-loans. **Crowdfunding & Impact Investment** Platforms that pool small contributions from diaspora or social-impact investors with clear ROI timelines (e.g., 5–7 years) to fund last-mile connectivity.

S/N	Recommended Investment Strategy	Suggested Actions
5	Phased and Modular Deployment Approaches	**"Build-Own-Operate-Transfer" (BOOT)** • Private operators build and operate rural nodes for a fixed concession period (e.g., 7–10 years) after which infrastructure transfers to a public entity or community trust. **Technology-Neutral Phases** • **Phase 1**: Low-cost, rapid-deployment solutions (e.g., 3G LTE relays, TVWS) to achieve basic coverage. • **Phase 2**: Gradual upgrade to high-capacity technologies (e.g., 4G/5G, fiber to the tower) as ARPU and demand grow.
6	Performance Monitoring and Adaptive Financing	**Digital Dashboards and KPIs** • Transparency portals tracking coverage, uptake rates, and subsidy utilization allow investors and regulators to adjust financing tranches in real time. **Outcome-Oriented Budgeting** Governments ring-fence funds for rural broadband in annual budgets, releasing tranches based on independent verification of connectivity outcomes.

Table 15: Investment Strategies

By adopting these investment strategies, both governments and private-sector partners can accelerate rural broadband rollout, improve financial viability, and ensure sustainable connectivity for underserved communities.

Key Takeaways

1. **Align incentives** through regulated PPPs and blended finance to leverage taxpayer and shareholder funds.
2. **De-risk investments** with guarantees, revenue floors, and phase-based rollouts to attract commercial capital.
3. **Empower communities** via equity stakes and cooperative models to share both costs and benefits.
4. **Incentivize efficiency** with tax breaks, spectrum discounts, and performance-based subsidies tied to measurable outcomes.

6.4 Criteria and Common Standards for Rural Areas and Villages to Address their Needs.

Grouping villages and rural clusters by a few measurable factors is essential to effectively guide interventions and investments in rural Africa's diverse contexts. Below is a proposed framework of criteria, standard definitions, and categorization tiers, plus guidance on how to use them to match needs to solutions.

Core Dimensions & Metrics

Dimension	Metric	Why it matters
Population size	Total resident population (e.g. < 500; 500–2 000; > 2 000)	Dictates scale of demand, revenue potential
Population density	People per km²	Impacts choice of technology (wireless vs. fiber)
Geographic area	Village footprint in km²	Larger area → more base-stations/backhaul nodes
Terrain & relief	% of area that is mountainous/hilly vs flat	Affects construction cost, power solutions
Road access	% of roads paved / year-round accessibility	Logistics and O&M planning
Economic activity	Dominant livelihood (agriculture, mining, tourism, etc.)	Shapes affordability, business model
Grid power availability	% of households with reliable grid power	Determines energy solution (solar, minigrid)
Mobile coverage today	Existing 2G/3G/4G footprint	Baseline for incremental upgrades
Digital literacy	% of adults have used mobile/internet in last year	Guides training & demand stimulation
Community anchor demand	Presence of school/ clinic/ government office (yes/no)	Early "anchor" traffic & social impact

Table 16: Core Dimensions & Metrics

Categorization Tiers

Archetype	Key Attributes	Typical Needs / Solutions
Clustered-High-Density ("large villages")	Pop. > 2000, density > 100 people/km², good road access	• 4G/5G or fiber-to-village • Shared towers, grid power
Dispersed-Medium-Density ("small towns & hamlets")	Pop. 500–2000, mixed terrain, partial grid	• LTE relays or low-cost fiber rings • Solar hybrid
Remote-Low-Density ("scattered settlements")	Pop. < 500, rugged terrain, no grid, low literacy	• TVWS or satellite backhaul + local Wi-Fi • Village Mini grid

Table 17: Categorization Tiers

Three broad **"Rural Archetypes"** were defined using the above metrics.

Applying the Framework

	Framework Application Steps
Data Collection	• Leverage national census, GIS land-cover and telecom coverage maps. • Conduct rapid village surveys for "anchor" sites and grid status.
Scoring & Mapping	• Assign each village a score in each dimension, then cluster by archetype using a simple weighted sum or k-means. • Produce a typology map to visualize where each solution fits best.
Intervention Design	• **Technology choice**: e.g. fiber backhaul for Clustered-High-Density; LTE relay plus village Wi-Fi for Dispersed; satellite/TVWS for Remote. • **Business model**: private operator in high-density, PPP in medium, community-based co-ops in low. • **Energy**: grid-tie for Clusters, solar-diesel hybrids for Dispersed, mini-grids for Remote. • **Demand stimulation**: digital literacy campaigns are most intensive in low-literacy, low-uptake areas.
Monitoring & Adaptation	• Track key KPIs (uptake, ARPU, uptime) per archetype. • Adjust subsidies or financing instruments (e.g. higher USF support for "Remote") as real-world data come in.

Through the implementation of these standardized approaches and a straightforward three-archetype framework, planners, regulators, and operators can transition from generic roll-out strategies to customized, cost-effective solutions that effectively address the specific requirements of Africa's varied rural populations.

Benefits of this Approach

- **Efficiency**: Targets scarce resources (subsidies, training, maintenance) exactly where they're needed.
- **Scalability**: A small set of archetypes can cover thousands of villages with a repeatable playbook.
- **Accountability**: Clear metrics let regulators and funders tie disbursements to real coverage and usage results.
- **Local buy-in**: By matching livelihood patterns and power realities, interventions better align with the community's ability to pay and maintain.

7.0 Conclusion and Next Steps

Conclusion

Rural broadband expansion in Africa is both a critical enabler of socioeconomic development and a complex undertaking requiring coordinated policy, investment, and technical innovations. Our study has demonstrated that:

Diverse Contexts Demand Tailored Solutions	Villages and hamlets vary widely in population density, terrain, economic activity, and infrastructure availability. A one-size-fits-all approach risks wasted resources or underserved communities.
Regulatory Frameworks Are Pivotal	Spectrum allocation, licensing obligations, and Universal Service Fund (USF) design strongly influence operators' willingness and ability to invest. When regulators align incentives with rural realities, through discounted spectrum fees, mandated infrastructure sharing, or tax breaks, deployments accelerate.
Business Models Must Adapt	Community co-ops, public-private partnerships, anchor-tenant financing, and mixed equity + debt structures each have a role, depending on local demand and operator capabilities. Blended finance and bulk-discounted capex commitments can bridge viability gaps.
Cost Structures & Financing Drive Sustainability	Capex and opex sensitivities vary by geography (e.g. off-grid solar vs. grid-powered sites) and must be addressed through innovative power solutions, shared infrastructure platforms, and realistic tariff models.
Digital Inclusion Is More Than Connectivity	Affordability programs, digital literacy initiatives, and locally relevant content are essential to ensure that new networks translate into genuine uptake and impact.

Next Steps

To translate these insights into action, we recommend the following phased roadmap:

Pilot Implementation & Validation	• **Select Diverse Testbeds:** Deploy representative pilot projects in a mix of micro-hamlets, small villages, and larger towns across countries. • **Apply Classification Framework:** Use our categorization criteria (population, terrain, economic profile) to tailor technology, power, and financing models per community. • **Monitor & Refine:** Collect data on capital/operating costs, subscriber uptake, and service performance; iterate on business and tariff models.

Policy & Regulatory Alignment	• **Engage Regulators & USF Managers:** Work with national authorities to codify the rural typology into licensing obligations, spectrum discount zones, and USF subsidy tiers. • **Standardize Reporting:** Develop common metrics and dashboards for rural coverage, service quality, and affordability to inform policy adjustments.
Scaling & Investment Mobilization	• **Aggregate Demand & Leverage Bulk Procurement:** Coordinate across operators and government projects to negotiate bulk-discounted capex (e.g., solar systems, tower builds) and shared backhaul. • **Design Blended Finance Vehicles:** Structure equity + debt funds, de-risked by concessional tranches, to attract institutional investors alongside government and donor capital. • **Expand PPP Models:** Formalize public-private partnerships for anchor-tenant government sites (schools, clinics) to catalyze wider network rollouts.
Digital Inclusion & Ecosystem Development	• **Launch Literacy & Content Programs:** Integrate community training, e-agriculture platforms, telehealth pilots, and women-focused digital skills workshops in tandem with network deployments. • **Foster Local Entrepreneurship:** Support local ISPs, tech hubs, and maintenance enterprises to build a sustainable rural digital ecosystem.
Continuous Learning & Adaptation	• **Annual Rural Broadband Review:** Establish a multistakeholder forum to share lessons learned, update the rural classification framework, and adjust policies based on real-world outcomes. • **Technology Watch:** Monitor emerging solutions—TV White Spaces, low-earth orbit satellite, Direct- to -Device (D2D), Open RAN—that may further drive down costs or enhance coverage.

By following this roadmap, grounded in robust data, adaptive policy and dynamic partnerships, Africa's rural communities can achieve universal, affordable and high-quality broadband access; unlocking education, healthcare, commerce, and social inclusion for all.

7.1 Summary of Key Findings

Broadband Status: Coverage vs. Use.

Across study countries, headline 3G/4G population coverage is high, yet a meaningful rural usage and quality gap persists. Rural links often rely on microwave backhaul, GSOs and diesel/solar hybrids, producing lower average speeds and higher downtime than urban sites. Fiber backbones are expanding, but last-mile fiber in rural settlements remains sparse; satellite (mostly NGSO pilots) is emerging for truly hard-to-reach areas. Universal Service Funds (USFs) exist in most markets, but disbursement cadence and project selection vary, affecting pace and consistency of rural build-out.

Overview of Core Challenges and Opportunities

Challenges	Opportunities
High unit costs in low-density areas: towers, power, and backhaul dominate CAPEX/OPEX.	**Active & passive sharing** (MORAN/MOCN, tower/fiber sharing) to compress cost per site and accelerate rollout.
Permitting/wayleaves and fragmented local fees slow time-to-build.	**USF/PPP programs** are tuned to results-based, multi-year OPEX support (not just CAPEX) in the toughest clusters.
Power constraints (weak/absent grid, diesel logistics) depress up tim**e** and raise OPEX.	**Hybrid access stacks:** NGSO backhaul, TVWS pilots in flat terrain, and lean LTE/FWA for last mile.
Device affordability & literacy limit adoption even where coverage exists.	**Energy innovations:** solar-hybrid power-as-a-service and mini-grids to stabilize uptime and cut fuel costs.
Spectrum & regulatory frictions: inconsistent fee structures and slow approvals; uneven enforcement of infrastructure sharing.	**Anchor demand** from schools, clinics, and local government to de-risk traffic ramp-up.
Revenue risk: low ARPU, seasonality of incomes, and theft/vandalism.	**Local ecosystems** (e-agriculture, e-health, digital payments) that convert coverage into sustained usage.

Table 18: Overview of Core Challenges and Opportunities

Overview of Proposed Business and Tariff Models

Business Models	Tariff Models
Neutral-Host Rural InfraCo: Third party finances/operates towers, power, and often RAN (MORAN/MOCN), selling wholesale access to all MNOs.	**Sachet prepaid data** (daily/weekly micro-bundles) with **social/affordability tiers** for low-income users.
Open-Access Fiber + Rural Clusters: State/PPP backbone with fair, published	**Anchor-linked bundles** (school/clinic + surrounding community), and

Business Models	Tariff Models
wholesale terms; clustered rural RF access layered on top. **Hybrid Satellite/FWA:** NGSO backhaul into lean LTE/FWA sites, shifting to fiber/microwave when demand justifies. **Network-as-a-Service (NaaS):** Turnkey build-operate model for remote clusters with availability SLAs; MNOs provide SIMs/branding. **Community-anchored Models:** Revenue-sharing kiosks/Wi-Fi hubs with local entrepreneurs; anchor institutions guarantee minimum take-or-pay. **Blended-Finance PPPs:** USF grants + concessional debt + private equity, with performance-based disbursements and claw-backs.	**family/household plans** to raise effective ARPU. **Zero- or low-rated essential services** (gov portals, health/education) with guardrails to protect competition and net-neutrality principles. **Off-peak pricing & booster packs** to smooth load and improve perceived value. **Device-plus-data micro-installments** to tackle handset affordability and drive adoption. **Wholesale-based tariffs** (for neutral-host/open-access) with transparent price caps and QoS-linked rebates.

Table 19: Overview of Business and Tariff Models

Bottom line:
Closing Africa's rural broadband gap is achievable with a pragmatic mix of **shared infrastructure**, **blended finance**, **energy innovation**, and **user-centric pricing**—all underpinned by streamlined permitting and predictable spectrum/licensing regimes. The combination of neutral-host deployment, anchor-tenant demand, and targeted social tariffs offers the clearest path to sustainable coverage, quality, and adoption.

7.2 Implementation Roadmap

Short-Term (0–2 years) Actions: Regulatory Reforms & Pilots

Governance & Planning	• Stand up a national Rural Connectivity PMO (Regulator + USF + line ministries + MNOs + tower/fiber/energy partners) with a 24-month mandate, weekly sprints, and a public dashboard. • Publish a geospatial "single source of truth": current coverage/quality, backhaul/power layers, anchor institutions, and priority rural clusters.
Regulatory quick wins	• One-stop permitting with statutory SLAs (e.g., 30 days) and harmonized wayleave/municipal fees. • Enforce **passive sharing** immediately; green-light **active sharing** (MORAN/MOCN) under standardized reference offers.

	• Spectrum roadmap with rural incentives (fee discounts in low-density zones; clarity on 700/800/900/1800/2100/2600/3500 MHz availability). • Retool the **USF** for results-based disbursement (CAPEX milestone + 24-month OPEX support tied to uptime/throughput/users).
Pilot Projects (6–12 months, then evaluate)	• **Neutral-host clusters** (20–50 sites): shared tower + power-as-a-service + MORAN/MOCN RAN. • **Backhaul hybrids:** NGSO satellite + microwave to reach "last 10%" villages; migrate to fiber when demand justifies. • **Anchor-led demand:** connect schools/clinics/admin posts with take-or-pay contracts; add community Wi-Fi. • **Energy pilots:** solar-hybrid mini-grids and containerized power for off-grid sites; diesel-to-solar swap-outs. • **Tariff/device pilots:** sachet data, social/means-tested bundles for the bottom quintile, and device-plus-data micro-instalments. • **Security & resilience:** anti-theft enclosures, community watch MoUs, and rapid-repair playbooks.
Financing preparation	• Design a **blended-finance window** (USF grants + concessional debt + guarantees) and a template PPP contract for neutral-host builds. • Aggregate demand for pooled procurement of towers, solar kits, batteries, and entry-level smartphones.

Table 20: Short-Term Implementation Roadmap

KPIs to hit by Month 24

Permit approval time ≤30 days; ≥ 200 pilot sites live; rural site uptime ≥95%; cost/GB down ≥15% in pilot clusters; ≥200k new rural broadband users.

Medium-Term (2–5 years) Actions: Scale what Works

Scale-up & Standardization	• Expand neutral-host clusters to hundreds of sites/year; extend open-access fiber spurs to priority districts; institutionalize MORAN/MOCN nationwide. • Convert pilots into standard offers: reference interconnect/infrastructure-sharing terms, wholesale price caps with QoS-linked rebates.
USF & PPPs at scale	• Shift USF from one-off CAPEX to **multi-year OPEX co-funding** for the hardest clusters; adopt rolling, competitive RBF tenders. • Close 10–15 regional PPPs for open-access backhaul and rural power-as-a-service.
Demand & Affordability	• National device affordability scheme (duty/VAT relief on sub-$40 handsets or voucher equivalents) + digital skills programs via schools/TVETs.

Operational depth	• Structured anchor programs (schools/clinics/admin offices) with guaranteed minimums and community hotspot extensions. • Regional field depots, shared spares pools, and joint maintenance routes. • Cybersecurity and disaster-recovery baselines for neutral-host and anchor sites.

Table 21: Medium-Term Implementation Roadmap

KPIs to hit by Year 5

Rural population coverage +12–15 pts; median rural downlink ≥10–15 Mbps; ≥70% of new rural sites on renewable power; cost/site ↓25–30%; ≥1.5–2.0m incremental rural users.

Long-Term (5+ years): Actions Sustainable investment strategies

Capital deepening & market maturation	• Taper subsidies via glide-paths tied to cash-flow breakeven; renew support only on performance. • Mobilize patient capital: infrastructure/green bonds, pension-fund allocations, and securitization of anchor receivables; scale guarantee programs to de-risk FX and policy risk.
Network evolution	• Reform spectrum via managed **2G/3G sunset**; expand 4G/5G FWA where density supports it; keep satellite/FWA hybrids for the last 5–10% of premises. • Continuous energy upgrades (battery chemistries, smart controllers) targeting ≥99% uptime for anchor sites.
Policy maintenance	• Five-year reviews of spectrum/USF frameworks; permanent one-stop permitting; predictable fee regimes; periodic affordability checks.

Table 22: Long-Term Implementation Roadmap

End-state KPIs (Year 8–10)

≥95% rural population coverage; ≥20–25 Mbps typical downlink; opex/site ↓35–40% vs. baseline; digital gender gap narrowed by ≥50%; sustained private investment without extraordinary subsidies in all but the most remote archetypes.

Ownership & Cadence

- PMO owns delivery; quarterly public scorecards; independent audits each year.
- "Scale or stop" discipline: expand only the pilots that meet unit-economics and QoS gates; sunset the rest.

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ANNEXES

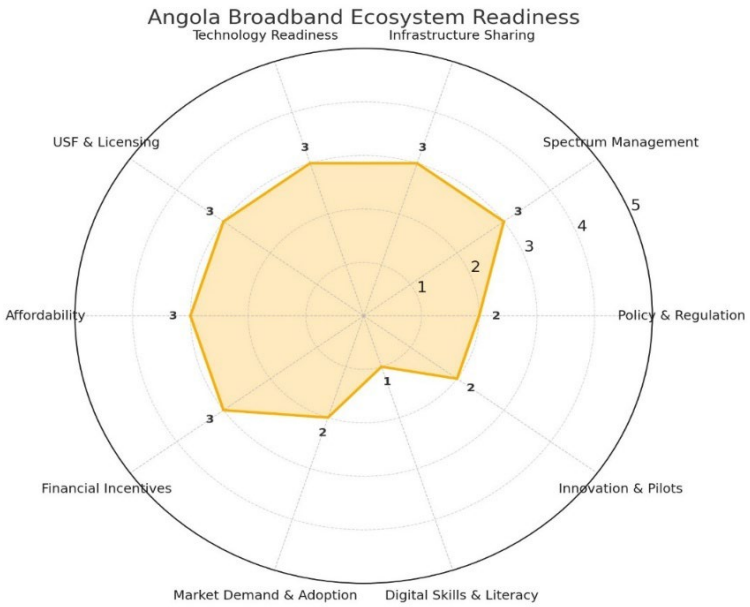
Annex 1: Country Broadband Ecosystem Readiness Frameworks.

Sub-Regions	Countries
SADC	Angola, Eswatini, South Africa and Zimbabwe
AMU	Egypt
EACO	Kenya, Rwanda and Tanzania
ECCAS	Cameroun, Central Africa Republic, DRC and Gabon
ECOWAS	Cote D' Ivoire, Ghana, and Nigeria

1. Angola's Broadband-Ecosystem Readiness Framework

Key Indicators	
Population broadband coverage	85.6 %
Rural broadband penetration	36.0 %
Unserved population	64.99 %
Rural satellite coverage	100 % (Angosat 2, GSO / NGSO)
Average broadband speed	Not specified
Fiber penetration	Not provided

Radar chart visualization of Angola's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Angola's broadband ecosystem readiness** across ten key dimensions.

Table 23: Angola's Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	2	No explicit rural strategy or targets; funding & tax-exemption processes are cumbersome; limited regulator levers; low private investment.
Spectrum Management	3	Rural spectrum fee discounts exist, but dynamic sharing/TVWS not implemented; mixed assignment processes create uncertainty.
Infrastructure Sharing	3	Passive-sharing mandated; operators share at varying levels, but active-sharing incentives are lacking.
Technology Readiness	3	Angosat 2 provides satellite backhaul, yet terrestrial deployments remain largely legacy 2G/3G; limited fixed-broadband initiatives.
USF & Licensing	3	USF funding is available, but no dedicated rural obligations; license incentives tied to overall coverage rather than rural performance.
Affordability	3	Regulator-approved rural pricing; operators offer low-cost bundles but there is no formal end-user subsidy program.

Dimension	Score	Rationale
Financial Incentives	3	Spectrum-fee and tax incentives exist on a case-by-case basis; limited systematic capex/opex support mechanisms.
Market Demand & Adoption	2	High overall coverage masks low rural uptake (36 % penetration); operators report rural customer shares of < 5 %–20 %.
Digital Skills & Literacy	1	No initiatives or targets for digital literacy or gender inclusion in rural areas.
Innovation & Pilots	2	No dynamic sharing/TVWS; few structured innovation pilots; some solar & satellite backhaul experiments, but no formal innovation framework.

Overall Readiness: 2.8 / 5

Angola has usable IMT low-band spectrum (700/800 MHz), rural fee waivers and USF grants supporting buildout; to accelerate rural broadband it should mandate broader sharing/open-access, streamline tax/permit and energy constraints, expand backhaul and reliable site power, and add affordability/device programs.

Regulator's Perspective

- **Policy & Regulation:** No standalone rural-broadband strategy or targets cited.
- **Barriers:** Funding gaps; tax-exemption approvals held by Parliament outside regulator's remit.
- **Spectrum Management:** 20–50 % discounted spectrum fees for rural bands; dynamic sharing/TVWS not yet implemented.
- **Infrastructure Sharing & Projects:** Passive-sharing mandated; Angosat 2 satellite project under National Space Program.
- **USF & Licensing:** USF provides universal-service grants; no strict rural-coverage license conditions, but overall coverage targets yield benefits.
- **Tariffs & Affordability:** Rural pricing subject to regulatory approval; no end-user subsidy schemes.
- **Financial Incentives:** Spectrum-fee reductions; case-by-case incentives.
- **Challenges:** High deployment costs; limited private investment.
- **Recommendations:** Introduce targeted tax breaks; strengthen PPP/incentive frameworks.

Table 24: Angola - Operators' Perspective

Dimension	Operator 1	Operator 2	Operator 3
Profile & Services	Voice, data & SMS over 3G (UMTS 900 MHz)	2G/3G/4G mobile broadband	GSM/WCDMA/LTE voice & data
Rural Base	< 5 % of customers; covers 20 provinces (none in Cubango)	~20 % of customers; covers 4 provinces (40 communities)	~20 % of customers; covers all provinces & 55 % of communes
Infrastructure	90 % owned towers; 10 % shared	36 % leased, 74 % owned towers	97 % company-owned towers
Pricing & Business Models	No rural-specific plans; same tariffs nationwide; low-cost bundles available.	Affordable prepaid bundles; cross-subsidization from urban profits.	Uniform tariffs; no rural-specific packages or financing models.
Challenges	Site acquisition; electricity access; backhaul capacity; high capex/opex.	High construction costs; land-acquisition delays; unstable power; low ARPU.	High O&M costs; poor roads; low device affordability; regulatory rigidity
Plans & Needs	+30 new rural sites; needs more site-space approvals & satellite capacity; exploring Starlink partnership.	Expand rural coverage from 23 % to 80 % by 2028; requests tax breaks & infrastructure-sharing incentives; piloting solar & satellite backhaul.	Massify 4G to new municipalities by 2028; seeks capex/opex subsidies, tax reliefs & better infrastructure sharing; exploring satellite backhaul & Open RAN.

Summary of Challenges & Opportunities

- **Challenges**
  - No clear rural-specific policy or targets.
  - Slow tax-exemption and USF disbursement processes.
  - Dynamic spectrum sharing/TVWS unimplemented.
  - High infrastructure costs, low rural ARPU, licensing delays.
  - Low rural uptake (< 36 % penetration).

- **Opportunities**
  - Convert fee waivers into **performance-linked** incentives (fee credits) tied to verified rural sites.
  - Move from passive-only to **guided active sharing** and **neutral-host** in low-demand clusters.
  - Make publicly funded fiber **open-access** with published reference prices.
  - Launch **USF OBA** windows (rural towers + institution links) and allow **LEO to backhaul** where fiber is uneconomic.

- Fast-track **duty/tax relief** on site-power kits and entry devices; scale **power-as-a-service**.
- Create a **one-stop RoW** with dig-once rules to accelerate fiber spurs to rural PoPs.

Next Steps

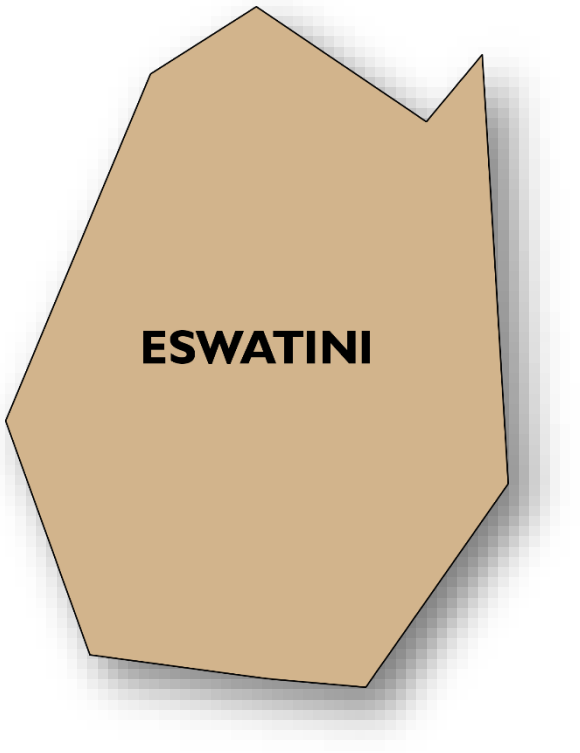
- Publish a rural-broadband strategy with targets.
- Streamline tax-exemptions and USF processes.
- Pilot dynamic spectrum sharing/TVWS.
- Incentivize active & passive infrastructure sharing.
- Develop rural affordability programs (vouchers/subsidies).
- Launch digital-skills and local adoption initiatives.
- Pilot solar-powered sites and satellite backhaul solutions.

Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt	Operator 3 Excerpt
Policy & Regulation	Q1–Q4 – Policies/targets; gov't role; barriers	"Funding and tax-exemption processes are outside the regulator's remit; investments in rural areas are unattractive."	(No rural-policy comment)	(No rural-policy comment)	(No rural-policy comment)
Spectrum Management	Q5–Q8 – Bands; fee incentives; TVWS; assignment process	"20–50 % rural spectrum-fee discounts; dynamic sharing/TVWS not implemented; assignment via administrative & auction."	(No additional spectrum comment)	(No additional spectrum comment)	(No additional spectrum comment)
Infrastructure Sharing	Q9 – Passive/active sharing	"Operators must share passive infrastructure only."	"10 % of towers are shared."	"36 % leased, 74 % owned; passive-sharing required by law."	"Passive-sharing supported; 97 % of towers are owned."

Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt	Operator 3 Excerpt
Technology Readiness	Q10 – Govt-led infra projects	"Angosat 2 satellite project supports rural broadband under the National Space Program."	(No gov't-project comment)	(No gov't-project comment)	(No gov't-project comment)
USF & Licensing	Q11–Q12 – USF/PPP role; rural license requirements	"USF provides universal-service grants; no dedicated rural obligations—benefits tied to overall coverage targets."	(No USF comment)	(No USF comment)	(No USF comment)
Affordability	Q13–Q14 – Pricing constraints; subsidies	"Rural pricing subject to approval; no formal end-user subsidy programs."	"No rural-specific packages; low-cost bundles available."	"No special rural packages; same prepaid offerings apply."	"Uniform tariffs; no rural-specific subsidies."
Financial Incentives	Q15–Q16 – Operator incentives; tax exemptions	"Spectrum-fee reductions; case-by-case incentives; 20–50 % fee discounts for rural deployments."	(No extra incentive comment)	(No extra incentive comment)	(No extra incentive comment)
Market Demand & Adoption	Q21–Q23 – Coverage; rural penetration; unserved	"Coverage 85.6 %; rural penetration 36.01 %;	"< 5 % of customers are rural."	"~20 % rural customer base; 23 % rural coverage."	"~20 % customers rural; 62 % municipalities covered."

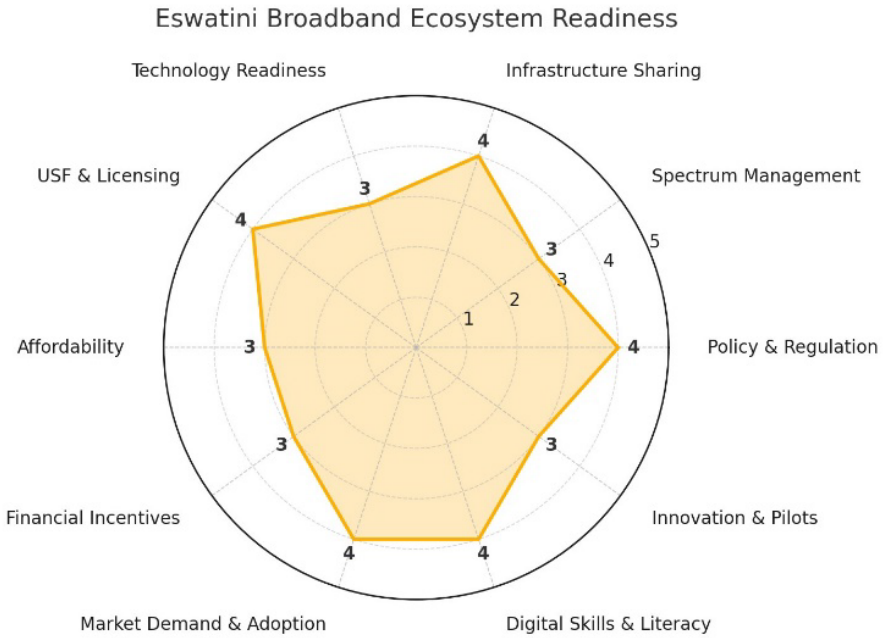
Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt	Operator 3 Excerpt
		unserved 64.99 %."			
Digital Skills & Literacy	Q27 – Literacy & gender targets	"N/A."	"N/A."	"N/A."	"N/A."
Innovation & Pilots	Q7 & Q17 – TVWS/dynamic sharing; regulatory incentives	"No dynamic sharing/TVWS; no formal innovation pilots yet; solar & satellite backhaul experiments under consideration."	"Considering Huawei RuralStart Radio, no pilots yet."	"Piloting solar power & satellite backhaul solutions."	"Testing satellite TX, Open RAN & exploring infra-as-a-service models."

2. Eswatini's Broadband-Ecosystem Readiness Framework



Key Indicators	
Population broadband coverage	93.5 %
Rural broadband penetration	Not separately reported
Unserved population	~ 6.5 %
Broadband speed (minimum)	5 Mbps
Fiber penetration	Data pending (EPTC)
Affordability indices	None
Digital literacy & gender targets	Yes (UASF Strategy)
Satellite coverage (rural)	Not reported (urban-focused)
Satellite type	LEO (Starlink)

Radar-chart visualization of Eswatini's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Eswatini's broadband ecosystem readiness** across ten key dimensions.

Table 25: Eswatini's Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Comprehensive UASF strategy and licensing mandates exist, but equipment/tax barriers remain.
Spectrum Management	3	TVWS and dynamic sharing are allowed, but there are no fee incentives and limited rural band variety.
Infrastructure Sharing	4	Clear regulatory requirement to share infra; high tower-leasing rates demonstrate compliance.
Technology Readiness	3	LTE broadly deployed; fiber-rollouts underway; 5G and LEO pilots planned but not widespread.
USF & Licensing	4	Active UASF subsidies and rural license obligations, though fund scale-up needed.
Affordability	3	Tariff-approval safeguards and some end-user support, but no formal rural subsidy schemes.
Financial Incentives	3	CAPEX subsidies via UASF in place; tax exemptions absent.
Market Demand & Adoption	4	High overall coverage (93.5%); strong operator rural customer bases.
Digital Skills & Literacy	4	Digital-literacy programmes embedded in UASF strategy.
Innovation & Pilots	3	Operators experimenting with tower sharing, solar hybrids, and RuralStar; regulatory pilots limited to TVWS in schools.

Overall Readiness: 3.5 / 5

Eswatini couples a clear UASF strategy, enforced infrastructure sharing, and rural rollout obligations with high national coverage; to reach the last mile it should deepen device affordability and fiscal incentives, scale innovation pilots (e.g., TVWS/neutral-host/solar-hybrid), and broaden digital-skills and SME adoption initiatives.

Regulator's Perspective

Eswatini's Universal Access and Service Fund (UASF) Strategy 2021–2024 underpins rural broadband by funding:

- Connectivity & User Interface
- Network Infrastructure Enhancement
- Digitization & Enabling Services
- Digital Literacy & ICT Training

Targets align with **SADC Broadband Targets**. The government, via UASF and other instruments, mandates the regulator to drive rural rollout. **Regulatory barriers** include high equipment costs

in foreign currency and taxes. **TV White Spaces** are allocated (currently used for schools), and spectrum for rural projects is assigned administratively. Infrastructure-sharing rules require operators to share when needed. UASF provides CAPEX subsidies; mobile-license conditions include rural-coverage requirements. Operators must obtain Commission approval before launching any service. End-user support includes UASF-funded mobile-phone grants and public Wi-Fi at Tinkhundla centres. No tax exemptions exist. Principal challenges are high terrain-related deployment costs, equipment import taxes/exchange-rate risk and powering remote sites. Policy recommendations emphasize reduced import taxes on equipment and embedding rural networks in national development funding.

Table 26: Eswatini - Operators' Perspectives

Dimension	Operator 1	Operator 2	Operator 3
Profile & Coverage	Mobile & Fixed Wireless LTE; 40 % rural customers; 4 regions/150 communities	GSM, UMTS & LTE; 33 % rural; Shiselweni & Lubombo regions	FWA via copper/wireless/fiber; serves all 4 regions; World Bank–Ministry of ICT partnership
Infrastructure	81 % rural towers leased; plan to expand 40 %→100 % by 2035 with 25 new sites/year	87 % towers owned, 13 % leased; 93.7 % rural geographic coverage (UASF-driven)	Own 68 %/shared 32 % towers; 77 % of towers in rural; plan to cover Tinkhundla, clinics, schools
Technology	LTE 700/800/1800 MHz; planning 5G 1.8 GHz	GSM 900 MHz, UMTS 900 MHz, LTE 800 MHz	Fixed Wireless 5 GHz
Business Models	No rural-specific tariffs; prepaid daily/weekly/monthly; usage-based pricing; cross-subsidization; capacity-first site builds	No special rural offers; full product range across all markets; low-cost bundles cater to segments	Tiered packages by volume/speed; urban cross-subsidizes rural infra
Financing & Incentives	Cross-subsidization; UASF CAPEX subsidies; no tax breaks	UASF partnership for LTE upgrades & sites; no tax incentives	External funding required; no executed community models
Shared Infrastructure	Site-sharing enforced by regulator	Site-sharing guidelines encourage colocation	Active/passive sharing under regulatory guidelines; calls for more incentives
Challenges	Site acquisition/access; road construction	High civils/power costs; low ARPU; OPEX from outages & distances	Power availability; low ARPU; vandalism

Innovation	Tower sharing	Renewable power, hybrid solutions, high-gain antennas	Unlicensed wireless deployments
Future Plans	Deploy 235 new rural sites	Low-cost rural site solutions; RuralStar pilot	Expand rural coverage & FTTx near urban
Regulatory Needs	Lower spectrum fees; infrastructure-sharing incentives	Lower spectrum & fiber-lease fees; subsidized rural rollout	CAPEX/OPEX subsidies; tax relief; subsidized connections; free rural FWA spectrum

Summary of Challenges & Opportunities

- **Challenges**
  - High equipment imports costs and unfavorable exchange rates
  - Terrain-driven deployment and powering costs
  - No tax exemptions for operators or end-users
  - Limited data on rural penetration and fiber footprint

- **Opportunities**
  - Leverage strong UASF to push the **"last 10%"** via neutral-host small towns and **5G-FWA** where fiber is costly.
  - Scale **TVWS** (already permitted) for schools/community Wi-Fi; consider rural **spectrum fee credits**.
  - Expand **device affordability** (vouchers/micro-finance) and SME digitization programs.
  - Publish **open-access** wholesale reference prices for any publicly supported backbones.
  - Standardize **solar-hybrid power** at rural sites to reduce outages and OPEX.

Next Steps

- **Reduce or waive import taxes** on rural telecom equipment.
- **Expand UASF funding** to cover end-user subsidies (devices, hotspots).
- Introduce rural spectrum incentives (fees, License durations).
- **Broaden TVWS pilots** beyond schools for last-mile access.
- **Embed rural broadband** in national development budgets.
- **Stimulate demand** via digital literacy and community ICT centres.
- **Encourage innovative pilots** (LEO satellites, RuralStar, solar-hybrids).

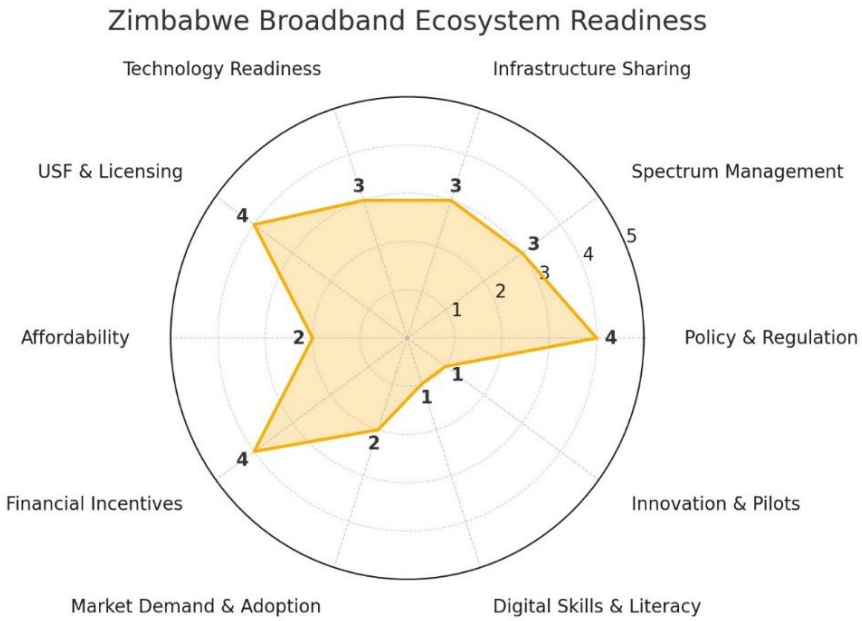
Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt	Operator 3 Excerpt
Policy & Regulation	Q1–Q4	UASF 2021–2024 programmes; SADC targets; mandatory regulator role; high import/tax costs are main barriers.	No rural policy beyond UASF; licensing includes rural obligations.	Licensing contains coverage targets (UASF-driven).	Regulations mandate passive/active sharing; fiscal relief under discussion.
Spectrum Management	Q5–Q8	TVWS allocated (schools); no fee incentives; dynamic sharing allowed; admin assignment for rural projects.	Plans 5G spectrum but uses LTE bands; awaiting rural fee incentives.	Uses LTE 800/900; spectrum costs burdensome; no rural incentives.	Free unlicensed spectrum at 5 GHz & 2.4 GHz; high spectrum costs remain.
Infrastructure Sharing	Q9	Infrastructure sharing regulations require operators to share as needed.	81 % towers leased under sharing agreements.	Site sharing guidelines in place; UASF backbone open to all MNOs.	32% towers shared; calls for more active sharing incentives.
Technology Readiness	Q10	Govt partnerships for fiber roll out via incumbent wholesale operator and UASF funded public Wi Fi.	LTE networks; future 5G build out planned.	GSM/UMTS/LTE deployed; UASF sites cover 93.7 % rural geography.	Fixed Wireless Access at 5 GHz; planning school/clinic connectivity via World Bank project.
USF & Licensing	Q11–Q12	UASF offers operator CAPEX subsidies; mobile Licenses include rural coverage conditions.	Relies on UASF subsidies; mobile Licenses mandate rural sites.	UASF partnership funds LTE upgrades; no special rural tax breaks.	No explicit rural obligations in Licenses beyond national coverage KPIs; FDSU under development.
Affordability	Q13–Q14	Operators must obtain	Uniform tariffs; no	No rural specific offers;	Tiered bundles by

		Commission approval for tariffs; UASF supports social grant recipients & public Wi Fi hotspots.	rural specific packages.	full portfolio across markets.	volume/speed; rural affordability via general product mix.
Financial Incentives	Q15–Q16	UASF provides CAPEX subsidies; no tax exemptions.	Receives UASF CAPEX subsidies; seeks tax relief.	UASF site funding; CAPEX sharing guidelines requested.	None executed yet; seeks tax and customs exemptions.
Market Demand & Adoption	Q21–Q23	93.5 % overall coverage; rural disaggregation unavailable; unserved ~ 6.5 %.	40 % rural customer base; growing.	33 % rural customer base; heavy UASF reliance.	~ 20 % rural base, expanding with World Bank support.
Digital Skills & Literacy	Q27	UASF Strategy includes Digital Literacy & ICT Training programmes.	N/A	N/A	N/A
Innovation & Pilots	Q7 & Q20	TVWS use encouraged; no other pilots noted.	Tower sharing; evolving to 5G and RuralStar experiments.	Renewable energy, hybrid solutions, high gain antennas reduce OPEX.	Exploring unlicensed wireless in lieu of fiber; solar hybrid sites under planning.

3. Zimbabwe Broadband-Ecosystem Readiness Framework

Key Indicators	
Population	87.9%
Broadband Coverage	
Rural Broadband Penetration	71.6%
Unserved Population	29.4%
Average Broadband Speed	1 Mbps (national average)
Fiber Backbone/Backhaul Penetration	84.6% (no urban/rural split)
Satellite Coverage (Rural)	100% via LEO
Digital Literacy & Gender Targets	None formalized
Affordability Indices	None reported

Radar-chart visualization of Zimbabwe's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Zimbabwe's broadband ecosystem readiness** across ten key dimensions.

Table 27: Zimbabwe's Broadband Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Clear national plan with universal targets, USF funding, tax incentives, and passive sharing; needs formal PPP frameworks and permit streamlining.
Spectrum Management	3	Light-licensing reduces costs, but no dynamic sharing or TVWS; administrative assignment only; could introduce rural-specific spectrum policies.
Infrastructure Sharing	3	Passive sharing mandated; MORAN and Wi-Fi projects exist; active sharing and enforcement could be strengthened.
Technology Readiness	3	Established fiber backbone and USF-funded rural sites; rural coverage still below targets; upgrade to higher-speed technologies needed.
USF & Licensing	4	USF capex grants and License roll-out obligations in place; could expand to OPEX support and clearer PPP provisions.
Affordability	2	No rural/urban tariff differentiation; very limited end-user subsidies; lacks broader affordability programs.
Financial Incentives	4	Capex subsidies and tax holidays effective; absence of formal OPEX support and clear financing models for operators limits long-term sustainability.
Market Demand & Adoption	2	Moderate rural penetration (71.6%); low ARPU and high unserved population; requires demand-stimulation and digital-skills initiatives.
Digital Skills & Literacy	1	No formal digital literacy or gender-equality targets; absence of affordability indices limits targeted interventions.
Innovation & Pilots	1	No TVWS/dynamic sharing pilots; minimal adoption of alternative technologies; needs encouragement for LTE relay, TVWS, and solar-hybrid site trials.

Overall Readiness: 2.7 / 5

Zimbabwe has a robust policy and USF framework with strong fiber and satellite infrastructure; to fully realize universal rural broadband, it should expand affordability programs, pilot innovative spectrum and site-energy solutions, and embed digital-skills and OPEX support in its regulatory toolkit.

Regulator's Perspective

- **Policy Framework:**
  – **National Broadband Plan (2020–2030):** 100% coverage at ≥1 Mbps by 2030.
  – **Rural Target:** 100% rural penetration by 2030.
- **Government Role:**
  – **USF Subsidies:** Capex grants for last-mile rural projects.
  – **Tax Incentives:** Rural infrastructure tax breaks and way-leave reductions.
  – **Infrastructure Sharing:** Mandated passive sharing; supports MORAN and community Wi-Fi centers.

- **Spectrum:**
  – **Light-licensing Bands:** 2.4 GHz and 5 GHz with reduced fees and relaxed conditions.
  – **Dynamic Sharing/TVWS:** Not currently permitted.
  – **Assignment:** Administrative for rural projects.

- **Licensing & Obligations:**
  – Roll-out Targets & USF Obligations embedded in operator Licenses.

- **Tariffs & Affordability:**
  – **Cost-based Tariffing:** No rural/urban differentiation; occasional user-subsidy programs (schools, hospitals).

- **Financial Incentives:**
  – Capex Subsidies & Tax Holidays for rural deployments.

- **Challenges Identified:**
  – **Limited Private Investment** due to low ARPU; high cross-ministry tax burdens.

- **Lessons & Recommendations:**
  – Need for **stronger government intervention**, targeted tax breaks, and PPPs to spur rural coverage.

Table 28: Zimbabwe - Operators' Perspectives

Dimension	Operator 1	Operator 2
Services & Reach	Mobile 2G/3G; ~20% rural subscribers; covers three provinces; partners via POTRAZ infra-sharing	GSM/UMTS/LTE; ~33% rural subscribers; covers 10 provinces; partners via USF site deployments
Infrastructure & Coverage	GSM 900 & U2100; ~20% rural community coverage; expansion planned; ownership	LTE 700/1800 MHz; 75.8% rural coverage (→ 80% by 2027); 81% towers owned vs. 19% leased;

	split unknown; site acquisition & power are key challenges	challenges: site acquisition, power, low ARPU, roads, vandalism
Pricing & Business Models	Prepaid daily/weekly/monthly; no rural-specific plans; financial sustainability not addressed (N/A); no subsidies or community models	Uniform network tariffs; no rural bundles; no specific rural financing models; no community/co-op models
Spectrum & Regulatory Environment	Uses 900 MHz & 2100 MHz; faces high spectrum costs and licensing delays; infrastructure-sharing supportive; seeks tax reliefs	Uses 700 MHz & 1800 MHz; no regulatory barriers reported; infra-sharing supportive but needs more sites; requests capex/opex subsidies and grid extension
Financial & Sustainability	Operational costs driven by power; external funding required for infrastructure; no cost-reduction innovations	Main cost drivers: towers, power, backhaul, operations; external funding still required; uses low-cost/solar tower models
Future Plans & Support Needs	Deploy new rural sites; needs lower regulatory fees, infra-sharing incentives, tax exemptions, external funding; exploring LEO satellite broadband	Rolling out 120 low-cost solar-powered rural sites; needs increased USF funding; exploring hybrid FWA/satellite models; seeks revenue-sharing agreements
Lessons & Opportunities	Opportunity: new subscriber base in rural markets. Challenge: high site costs and low ARPU.	Lesson: satellite backhaul is viable, but capacity and cost constraints remain.

Summary of Challenges & Opportunities

- **Challenges**
    - Limited private investment due to low rural ARPU and high cross-ministry taxes
    - High capex/opex (sites, power, backhaul, roads, licensing delays, vandalism)
    - Lack of dynamic spectrum tools (TVWS) and rural-specific licensing incentives

- **Opportunities**
    - Strong USF framework with capex subsidies and tax holidays
    - Light-licensing of 2.4 GHz/5 GHz bands
    - MORAN and community Wi-Fi initiatives
    - Mature fiber backbone (84.6%) and universal satellite coverage

Next Steps

- **Enhance Private Investment:** Expand USF to cover OPEX and introduce rural-targeted capex/opex subsidies.
- **Spectrum Innovation:** Authorize TVWS and dynamic sharing pilots in rural districts.
- **Tax Reform:** Standardize and reduce cross-ministry levies; provide clear tax holidays for rural deployments.
- **Extend Licensing Incentives:** Embed rural roll-out milestones with financial rewards and streamlined permits.
- **Upskill Rural Users:** Launch digital literacy campaigns and community ICT centers to drive uptake.

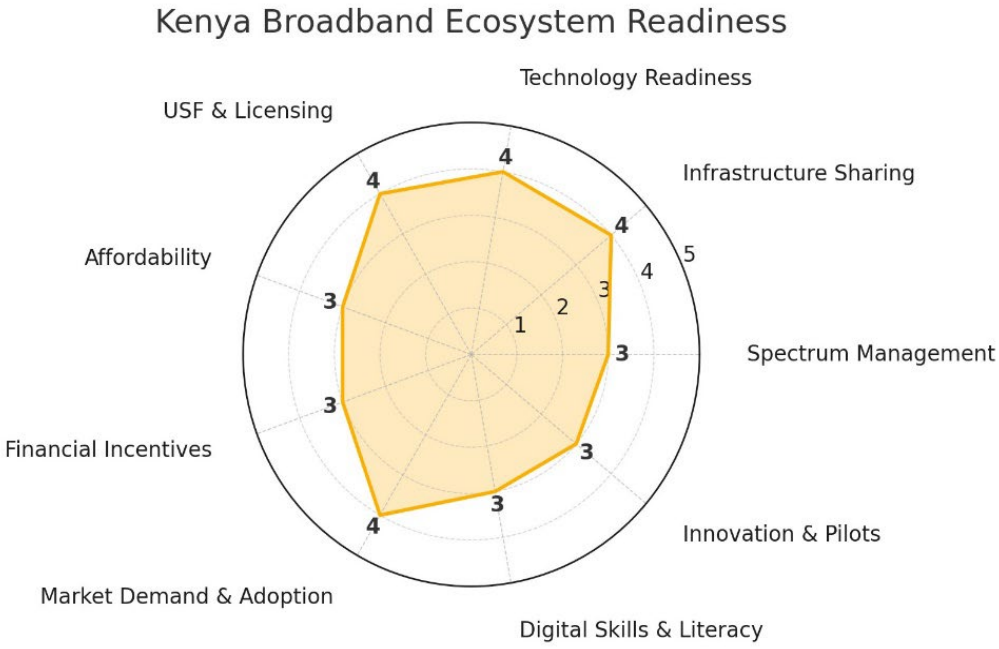
Dimension	Key Questions	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt
Policy & Regulation	Q1–Q4	National Broadband Plan 2020–2030 (100% @ 1 Mbps by 2030); rural 100% target; USF capex, tax incentives, passive sharing, MORAN, community Wi Fi projects.	20% rural base; POTRAZ infra sharing partnership	33% rural base; USF site deployment partnerships
Spectrum Management	Q5–Q8	Light licensing 2.4/5 GHz (lower fees, relaxed conditions); no dynamic sharing/TVWS; administrative assignment for rural spectrum.	Uses 900 MHz & 2100 MHz; high spectrum costs; licensing delays	Uses 700 MHz & 1800 MHz; no regulatory barriers; requests microwave fee waiver
Infrastructure Sharing	Q9	Passive sharing mandated (Access & Co Location Regulations); supports MORAN multi operator networks.	— Implicit via POTRAZ sharing	— GIFEC shared site model; supportive but needs more roll out
Technology Readiness	Q10	MORAN initiatives; community Wi Fi/Info centers; strong fiber	20% rural coverage;	75.8% rural coverage;

		backhaul via USF funded projects.	expansion planned	expansion to 80% by 2027
USF & Licensing	Q11–Q12	USFs grant last mile subsidies; USF obligations in Licenses; PPP facilitation; roll out targets in Licenses.	Relies on USF for new rural site roll outs	USF finances rural sites; PPP via USF levy; ongoing partnership
Affordability	Q13–Q14	No rural/urban tariff distinction; cost-based tariff principle; occasional end user subsidies for schools/hospitals.	Uniform prepaid models; no rural only bundles	Nationwide bundles only; no rural discounts
Financial Incentives	Q15–Q16	Capex subsidies; tax holidays for rural operators; relaxed light licensing fees.	Seeks tax relief; no formal subsidies	Requests CAPEX/OPEX subsidies; grid extension; reduced rentals
Market Demand & Adoption	Q21–Q23	87.9% coverage; 71.6% rural penetration; 29.4% unserved; average speed 1 Mbps.	Growth potential in rural–20% base; new markets	Low ARPU forces external funding; gradual uptake
Digital Skills & Literacy	Q27–Q28	None formal; no affordability indices; 100% satellite coverage but no literacy targets.	None reported	None reported
Innovation & Pilots	Q7	No TVWS/dynamic sharing; light licensing only; no formal innovation pilots.	No innovative solutions implemented	Pilot solar/low cost towers; satellite backhaul explored

4. Kenya's Broadband-Ecosystem Readiness Framework

	Key Indicators
Cellular broadband penetration	96.4% of population (3G/4G)
Fixed broadband access target	50% of population by 2030 (proposal)
Rural unserved	2.6% of population
Average speeds	**Urban:** ~15 Mbps DL / 7 Mbps UL **Rural:** ~5 Mbps DL / 2 Mbps UL

Radar-chart visualization of Kenya's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Kenya's broadband ecosystem readiness** across ten key dimensions.

Table 29: Kenya's Broadband Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Robust multi-layered strategies and clear rural roll-out obligations—but successor strategy (2025–2030) still in development.
Spectrum Management	3	Wide spectrum availability (700–3500 MHz) and pilot TVWS, but incentives limited to Zone B discounts and dynamic sharing not yet mature.
Infrastructure Sharing	4	Active/passive sharing mandated with Guidelines in force; stronger enforcement expected with 2025 regulations.
Technology Readiness	4	High population coverage (>96%); diverse technologies (LTE, fiber, satellite) available; 5G and hybrid pilots planned.
USF & Licensing	4	USF capex subsidies and rural license obligations are well established; PPP framework in place.
Affordability	3	Free tariffing under competition rules; no rural end-user subsidies, affordability varies by operator bundles and device finance schemes.
Financial Incentives	3	Capex subsidies via USF exist; tax exemptions and Opex support under discussion but not yet realized.
Market Demand & Adoption	4	Near-universal coverage driving strong demand; rural uptake growing with smartphone penetration, though ARPU remains low.
Digital Skills & Literacy	3	National targets for digital literacy and gender equity are set, but program roll-out and rural focus are still evolving.
Innovation & Pilots	3	TV White Spaces and dynamic sharing pilots ongoing; LEO and RAN-sharing trials planned, but full-scale deployment pending regulatory clearance.

Overall Readiness: 3.6 / 5

Kenya demonstrates a high baseline of coverage and a strong policy framework, with scope to accelerate rural penetration through enhanced spectrum incentives, expanded end-user subsidies, and targeted digital skills programs.

Regulator's Perspective

Kenya's regulator reports a mature policy environment anchored in multiple national frameworks (National Broadband Strategy 2018–2023; ICT Master Plan 2022–2032; Digital Economy Blueprint; Vision 2030, etc.) with successor strategy under development targeting 99% wireless and 50% fixed-broadband by 2030. The government uses the Universal Service Fund (USF) to subsidize mobile broadband in unserved areas, embeds rural roll-out obligations in licenses, and offers spectrum-fee discounts in underserved zones. Spectrum (700–3500 MHz)

is assigned administratively or by beauty contest, and TV White Spaces are piloted. Infrastructure-sharing (active & passive) is mandated, with updated regulations forthcoming. While operators set tariffs freely, no end-user subsidies currently exist. Capex subsidies are provided via USF, though tax exemptions remain under discussion. Major regulatory challenges include cumbersome wayleave approvals, high deployment costs, low commercial viability in rural zones, and infrastructure vandalism.

Table 30: Kenya - Operators' Perspectives

Dimension	Operator 1	Operator 2
Presence	Covers all 47 counties; ~70% of population in rural areas; partners via USF project	~30% rural customer base; 91.9% national population coverage (unable to split rural/urban); licensed USF partnership
Infrastructure & Tech	LTE 700/800 MHz & 3G (900/2100 MHz); GEO satellite backhaul; plans to deploy 5G; most sites company-owned	3G/4G on 800/900/1800 MHz; >97% towers leased; high-gain backhaul (MW); no region-specific bundles
Business Models	No rural-only pricing; device finance (Lipa Mdogo Mdogo); shared tower partnerships; USF-funded low-cost bundles	Nationwide pricing; cross-subsidization from urban markets; USF support insufficient to cover OPEX
Regulatory Needs	Requests lower spectrum fees, tax reliefs, and streamlined permits; exploring LEO pilots	Seeks CAPEX/OPEX subsidies, tax exemptions on devices & services; relief on microwave spectrum fees
Challenges & Innovation	High deployment costs (power, backhaul, wayleaves); digital literacy gaps; exploring micro-financing and hybrid energy; shared-infrastructure pilots (RAN sharing)	Challenging terrain, low ARPU, infrastructure vandalism; deploying solar-powered sites; low-cost "RuralStar" solutions under evaluation

Summary of Challenges & Opportunities

- **Challenges**
    - High rural deployment costs (power, backhaul, civil works, wayleaves)
    - Low ARPU and commercial viability in sparsely populated areas
    - Regulatory delays (permits, license approvals) and non-fiscal barriers (infrastructure vandalism)

- **Opportunities**
    - Strong national coverage baseline (97.4%) and high demand for digital services
    - Existing USF mechanism and forthcoming spectrum-discount zones
    - Potential for innovative pilots (TVWS, LEO-satellite, RAN sharing) and demand stimulation (digital skills programs)

Next Steps

- **Finalize & Publish 2025–2030 Broadband Strategy:** Cement rural targets and align financial incentives.
- **Streamline Permitting & Wayleave Processes:** Harmonize across counties to reduce rollout delays.
- **Enhance USF & PPP Frameworks:** Increase funding, broaden scope to cover OPEX, and incentivize active sharing.
- **Scale Innovation Pilots:** Fast-track TVWS, RAN-sharing, and LEO interventions with clear regulatory guidance.
- **Stimulate Demand & Skills:** Deploy nationwide digital literacy campaigns, community-based ICT centers, and local content initiatives.

Dimension	Key Questions	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt
Policy & Regulation	Q1–Q4	National Broadband Strategy; Vision 2030 MTP IV; ICT Master Plan 2022–2032; Digital Economy Blueprint; USF subsidies; rural license obligations; spectrum fee discounts; infrastructure sharing rules	Covers all 47 counties; rural base ~70%; USF project partnership	~30% rural customers; 91.9% pop coverage; USF partnership critical
Spectrum Management	Q5–Q8	Bands 700–3500 MHz licensed; administrative assignment or beauty contest; discounted fees in Zone B; TVWS pilots; dynamic spectrum under review	Deploys LTE 700/800 MHz and 3G; GEO satellite backhaul; planning 5G	Uses 800/900/1800 MHz for 3G/4G; high cost microwave; requested microwave fee waivers

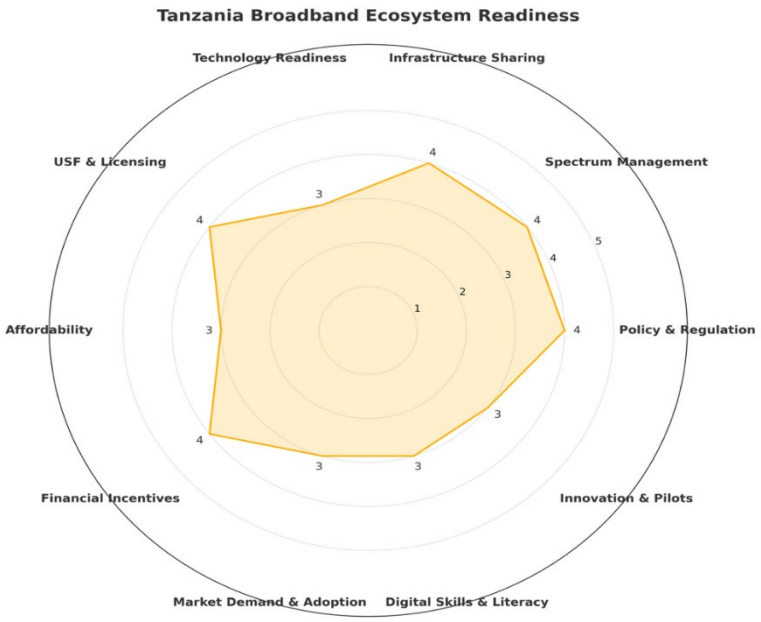
Infrastructure Sharing	Q9	Active and passive sharing mandated; 2016 Guidelines in force; 2025 regulations forthcoming	Shared tower agreements; 40% of towers leased; co location enforced by regulator	>97% towers leased; supportive regulations but seek more incentives
Technology Readiness	Q10	Government led fiber backbone (DSHP Phases I & II); cellular projects covering 500+ sublocations; e Government network; GDAP; NGIC shared 5G infrastructure	No rural specific plans; device affordability (Lipa Mdogo Mdogo); shared RAN reduces CAPEX by ~35%	Nationwide bundles; no region specific offers; exploring "RuralStar" low cost sites
USF & Licensing	Q11–Q12	USF provides capex subsidies for unserved/underserved areas; license roll out obligations; PPP Act 2021 enabling broader partnerships	Relies on USF for new site roll out; conversion of QoS penalties into rural deployments	USF partnership for LTE upgrades; 1% revenue levy supports GIFEC mandate
Affordability	Q13–Q14	Free tariffing within fair competition & consumer protection rules; no direct end user subsidies currently	No rural only pricing; low income bundles as low as GHS 1 equivalent; device financing	No special rural packages; cross subsidization from urban revenues
Financial Incentives	Q15–Q16	Capex subsidies via USF; no tax exemptions yet; regulator engaging Treasury & KRA on fiscal incentives	Requests lower spectrum fees; concessional loans; tax relief for equipment	Calls for CAPEX/OPEX subsidies; tax exemptions on devices & services
Market Demand & Adoption	Q21–Q23	97.4% population coverage; rural penetration TBA; unserved 2.6%; Urban speeds 15/7 Mbps, Rural speeds 5/2 Mbps	Rural demand growing; prioritizes capacity over coverage; exploring hybrid models for user uptake	Acknowledges slow rural uptake; service revenue growing with smartphone penetration

Digital Skills & Literacy	Q27	National Digital Master Plan 2022–2032 targets 60% adult digital literacy and 50% female ICT participation by 2030	Supports Girls in ICT and community training; working with local ICT centres	No specific community based literacy programs noted; notes importance of local engagement
Innovation & Pilots	Q7	TVWS regulated under pilot licensing; dynamic spectrum access models under review	Piloting LEO satellite services; evaluating RAN sharing and small cell deployments	Deploys solar powered base stations; evaluating low cost "RuralStar" and LEO solutions

5. Tanzania Broadband-Ecosystem Readiness Framework

Key Indicators	
3G coverage	92.2 %
4G coverage	90.7 %
5G coverage	23 %
Unserved population	7.8 %
Rural broadband target	80 % population by 2025
Spectrum bands	700, 800, 900, 1800, 2100, 2300, 2600, 3500, 3800 MHz
Infra-sharing policy	Active & passive (2018 Regs, 2022 amendment)
UCSAF role	CapEx subsidies for towers; funds shared-infrastructure
License rural-rollout obligation	Yes
Fiber-backbone coverage	NICTBB PoPs in nearly all districts
Rural subscriber base	58 % (Op 1); 29 % (Op 2)

Radar-chart visualization of Tanzania's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Tanzania's broadband ecosystem readiness** across ten key dimensions.

Table 31: Tanzania Broadband Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Multiple strategic policies and clear rural targets; strong backbone project and UCSAF but need formal tax measures and urban/rural spectrum differentiation.
Spectrum Management	4	Full assignment of 700–3800 MHz, long-term Licenses, active sharing;
Infrastructure Sharing	4	Robust sharing regulations (2018/2022); active & passive models in place.
Technology Readiness	3	Extensive backbone (NICTBB) and tower roll-outs; community coverage still below 70%; innovation pilots limited.
USF & Licensing	4	UCSAF capex subsidies and License obligations well established; PPPs emerging but could be expanded.
Affordability	3	Tariff principles ensure fairness; no direct end-user subsidies, operator schemes limited to smartphone financing.
Financial Incentives	4	UCSAF provides substantial capex support; tax exemptions pending formalization; License incentives present.

Market Demand & Adoption	3	High overall mobile coverage; rural uptake constrained by ARPU and infrastructure gaps; demand stimulation programs not yet widespread.
Digital Skills & Literacy	3	National digital clubs' initiative in place; broader digital literacy and content programs still in early stages.
Innovation & Pilots	3	Allowed Active sharing, provisioning of free communication resources (spectrum and numbering) for innovators and start-ups is done. TVWS pilots was permitted but did not give an impactful results hence not commercialized; Limited alternative-technology pilots (LTE relay, solar hybrid) so far.

Overall Readiness: 3.5 / 5

Tanzania boasts a comprehensive policy and funding framework with strong backbone infrastructure and UCSAF support; further gains await targeted affordability programs, formal tax incentives, expanded pilots of innovative technologies, and strengthened digital-skills initiatives.

Regulator's Perspective

Tanzania's regulator has established a strong strategic foundation with:

- **Policy Frameworks:** Digital Economy Strategic Framework (2024–2034); National Broadband Strategy (2021–2026); Universal Communications Service Access Act (UCSAF); National ICT Policy 2016; and the National ICT Broadband Backbone (NICTBB) providing fiber to nearly all districts.
- **Rural Targets:** 80% broadband penetration by 2025, focusing on underserved areas.
- **Government Role:** UCSAF capex subsidies for tower roll-out; NICTBB fiber backbone; mandatory rural coverage obligations in operator Licenses.
- **Spectrum:** 700–3800 MHz fully assigned to MNOs; long-duration Licenses; infrastructure-sharing and active spectrum-sharing encouraged; TVWS pilots permitted but did not provide an impactful output and therefore not commercialized.
- **Infrastructure Sharing:** Regulations (Access, Co-Location & Infrastructure Sharing Regulations 2018, amended 2022) mandate passive and active sharing.
- **USF & PPP:** UCSAF funds rural infrastructure; PPPs implicitly supported via UCSAF and NICTBB collaboration.
- **Pricing & Tariffs:** No rural price caps; Tariffs Regulations 2018 and Bundle Rules 2021 set guiding principles and limits per MB to ensure affordability.
- **Subsidies & Incentives:** Operator smartphone installment schemes; UCSAF capex subsidies; no formal tax exemptions.
- **Challenges:** Lack of urban/rural spectrum differentiation complicates targeted incentives; high rollout costs; low rural ARPU.
- **Lessons:** Effective government–private–community partnerships; need for affordability, digital literacy, and relevant local content.

Table 32: Tanzania - Operators' Perspectives

Dimension	Operator 1	Operator 2
Services & Reach	4G-LTE; 58% rural customer base; covers all rural areas via 47% of sites; partners via UCSAF	2G/3G/4G-LTE & VoLTE; 29.1% rural customers; 1,666 rural sites; UCSAF partnerships
Infrastructure & Tech	LTE 700/800/1800/2600 MHz; >98% rural towers leased; 62% rural community coverage (→ 65% by end-2025)	UMTS 900 MHz & LTE 800 MHz (some LTE 1800 MHz); 25% owned vs. 75% leased towers; 69.9% rural community coverage (→ 75% by 2026)
Business & Tariffs	Tariffs uniform nationwide; no rural-specific plans; cross-subsidization; USF-funded roll-out; smartphone instalment schemes	Bundles start at TZS 500; no rural-only plans; 1% MNO-revenue levy funds UCSAF rural projects; limited donor/PPP financing
Regulatory Needs	Requests CAPEX/OPEX subsidies; tax reliefs; reliable grid power; improved road access; streamlined permits	Seeks CAPEX/OPEX subsidies; tax exemptions on ICT equipment; removal of rural-expansion restrictions in Licenses; redirection of GIFEC funds to new rural sites
Challenges & Innovation	Site acquisition, permits, roads, power, low ARPU; deploying solar-powered base stations and lean "ultra-rural" sites	Road/access challenges, low population density, high tower leasing costs; exploring low-cost tower designs and LTE relay backhaul as alternatives to MW and satellite backhaul

Summary of Challenges & Opportunities

- **Challenges**
  - High capex/opex (towers, power, backhaul, roads)
  - No urban/rural spectrum differentiation
  - Low ARPU and limited commercial incentives in sparsely populated areas

- **Opportunities**
  - Strong policy framework and UCSAF funding
  - Extensive backbone (NICTBB) and high overall coverage
  - Potential in active spectrum sharing, LTE relay, LEO satellite, and solar-hybrid sites

Next Steps

- **Clarify Spectrum Policy:** Introduce rural-targeted spectrum pricing or set-asides.
- **Enhance Tax Incentives:** Implement formal exemptions for rural deployments and ICT equipment.
- **Strengthen USF Mechanism:** Expand UCSAF to cover OPEX and incentivize active sharing.

- **Pilot Innovations:** Scale up innovations and pilots. Example; LTE relay, LEO satellite, and solar-powered site pilots with clear regulatory guidelines.
- **Promote Digital Literacy:** Roll out national digital clubs and local content programs to stimulate demand in rural communities.

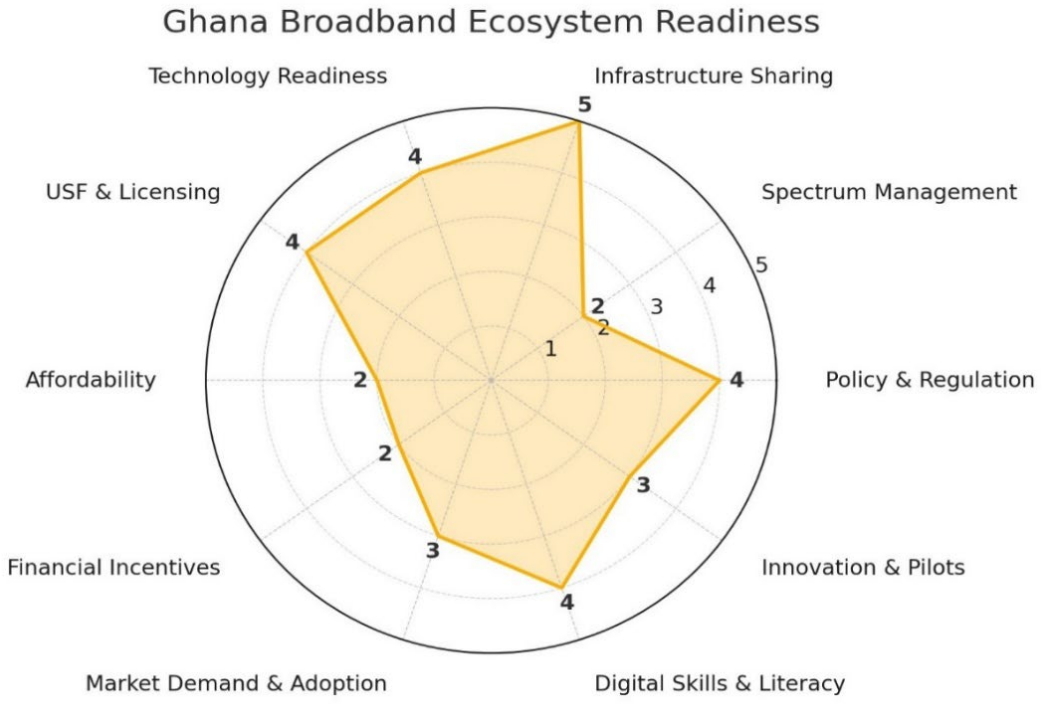
Dimension	Key Questions	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt
Policy & Regulation	Q1–Q4	Digital Economy Framework 2024–2034; National Broadband Strategy 2021–2026; UCSAF Act; NICTBB backbone; ICT Policy 2016; rural target of 80% by 2025; mandatory License roll out obligations	58% rural base; UCSAF capex partnership; nationwide rural site coverage	29.1% rural customers; 1,666 rural sites; UCSAF funding key
Spectrum Management	Q5–Q8	Bands 700–3800 MHz assigned to MNOs; long duration Licenses; active spectrum sharing; TVWS allowed but uncommercialized; mixed administrative/auction assignment	LTE 700/800/1800/ 2600 MHz; GEO satellite backhaul; >98% towers leased	UMTS 900 MHz & LTE 800 MHz; MW backhaul; requested microwave fee waiver
Infrastructure Sharing	Q9	2018 Access, Co Location & Infrastructure Sharing Regulations (amended 2022) permit active and passive sharing	>98% towers leased under sharing agreements	75% towers leased; supportive but seek stronger incentives
Technology Readiness	Q10	NICTBB PoPs in rural districts; UCSAF tower projects; Digital	62% rural community coverage; plans for 65% by 2025	69.9% rural community coverage; plans for 75% by 2026

		Tanzania Project covering 713 areas		
USF & Licensing	Q11–Q12	UCSAF subsidizes capex for rural towers; License conditions embed rural coverage targets	Relies on UCSAF for new site roll out; caps QoS penalty conversions to rural deployments	Funded by 1% MNO levy to GIFEC/UCSAF; no cooperative models yet
Affordability	Q13–Q14	No special rural price caps; Tariffs Regulations 2018 & Bundle Rules 2021 set guiding tariff principles	Uniform tariffs; no rural only bundles; device installment schemes	Bundles from TZS 500; "pay as you go" via GIFEC at reduced rates
Financial Incentives	Q15–Q16	UCSAF capex subsidies; no formal tax exemptions; licensing framework allows investment time; active sharing incentives	Requests CAPEX/OPEX subsidies; tax reliefs; reliable grid	Seeks CAPEX/OPEX subsidies; tax exemptions; License restrictions removal
Market Demand & Adoption	Q21–Q23	3G 92.2%, 4G 90.7%, 5G 23%; rural target 80% by 2025; unserved 7.8%	Rural uptake growing; cross subsidization from urban revenues	Acknowledges low rural ARPU; external funding required until demand grows
Digital Skills & Literacy	Q27	National digital clubs initiative at all education levels	Supporting local ICT centres; community training	No specific literacy programs; notes critical role of skills in adoption
Innovation & Pilots	Q7	Active spectrum sharing allowed; TVWS permitted but pilots were not impactful	Piloting solar hybrid stations and lean "ultra rural" sites	Evaluating LTE relay backhaul and RuralStar solutions; satellite services under consideration

6. Ghana Broadband-Ecosystem Readiness Framework

Key Indicators	
Unserved population (no ≥ 3G coverage)	0.5 %
Median mobile speed (DL)	13.17 Mbps
Median fixed internet speed (DL)	33.60 Mbps
Fixed broadband subscriptions (per 100 pop.)	0.56
Current 4G penetration	15 % (2024)
4G target	80 % by 2027
Internet cost (% of GNI)	< 1 % for low-use basket

Radar-chart visualization of Ghana's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Ghana's broadband ecosystem readiness** across ten key dimensions.

Table 33: Ghana's Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Robust national strategies and USF framework in place; lacks explicit rural coverage targets.
Spectrum Management	2	No rural-dedicated bands or fee incentives; TVWS and dynamic sharing unused.
Infrastructure Sharing	5	Strong legal mandates and multiple sharing initiatives (TowerCos, NGIC, GIFEC).
Technology Readiness	4	LTE/3G widely deployed; major fiber/backbone projects under way; limited satellite and 5G pilots.
USF & Licensing	4	Active USF subsidies and License coverage KPIs; could formalize rural KPIs.
Affordability	2	Free pricing freedom but no rural-specific end-user subsidies or vouchers.
Financial Incentives	2	Absence of spectrum-fee discounts or tax relief for rural deployments.
Market Demand & Adoption	3	Operators report modest rural customer shares (2–8 %); high overall network footprint but rural uptake remains low.
Digital Skills & Literacy	4	Comprehensive digital-literacy and inclusion programmes embedded in national agendas and UASF initiatives.
Innovation & Pilots	3	Infrastructure sharing pilots strong; limited experimentation with TVWS, LEO satellites, or community network models to date.

Overall Readiness: 3.3 / 5

Ghana demonstrates a solid foundation for broadband expansion, anchored by strong regulatory frameworks, one of Africa's most advanced infrastructure-sharing markets, and active USF interventions. However, limited spectrum incentives, minimal affordability support, and slow adoption of innovative access technologies continue to constrain deeper rural penetration. Strengthening fiscal incentives and scaling community-level digital-skills and affordability programmes would significantly enhance Ghana's rural broadband readiness.

Regulator's Perspective

Ghana's rural broadband ecosystem is anchored by:

1. **National Broadband Policy** (universal access, infra sharing, rural incentives)
2. **Digital Ghana Agenda** (expand rural infra & skills)
3. **GIFEC Strategy** (USF-funded shared infrastructure and digital inclusion)
4. Ghana Digital Acceleration Project (GDAP) (World Bank PPP funding)
5. **NCA Regulations** (rural licensing, spectrum allocation, infra sharing)

No specific rural coverage targets exist. The government drives rural expansion through USF subsidies, tax exemptions on ICT imports, concessional loans, PPPs, and demand stimulation (digital-literacy programs, community ICT centers). **Barriers** include protracted permitting/ROW, high spectrum fees, enforcement gaps in infra sharing, regulatory uncertainty, municipal levies, and QoS/USO monitoring challenges. No spectrum bands or fee incentives are reserved for rural deployment.

Table 34: Ghana - Operators' Perspectives

Dimensions	Operator 1	Operator 2
Services	Mobile 2G/3G; GEO satellite in select partnerships	2G/3G/4G LTE voice, data, SMS
Coverage	8 %	~ 2 %
Infrastructure	All 16 regions, all 261 districts; rural network at 5 % (plans to 20 % by 2027)	15 of 16 regions; 360 MTN-owned sites + 1,082 GIFEC sites (expanding to 2,016)
Challenges	99 % of towers & power infra leased; active infra owned	MTN owns 100 % of its sites; GIFEC sites shared by all MNOs
Spectrum	Power access, community accessibility, low ARPU/ROI	Power availability/costs, road access, unstable grid, low solar yields
Pricing	900/2100 MHz UMTS, Ku-band satellite	GSM 900/UMTS 900/800 MHz LTE relay
Financing	Prepaid & postpaid; no rural-specific plans	Uniform commercial bundles; rural PAYG via GIFEC at reduced rates
Regulatory asks	Government funding; no community models	1 % levy to GIFEC supports rural rollout

Summary of Challenges & Opportunities

- **Challenges**
  - Lack of dedicated rural coverage targets
  - Bureaucratic permitting and high spectrum/tax costs
  - Enforcement gaps in infrastructure sharing
  - Low rural ARPU and ROI, power and backhaul constraints

- Absence of rural-specific tariffs or end-user subsidies

- **Opportunities**
  - Use **GIFEC** to run OBA lots (rural towers + public-institution links) with measurable QoS milestones.
  - Establish a **one-stop RoW** and harmonize local levies; adopt dig-once/common-duct.
  - Pair sub-1 GHz obligations with **rural spectrum fee credits** for verified coverage.
  - Mandate **open-access** and publish wholesale **reference offers** (fiber, tower, backhaul).
  - Pilot **TVWS/dynamic sharing** for schools; expand **device financing** via OEM–fintech partnerships.

Next Steps

- Set rural coverage targets (e.g., 80 % by 2028)
- Streamline permitting/ROW via one-stop digital portals
- Introduce rural spectrum incentives (fee discounts, longer Licenses)
- Strengthen infra-sharing enforcement and incentivize active sharing
- Use USF strategically for last-mile subsidies (devices & connections)
- Promote demand stimulation (digital-literacy, community ICT centers)
- Pilot alternative technologies (TVWS, LEO satellites, RuralStar)
- Coordinate PPPs under clear performance and cost-sharing frameworks

Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt
Policy & Regulation	Q1–Q4	National Broadband Policy, Digital Ghana Agenda, GIFEC USF, GDAP (World Bank), NCA rural licensing. No rural targets. USF, tax waivers, concessional loans, PPPs, digital literacy programs drive expansion. Barriers: permitting/ROW, spectrum cost, infra sharing enforcement, regulatory uncertainty, municipal levies, QoS/USO monitoring.	Regulatory rural coverage obligations in License ; relies on USF & partnerships.	MTN and GIFEC sites deployed under USF; regulatory ask to remove rural expansion restrictions.

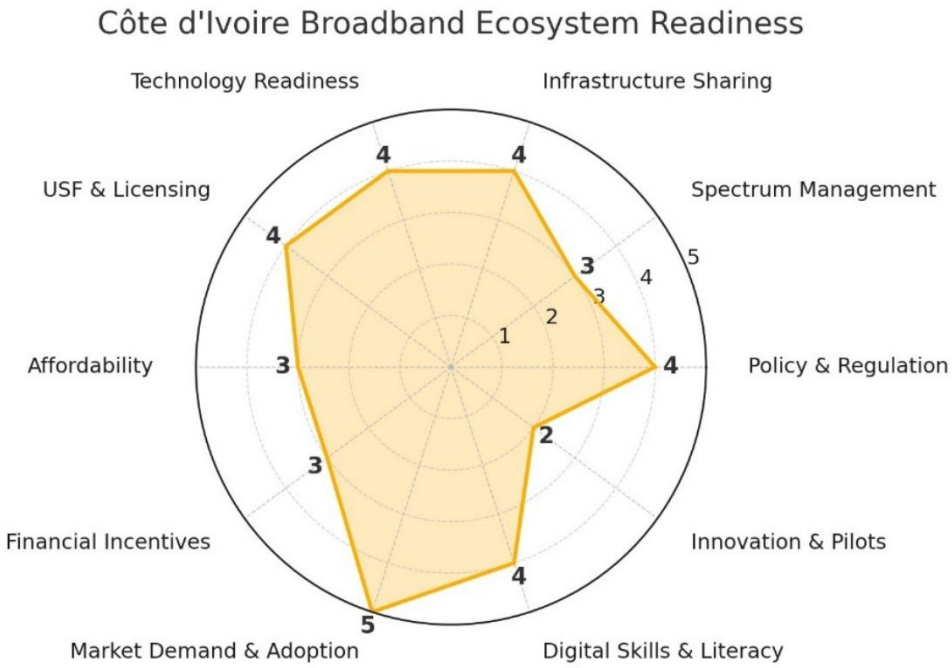
Spectrum Management	Q5–Q8	No spectrum bands or fee incentives dedicated to rural services. Dynamic sharing/TVWS not utilized. Admin assignment for USF projects.	Uses 900/2100 MHz UMTS and satellite Ku band; seeks rural fee reductions.	Uses GSM 900, LTE relay on 800 MHz; spectrum cost cited as principal barrier.
Infrastructure Sharing	Q9	Legal mandate for passive & active sharing: Electronic Communications Act, NCA Tower Guidelines, TowerCo Licenses, GIFEC projects, NGIC for 5G.	99 % of towers leased under sharing agreements enforced by regulator.	MTN owns 100 % of its rural sites; GIFEC's 1,082 shared towers (to expand to 2,016).
Technology Readiness	Q10	Government led projects: National Fiber Backbone, e Government Network, GIFEC Rural Telephony, GDAP PPPs, NGIC 5G infra.	Mobile 2G/3G networks; selective GEO satellite deployments.	2G/3G/4G LTE mobile; GIFEC & MTN rural fiber/ microwave backhaul.
USF & Licensing	Q11–Q12	USF (GIFEC) funds last mile and shared infra; PPPs mobilize private capital; no rural only License obligations but 99 % population coverage in mobile Licenses drives rural reach.	Relies on GIFEC USF for network sharing and rural PAYG bundles; License mandates rural build out.	MTN/GIFEC USF levy funds share towers; Licenses national in scope; desire clearer rural KPIs.
Affordability	Q13–Q14	No pricing constraints—operators free to set tariffs. No rural end user subsidy programs or satellite vouchers.	Standard prepaid & postpaid bundles; no rural specific pricing.	PAYG data under GIFEC Rural Telephony at reduced rates; overall uniform pricing.
Financial Incentives	Q15–Q16	None for rural operators (no spectrum or tax incentives).	Seeks lower spectrum fees and active sharing incentives.	Requests CAPEX subsidies, tax relief, redirection of GIFEC levy to new sites.

Market Demand & Adoption	Q21–Q23	No formal rural penetration or unserved metrics published; overall coverage data not provided.	8 % rural customer base; growing with network expansion.	~ 2 % rural broadband adoption; expanding via USF partnerships.
Digital Skills & Literacy	Q3, Q11	Digital literacy built into Digital Ghana Agenda; community ICT centres funded by GIFEC.	N/A	N/A
Innovation & Pilots	Q4, Q9	Regulatory support for TVWS/white space pilots under review; move toward active infra sharing (NGIC) and new PPP models.	Exploring niche GEO satellite partnerships; no public TVWS trials.	Exploring microwave relay and rural star LTE solutions; no community coop models yet.

7. Côte d'Ivoire's Broadband-Ecosystem Readiness Framework

Key Indicators	
Population coverage	98.34 %
Rural locality coverage	93.48 % (7 486 localities)
Unserved population	1.66 %
Urban speed (DL/UL)	75 Mbps / 32 Mbps
Rural speed (DL/UL)	33 Mbps / 17 Mbps
Fiber footprint:	30 303 km backbone; FTTH in 19 urban localities
License coverage obligations	≥ 99 % pop. voice; ≥ 95 % pop. data
Spectrum bands used	800/900/1 800/2 100/2 600 MHz
Infra-sharing mandate	Active & passive (law-backed)
USF-funded backbone	RNHD (> 5 200 km)
Digital-skills & gender targets	Ambitious national digital literacy & STEM targets (e.g. 100 000 engineers by 2025; 25 000 women trained per year)

Radar-chart visualization of Cote Dvoire's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Cote D'Ivoire's broadband ecosystem readiness** across ten key dimensions.

Table 35: Côte d'Ivoire's Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Strong multi-layered strategic frameworks & public programs (PNCR, PSNDEA); however, no standalone rural target; reliance on umbrella coverage obligations.
Spectrum Management	3	Uses full national-band allocations; lacks tailored rural fee or License incentives; dynamic-sharing prohibited.
Infrastructure Sharing	4	Mandated passive & active sharing; tower-cos and co-location models in place; strong regulator support.
Technology Readiness	4	RNHD provides extensive fiber backbone; significant public-sector projects complement private networks.
USF & Licensing	4	USF-driven backbone and rural towers; License conditions drive near-universal coverage; strong PPP model.
Affordability	3	Full tariff-freedom ensures market responsiveness; absence of rural-subsidy schemes limits targeted affordability.
Financial Incentives	3	No direct spectrum or tax incentives; USF and PPP are primary funding mechanisms but lack rural-specific customization.

Market Demand & Adoption	5	Very high coverage metrics (98.34 % overall; 93.48 % rural); unserved population minimal (1.66 %).
Digital Skills & Literacy	4	Ambitious national digital-education & gender-inclusion targets firmly established; strong execution plans.
Innovation & Pilots	2	No dynamic spectrum or TVWS pilots; regulatory challenges around incentivizing rural innovation; limited structured R&D or pilot programs beyond large infrastructure.

Overall Readiness: 3.6 / 5
Côte d'Ivoire exhibits one of the strongest broadband readiness profiles in West Africa, driven by advanced national strategies, extensive fiber backbone investments, strong USF-supported programs, and exceptionally high coverage levels. However, limited innovation pilots, the absence of rural-specific spectrum or fiscal incentives, and lack of targeted affordability schemes moderate its readiness score. Strengthening rural-focused innovation and targeted subsidies would further enhance rural broadband sustainability and adoption.

Regulator's Perspective

- **Policy & Regulation:**
  - Rural broadband embedded within multiple national frameworks (PND, Digital-Strategy, PNCR, PSNDEA).
  - No standalone rural-penetration target, but operators must cover 99 % mobile population; public initiatives aim for 100 %.
- **Spectrum Management:**
  - No rural-specific bands; use national allocations (800, 900, 1800, 2100, 2600 MHz).
  - No fee discounts or dynamic sharing/TVWS.
- **Infrastructure Sharing & Projects:**
  - Both passive & active sharing are mandated to reduce duplication.
  - Major public projects: RNHD (5 200 km fiber), PNCR, PSNDEA (160 towers, 175+ localities).
- **USF & Licensing:**
  - ANSUT-managed USF funds RNHD and rural projects.
  - No exclusive rural-licensing obligations, but 99 %/95 % population/data coverage clauses drive rural rollout.
- **Tariffs & Affordability:**
  - Full tariff-freedom subject to consumer-protection rules.
  - No targeted rural subsidies or end-user voucher programs.
- **Financial Incentives:**
  - No direct spectrum- or tax incentives for rural deployments; relies on USF grants and PPP (PCR).
- **Digital Skills & Literacy:**
  - National Digital Master Plan 2021–2025 sets extensive digital-education and gender-equality targets.

- **Innovation & Pilots:**
  - No dynamic-sharing or TVWS pilots yet; focus has been on large-scale fiber and tower projects.
- **Challenges:**
  - Economic/technical/geographic constraints (sparsity, ROI, energy/transport infrastructure).
  - Lack of tailored rural incentives beyond USF/PPP mechanisms.

Table 36: Côte d'Ivoire - Operators' Perspective

Dimension	Operator 1	Operator 2
Services & Coverage	Mobile voice/SMS/data; fixed voice/data (FTTH); mobile money **Rural customer share:** 24% **Coverage:** 74 % of rural communities (→ 81 % by 2027)	2G/3G/4G LTE **Rural customer share:** (data in progress) **Coverage:** 86.5 % of rural communities (→ 97 % by 2027)
Partners	ARTCI, ANSUT, PNCR	USF/PPP (via UCSAF)
Infrastructure	2G 900 MHz, 3G 900 MHz, 4G 800/1800 MHz40 % towers leased	2G 900 MHz, 3G 900 MHz, 4G 800 MHz/1800 MHz95 % infrastructure leased via revenue-share or tower-cos
Business Models	No rural-specific plans; national prepaid/data bundles	Prepaid voice/data bundles, usage-based billing; low-cost rural packs; targeted USSD/MoMo promotions
Financing	QoS-penalty conversions; USF subventions via ANSUT	Infrastructure sharing reduces capex; USF grants; cross-subsidization models
Challenges	Electricity unreliability; poor rural roads; low ARPU	Site-acquisition complexity; logistical/access constraints; power instability; security/vandalism
Needs & Next Steps	Spectrum-fee reductions; infrastructure-sharing incentives; tax breaks; extend penalties-to-investment protocol	Continued USF funding; simplify permits/wayleaves; tax exemptions for ICT equipment; regulatory incentives for shared MW/satellite backhaul

Summary of Challenges & Opportunities

- **Challenges**
  - No dedicated rural-broadband target or spectrum incentives.
  - High last-mile capex/opex; ROI uncertainty in sparsely populated areas.
  - Lack of formal rural subsidy or dynamic-sharing pilots.

- **Opportunities**
    - Create **rural spectrum fee credits** to complement high national coverage obligations.
    - Run **USF OBA** tenders for rural towers and community Wi-Fi; prioritize PSNDEA/PNCR localities.
    - Institutionalize **open-access** on RNHD/backbone segments with transparent wholesale pricing.
    - Enable **dynamic sharing/TVWS** for school/clinic clusters; pilot **neutral-host** in smaller towns.
    - Launch **targeted device/data subsidies** and SME digital programs to deepen adoption.
    - Streamline permits via a **one-stop RoW** with standard fees and SLAs.

Next Steps

- **Set explicit rural targets** within the upcoming broadband strategy (e.g. 95 % rural by 2030).
- **Introduce targeted incentives** (spectrum-fee discounts, tax exemptions, extended licenses) for rural deployments.
- **Pilot TVWS/dynamic-sharing projects** in select counties to boost innovation.
- **Enhance USF transparency** and streamline grant disbursement for tower and fiber projects.
- **Promote digital-skills programs** in tandem with infrastructure rollout to stimulate demand.
- **Encourage PPPs and community models**, leveraging local cooperatives and revenue-share agreements.
- **Explore renewable-power sites** and satellite backhaul for last-mile cost reduction.

Dimension	Key Question(s)	Regulator Excerpt	Operator 1 Excerpt	Operator 2 Excerpt
Policy & Regulation	Q1–Q4 – Strategy; targets; gov't role; barriers	"Rural connectivity is embedded in PND, Digital Strategy, PNCR & PSNDEA (38 billion FCFA, 160 towers). No specific rural targets—operators must cover 99 % mobile population; public initiatives aim for 100 %."	"We operate in all rural provinces under ARTCI/ANSUT/PNCR partnerships."	"We cover 86.5 % of rural communities, targeting 97 % by 2027 under USF/PPP frameworks."
Spectrum Management	Q5–Q8 – Bands; incentives; TVWS; process	"No rural specific bands; use national 800/900/1800/2100/2600 MHz. No reduced fees or extended Licenses for rural; spectrum procedure same as	"We deploy 2G/3G/4G on standard bands (900/1800/2600 MHz)."	"We use 2G/3G/4G (800/900/1800 MHz) with MW & VSAT backhaul."

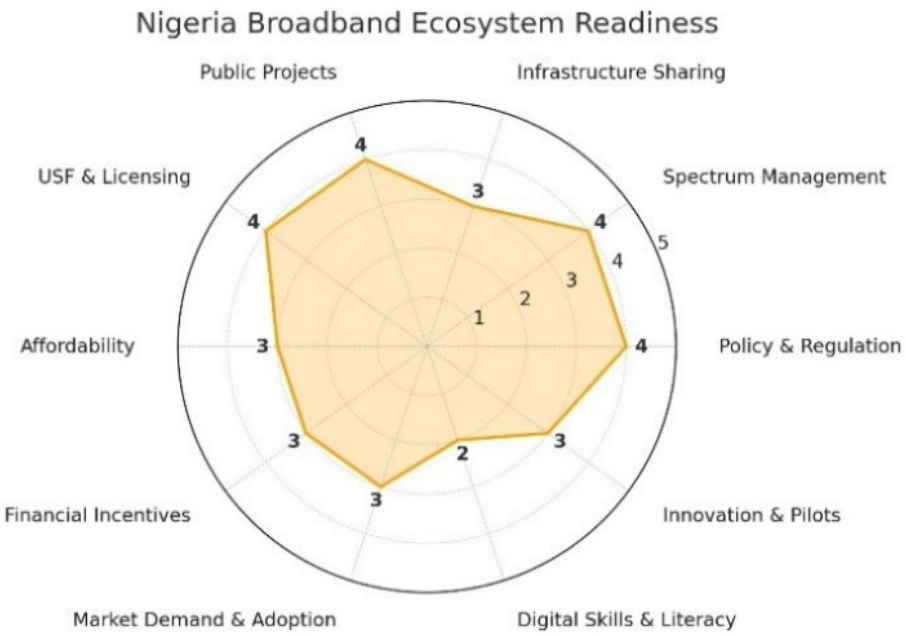
		urban (tenders/auctions). TVWS/dynamic sharing not allowed."		
Infrastructure Sharing	Q9 – Passive/active sharing	"Both passive and active infrastructure sharing are mandated to reduce costs, avoid duplication, and accelerate rural rollout."	"40 % of our rural towers are leased under sharing agreements; active sharing via national roaming."	"95 % of our infrastructure is leased under tower cos/revenue share."
Technology Readiness	Q10 – Govt led infra projects	"RNHD (5 200 km fiber), PNCR, PSNDEA (160 towers) are public flagship projects to extend broadband in rural areas, complementing private investments."	(No additional comment)	(No additional comment)
USF & Licensing	Q11–Q12 – USF/PPP role; rural License requirements	"ANSUT managed USF funds RNHD and rural connectivity. No exclusive rural License obligations—operators commit to 99 %/95 % population/data coverage, which drives rural expansion."	(No additional comment)	(No additional comment)
Affordability	Q13–Q14 – Tariff constraints; end user subsidies	"Operators enjoy full tariff freedom (subject to transparency & consumer protection rules). No targeted rural subsidies or voucher schemes, including for satellite."	"No rural specific plans; we offer national prepaid/data bundles."	"Prepaid voice/data bundles via USSD/MoMo; low cost packs for rural segments."
Financial Incentives	Q15–Q16 – Operator incentives; tax breaks	"No direct spectrum or tax incentives for rural deployments. Reliance on USF grants and PPP	(No additional comment)	"Infrastructure sharing reduces capex; USF grants support new rural LOTs."

		(PCR) for capex support."		
Market Demand & Adoption	Q21–Q23 – Coverage; rural penetration; unserved	"Coverage 98.34 %; rural localities 93.48 %; unserved 1.66 %. Strong rural uptake under public & private rollouts."	"24 % of our customers are rural; we cover 74 % of rural communities (→ 81 % by 2027)."	"We cover 86.5 % of rural communities (→ 97 % by 2027) and serve via shared infrastructure."
Digital Skills & Literacy	Q27 – Literacy/gender targets	"National Digital Master Plan 2021–2025 targets 100 000+ digital engineers, 25 000 women trained in STEM per year, ICT in curricula, training centers & e libraries."	(No additional comment)	(No additional comment)
Innovation & Pilots	Q7 & Q17 – Dynamic sharing; regulatory challenges**	"No TVWS/dynamic sharing. Major challenges: no coercive incentives for rural investment; some operators reluctant to share despite regulatory push."	"Rely on large scale fiber/tower projects; minimal innovation pilots."	"Leverage MW & VSAT; exploring cost effective rural site solutions; innovation focus on sharing models."

8. Nigeria's Broadband-Ecosystem Readiness Framework

Key Indicators	
Population Broadband Coverage	~48%
Rural Broadband Penetration	Significantly lower than urban; exact data not reported
Unserved Population	~52.3% remain without broadband access
Average Broadband Speeds	Urban 25 Mbps DL / 10 Mbps DL in rural areas (NNBP targets)
Fiber Penetration	Urban ~40%; Rural < 10%
Affordability Index	≤ ₦390 / GB (~ 2% median income)
Digital Literacy & Gender Equality Targets	95% digital literacy by 2030; gender equity goals embedded in digital economy strategy
Satellite Coverage	Key solution for hard-to-reach areas; no definitive rural coverage figure
Satellite Types	Ka-band and LEO systems under consideration

Radar-chart visualization of Nigeria's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Nigeria's broadband ecosystem readiness** across ten key dimensions.

Table 37: Nigeria's Broadband Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Comprehensive NNBP targets and USPF funding; needs finer geographic differentiation and rural KPI calibration.
Spectrum Management	4	Broad licensed/unlicensed bands and TVWS pilot frameworks; spectrum cost remains a barrier for operators.
Infrastructure Sharing	3	Long-standing sharing guidelines and open-access model; incentives for active sharing need strengthening.
Public Projects	4	Multiple flagship projects (RUBI, BTRAIN, NBAN, 7000 towers) under way; fiber backbone still uneven in rural zones.
USF & Licensing	4	USPF grants and License obligations enforce rural coverage; expanding scope to include device subsidies would help uptake.
Affordability	3	Mandated price caps and USPF subsidies exist; device and data affordability still limits penetration.

Dimension	Score	Rationale
Financial Incentives	3	USPF capex/opex funding and tax reliefs offered; more targeted fiscal incentives for rural broadband needed.
Market Demand & Adoption	3	~48% national coverage; rural uptake constrained by costs, literacy, and device availability; demand-stimulation lacking.
Digital Skills & Literacy	2	Ambitious 95% digital literacy target; few concrete rural training or inclusion programs implemented so far.
Innovation & Pilots	3	Emerging solar-hybrid and LEO trials; TVWS pilots in place; scaling and regulatory support for new tech still limited.

Overall Readiness: 3.4 / 5

Nigeria has a strong policy foundation, diverse spectrum assets, and extensive public projects. To close rural gaps, it should refine geographic KPIs, deepen affordability and literacy programs, enhance financial incentives for active sharing, and accelerate innovative pilots (TVWS, LEO, solar micro-stations).

Regulator's Perspective

Nigeria's regulatory framework for rural broadband is anchored in the **National Broadband Plan 2020–2025** and the **Digital Economy Blueprint** of the Ministry of Communications, Innovation & Digital Economy. Targets include 70% overall broadband penetration, 90% population coverage, minimum rural speeds of 10 Mbps, and universal service to 100% of unserved communities by 2025, with data priced at no more than ₦390/GB.

To achieve this, the Commission drives:

- **Policy & Funding:** Strategic planning, public-private partnerships, USPF grants, tax reliefs, and RoW fee reductions.
- **Spectrum Management:** Licensed IMT bands (700 MHz, 800 MHz, 2.3 GHz, 2.6 GHz), unlicensed bands (2.4 GHz, 5–5.9 GHz), and TV White Space usage.
- **Infrastructure Sharing:** Open-access and collocation guidelines dating to 2006, reinforced under NBP 2020–2025.
- **Public Projects:** "Project Bridge", "Project 774", NBAN, BTRAIN, RUBI and the Universal Access Connectivity Initiative (7,000 towers).
- **Licensing Obligations:** Mandated rural coverage and QoS KPIs, with RoW incentives.
- **Challenges:** High RoW costs, multiple taxation, limited spectrum availability, security risks, vandalism, digital-literacy gaps, and device affordability.
- **Recommendations:** RoW waivers, expanded PPPs, more USPF subsidy schemes, differentiated rural KPIs, and multi-stakeholder planning including energy and environment ministries.

Table 38: Nigeria - Operators' Perspectives

Dimension	Operator 1	Operator 2	Operator 3	Operator 4
Services & Reach	LTE mobile & leased-line in rural areas; ~32% customer base rural; national coverage via LTE.	2G/3G/4G across all regions; ~2% rural RGS 90 subs; 72% rural coverage, 75% planned by 2027.	2G/3G/4G voice/data; 32.6% rural subs; covers all geo-zones.	GSM voice/data; <10% rural subs; national cellular footprint.
Infrastructure	700/1800/2100 MHz; 30% rural coverage with 5% annual expansion; 100% company-owned.	Partners supply 65% of towers; MTN owns 35%; uses 900/1800 MHz (2G), 2 GHz (3G), 800/2600 MHz (LTE).	>95% towers leased; rural coverage 58.5%.	10% current rural coverage; plan to 70% by 2026; all sites leased.
Tariffs & Models	Tiered daily/weekly/monthly plans for all segments; no rural-specific pricing but targeted promos by geography.	Uniform nationwide plans; no differentiated rural pricing; cross-subsidy via device financing and low-entry bundles.	Prepaid daily/weekly/monthly with unlimited fair-use policies; discounted low-usage rural bundles; local ambassadors pilot.	No rural-specific plans; uniform pricing; exploring MVNO-style partnerships.
Challenges	High CAPEX/OPEX, low ARPU, security issues.	High TCO, security, ARPU, OPEX.	Site acquisition, power, vandalism, low profitability.	Low ARPU, poor ROI, lack of grid power.
Innovation & Partnerships	Rural telephony project with Huawei & Federal Government; hybrid power systems for sites.	USPF-backed rural telephony, partnerships with Infratel, VANU, others; solar-powered rural sites (194 deployed in 2024).	Mono-pole towers, MW-optimized backhaul, device subsidies via Airtel Foundation CSR.	Hybrid LTE relay backhaul; seeking Government collaboration and USPF funding.

Summary of Challenges & Opportunities

- **Challenges**
  - High CAPEX (towers, radio, ROW) and OPEX (diesel, maintenance).
  - RoW charges, spectrum cost, multiple taxes, uniform QoS KPIs.
  - Insufficient fiber backhauls, power scarcity, security and vandalism.
  - Digital-literacy deficits, device affordability, low rural ARPU.

- **Opportunities**
  - Ambitious NNBP targets and USPF financing.
  - Availability of TVWS pilots and open-access guidelines.
  - Major initiatives (RUBI, BTRAIN, NBAN) driving rural nodes.
  - Solar-hybrid sites, LEO satellite partnerships, low-cost tower designs.

Next Steps

- **RoW Reform:** Implement permanent waivers or fee-caps for rural deployments.
- **Spectrum Innovation:** Expand TVWS/dynamic sharing trials to spur investment.
- **Targeted USPF Schemes:** Extend grants to device subsidies and digital-skills training.
- **Differentiated KPIs:** Relax QoS thresholds for rural areas to reflect terrain and costs.
- **Multi-Stakeholder Coordination:** Joint planning with energy, environment, and local governments to streamline site access and provide power.

Dimension	Key Questions	Regulator Excerpt	Operator 1	Operator 2	Operator 3	Operator 4
Policy & Regulation	Q1–Q4	NNBP 2020–2025 & Digital Economy Blueprint: 70% penetration, 90% coverage, 10 Mbps rural speeds by 2025; USPF levies & RoW	Tiered daily/weekly/monthly offers; targeted rural promos under federal rural telephony project.	Uniform national plans; no special rural tariffs; cross subsidy via device financing and low entry bundles.	Prepaid daily/weekly/monthly with unlimited fair use; discounted low usage rural bundles; community ambassadors.	Uniform GSM plans; no dedicated rural packages; seeking Government USPF collaboration for rural rollout.

		incentives.				
Spectrum Management	Q5–Q8	Licensed IMT bands (700/800 MHz, 2.3/2.6 GHz); unlicensed 2.4/5–5.9 GHz; TVWS allowed; NCC piloting rural/community networks.	Uses 700/1800/2100 MHz; exploring LEO backhaul; constrained by high spectrum fees.	900/1800 MHz (2G), 2 GHz (3G), 800/2600 MHz (4G); solar powered rural sites deployed via USPF funding.	900/1800/2100/2600 MHz depending on traffic; no active TVWS; high frequency fees limit expansion.	GSM900/1800 MHz for rural telephony; no dedicated broadband spectrum but exploring hybrid satellite backhaul.
Infrastructure Sharing	Q9	Open Access Model (2013); NCC collocation guidelines (2006); NBP mandates both active & passive sharing.	100% company owned rural towers; mandates compliance with 2013 sharing guidelines.	65% partner owned rural towers; mandates collocation; calls for additional CAPEX sharing incentives.	> 95% towers leased under AER facilitated sharing; advocates active sharing incentives to cut OPEX.	100% leased sites; supports existing sharing regs; requests stronger incentives for operators.
Public Projects	Q10	"Project Bridge," "Project 774," NBAN, BTRAIN, RUBI,	Federal rural telephony with Huawei; USPF grants;	194 solar powered rural telephony sites in FY 2024; partnershi	Airtel Foundation CSR: solar micro pole projects; village level community Wi	Hybrid LTE relay trials; MVNO style roaming on Government rural network; USPF phase 10

		Universal Access Connectivity Initiative (7 000 towers).	hybrid power pilots for site sustainability.	p with USPF backed tower builds.	Fi pilots under USPF.	bidding underway.
USF & Licensing	Q11–Q12	USPF capex/opex grants; License obligations for rural coverage & QoS KPIs; RoW fee waivers for rural sites.	Leverages USPF for capex & opex; meets License roll out targets; no separate PPP beyond gov't project.	Self deployment by MNO and revenue share with partners; License mandates drive coverage in unserved wards.	USPF funding for last mile rural connectivity; strict QoS obligations but cross subsidy builds viability.	USPF grants pivotal; License requires rural rollout; seeks relaxation of uniform QoS for rural KPIs.
Affordability	Q13–Q14	Price regulation & consumer protection; mandatory affordable pricing; USPF subsidies for satellite; RoW fee reductions.	Multiple price points address all segments; no rural only tariffs but zonal promos.	Uniform pricing across board; no rural specific plans; device financing reduces entry barrier.	Low entry bundles start at ₦500; device subsidies via CSR; no dedicated discount plans for rural zones.	Uniform GSM tariffs; exploring MVNO models; no dedicated rural affordability scheme yet.

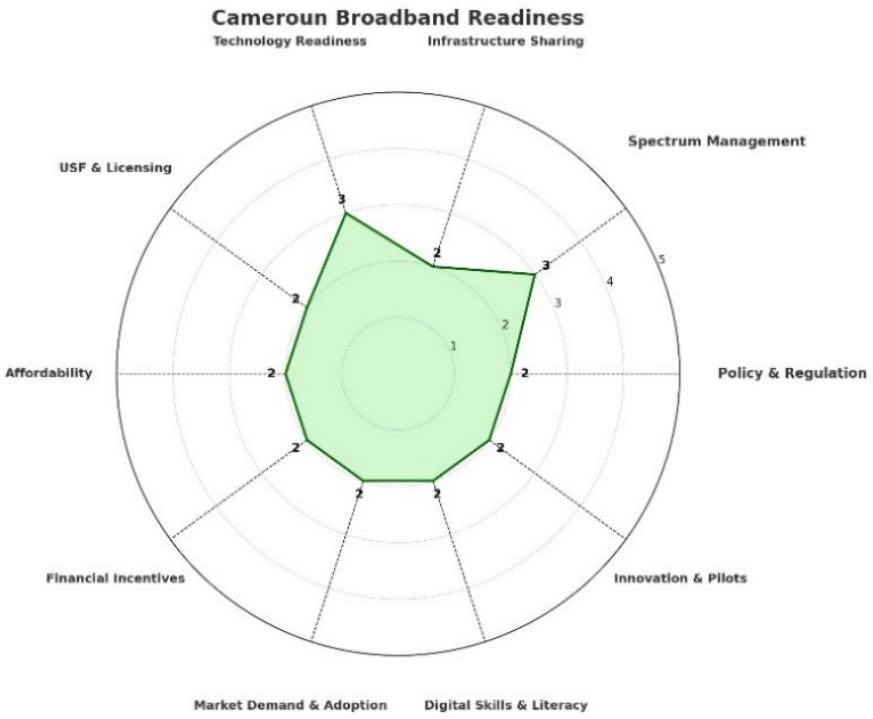
Financial Incentives	Q15–Q16	USPF capex/opex funding; tax relief on equipment; no broadband specific duty exemptions yet.	CAPEX/OPEX subsidies via USPF; high RoW waivers; engaging Treasury for rural fiscal incentives.	USPF BTS funding; tax reliefs for rural site imports; calls for full customs exemptions on equipment.	CAPEX/OPEX grants via USPF; enjoys duty free status on general ICT imports; seeks expansion to broadband kit.	USPF capex subsidies; seeks broader tax holidays; road access support through TANROADS/TARURA partnerships.
Market Demand & Adoption	Q17	High CAPEX/OPEX, vandalism, digital literacy gaps; need further PPPs, community engagement & device subsidies.	Low rural ARPU; security/vandalism hinder maintenance; community pilots show promise.	ARPU, TCO, security and high OPEX constrain ROI; rural ambassadors improve site protection.	Vandalism, low modem penetration; local ambassador scheme fosters trust and uptake.	Poor ROI; nascent demand stimulation; exploring satellite trials to expand coverage and usage.
Digital Skills & Literacy	Q27	95% digital literacy target by 2030; gender equity goals; few concrete rural	Partners with UNICEF on school digitalization; limited rural adult training so far.	Engages NGOs for community ICT centers under USPF; literacy remains significant gap.	Airtel Foundation trains youth in rural ICT clubs; more structured adult learning initiatives needed.	No dedicated digital skills programs yet; urges regulator to fund rural ICT labs and training hubs.

		training programs to date.				
Innovation & Pilots	Q7, Q19–Q20	TVWS adoption; NCC pilot for rural/community networks; recommends solar & mini stations; LEO evaluations.	Hybrid power BTS; Huawei rural site design; exploring dynamic sharing pilots.	Solar rural BTS (194 sites); LEO backhaul trials in partnership with Lynk; MW optimized relay solutions.	Mono pole towers; renewable energy for BTS; exploring small cell rural star solutions.	Solar BTS; LTE relay for last mile; advanced LEO satellite integration in proof-of-concept stage.

9. Cameroun's Broadband-Ecosystem Readiness Framework

	Key indicators
Policy status	National broadband policy responsibility sits with MINPOSTEL; operator licenses include rural coverage & QoS obligations.
Spectrum	IMT bands 700/800/1800/2100 MHz plus 5.8 GHz in use for access; microwave FH (5/8/18 GHz) and 2600 MHz (WiMAX/LTE) for transmission; administrative assignment process. TVWS/dynamic sharing did not authorize.
Incentives	New joint MINPOSTEL/MINFI order reduces rural spectrum fees; additional capex/opex coefficients applied for rural zones. Limited, targeted tax exemptions (not broadband-specific).
Infrastructure sharing	Passive sharing mandated, with some active mutualization cases.
USF/Funds	References to FST/FSE; regulator notes no USF-led rural projects to date.
Government buildings	No current state-led backbone expansion; legacy CAMTEL monopoly has stalled inter-urban fiber/FH deployment by operators.
Data gaps	National coverage %, rural penetration, speeds, fiber penetration, affordability indices, and digital-skills targets not supplied.
Satellite coverage	Regulator indicates 100% rural satellite coverage (GSO & NGSO; recent LEO (D2D) activity).
Data gaps	National coverage %, rural penetration, speeds, fiber penetration, affordability indices, and digital-skills targets not supplied.

Radar-chart visualization of Cameroun's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Cameroun's broadband ecosystem readiness** across ten key dimensions.

Table 39: Cameroun: Broadband Readiness Scores (1 = very low … 5 = very high)

Dimension	Score	Rationale
Policy & Regulation	2	Policies and License obligations exist, but legacy transport monopoly and high compliance costs constrain effective rural rollout.
Spectrum Management	3	Suitable IMT bands and admin assignment in place; rural-weighted fees help, but no TVWS/dynamic-sharing regime yet.
Infrastructure Sharing	2	Passive sharing allowed and used, limited active sharing; market structure and incentives not yet sufficient for scale.
Technology Readiness	3	3G/4G deployed with 70% rural-community coverage and plans to reach 90%, but power/backhaul gaps persist.
USF & Licensing	2	License obligations are clear, yet USF execution is limited; FST/FSE referenced but few realized rural projects.
Affordability	2	Market-based tariffs without rural subsidies; operator relies on cross-subsidy; low ARPU remains a brake on adoption.

Dimension	Score	Rationale
Financial Incentives	2	Some spectrum-fee relief and rural coefficients; broader tax/CapEx incentives are ad-hoc and not broadband-specific.
Market Demand & Adoption	2	Only ~4% of customers are rural; affordability, access and security issues suppress uptake.
Digital Skills & Literacy	2	No national targets/programmes reported; usage stimulation at institutions still needed.
Innovation & Pilots	2	Early movement on low-cost sites and LEO D2D exploration, but no formal national pilot frameworks (e.g., TVWS) yet.

Overall Readiness: 2.0 / 5

Cameroun shows foundational elements (bands, obligations, passive sharing), but rural execution is constrained by transport monopolies, energy/backhaul deficits, limited USF delivery, and weak affordability/demand enablers; targeted incentives, power co-investment, and active sharing/LEO pilots could lift readiness.

Regulator's perspective

- **Policy & targets:** Policies exist (MINPOSTEL); **License obligations** enforce rural coverage/QoS.
- **Enablers: Rural-weighted spectrum fees**; administrative spectrum awards; **passive sharing** policy; tariff setting **market-based** (no rural price controls).
- Barriers: Transport/multiplex monopoly, high compliance costs for new entrants; energy, infrastructure gaps, and insecurity; no TVWS framework; USF projects absent.
- **Recommendations:** Create an **enabling environment** (power, security, PPPs); align administrations and users (hospitals, universities, agencies) to **drive usage**.

Table 40: Cameroun - Operators' perspective

Dimension	Operator 1
Services & footprint	GSM/UMTS/LTE; **70%** of rural communities covered, aiming for **90% by 2027**; presence in **all 10 regions** where rollout is active.
Network model	Rural tech: UMTS2100, LTE700/800/2600; 73% of rural towers leased/shared (1 116/1 523).
Commercials	**Prepaid bundles** (daily/weekly/monthly); **cross-subsidy from urban** markets; no rural-only plans.
Challenges	Site acquisition; power scarcity; no fiber backhaul; fuel logistics; access & insecurity; low ARPU.
Asks from government/regulator	Spectrum-fee reductions, stronger sharing incentives, FST-backed capex for new sites, tax relief.
Innovation & plans	**Low-cost rural sites**; modernize existing sites; explore **LEO "direct-to-cell"** and community-network/revenue-share models.

Summary of Challenges & Opportunities

- **Challenges**

  Fragmented transport rights & legacy monopoly constraints; power and backhaul deficits; security & access; low rural affordability/ARPU; no TVWS regime; limited USF execution.

- **Opportunities**

  Rural-weighted spectrum fees; expand passive/active sharing; leverage AER mini-grids/solar; LEO backhaul/D2D pilots; FST/FSE to de-risk capex; PPP templates for low-cost sites; harmonized fiber reference framework.

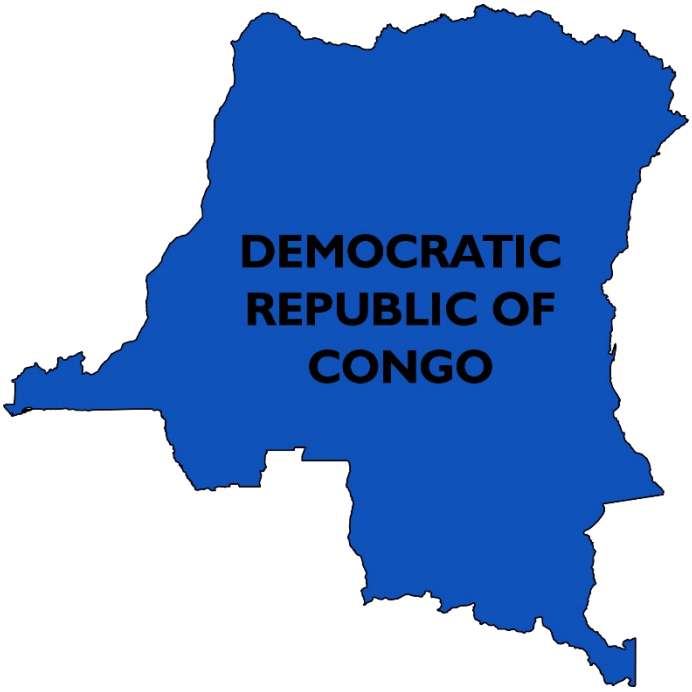
Next Steps

- Publish **fiber-deployment reference** & open-access guidelines; operationalize **rural spectrum-fee rebates**; launch **FST-funded low-cost site program** with power co-investment via AER; fast-track **wayleave** SLAs.
- Approve **active-sharing** offers (MORAN/MOCN) in rural; run **LEO backhaul/D2D pilots**; ring-fence USF/FST for **tower + solar + microwave/LEO** bundles; standardize **rural tariff safeguards** (fair-usage, zero-rating for e-gov).
- Gradually unwind transport monopolies; scale **open-access backbones/spurs**; embed **results-based financing** tied to usage (education/health anchors).

Dimension	Key question	Regulator excerpt	Operator 1
Policy & Regulation	Is there a clear rural policy and enforceable targets?	"MINPOSTEL is in charge of policies… Obligations de couverture et de QoS dans les cahiers de charge." Barriers include transport/multiplex **monopoly** and high compliance costs.	Present in **10 regions**; rollout driven by License **coverage obligations**; meeting timelines is a regulatory constraint.
Spectrum Management	Are rural-friendly bands and processes in place?	IMT bands 700/800/1800/2100 MHz and 5.8 GHz; microwave 5/8/18 GHz; administrative assignment; TVWS not regulated; new fee order accounts for rural zones.	Uses 700/800/2100/2600 MHz; seeks spectrum-fee reductions to improve viability.
Infrastructure Sharing	Is sharing (passive/active) enabled and used?	**Passive sharing** policy; "quelques cas" of **active** mutualization.	**73%** of rural towers **leased/shared**; wants **more incentives** for

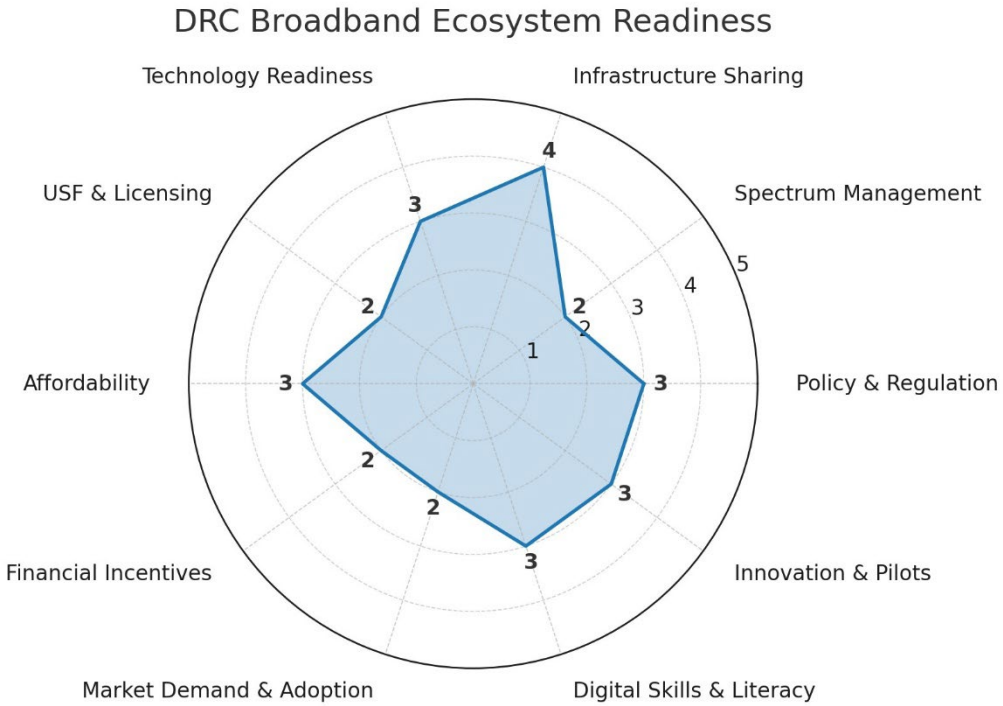
			active sharing to cut cost/time.
Technology Readiness	Are the right access/backhaul technologies available?	Operators have access to IMT bands; constraints: **energy, infrastructure, insecurity**; no state fiber expansion due to **CAMTEL monopoly**.	Rural tech: **UMTS2100, LTE700/800/2600**; **70%** communities covered; aims **90% by 2027**; **no fiber** in many areas; power/logistics hurdles.
USF & Licensing	Do USF/PPP and licensing conditions support rural?	Mentions **FST/FSE**; regulator reports **no USF (FSU) projects**; Licenses embed rural **coverage/QoS** requirements.	Seeks **FST capex** support and PPP facilitation for new rural sites and power access (via **AER**).
Affordability	Are rural tariffs & end-user support addressed?	**No tariff constraints**; competition drives prices; **no end-user subsidies** (incl. satellite).	**Prepaid** daily/weekly/monthly bundles; **cross-subsidy** from urban markets; no rural-specific plans.
Financial Incentives	Are fiscal/spectrum incentives available?	Rural-weighted spectrum fees; capex/opex coefficients; limited tax exemptions (not broadband-specific).	Requests **capex subsidies (FST)** and **tax relief** due to low rural ROI.
Market Demand & Adoption	Is there evidence of demand/usage growth?	Notes affordability/power/insecurity hurdles; no quantitative adoption metrics provided.	Rural customers ≈ **4%** of base; **low ARPU**; plans to extend coverage and modernize to stimulate demand.
Digital Skills & Literacy	Are there national targets/programmes ?	**RAS** (not available).	No specific programmes cited; indicates need to drive usage at public institutions and communities.
Innovation & Pilots	Are new models/tech being trialed?	**No TVWS**; calls for enabling environment (power/security/PPP) before scale.	Low-cost rural sites; exploring LEO "Direct-to-Cell"; open to community networks and revenue-share partnerships.

DRC's Broadband-Ecosystem Readiness Framework



Key Indicators	
Population covered by broadband	**55 %**
Population unserved	66 %
Rural community coverage	20 %
Urban broadband speed	50–100 Mbps (DL)
Backbone fiber built	~ 12 500 km (25 % of target)
Rural spectrum reserved	None
License coverage obligations	National only
Infra-sharing mandate	Active & passive
USF operational status	Not yet functional

Radar-chart visualization of DRC's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **DRC's broadband ecosystem readiness** across ten key dimensions.

Table 41: DRC's Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	3	Strong strategic vision (PNSD 2050) but USF not operational and no rural License mandates.
Spectrum Management	2	No dedicated rural bands; incentives under discussion; TVWS not yet allowed.
Infrastructure Sharing	4	Both passive and active sharing legally permitted, easing new-site rollouts.
Technology Readiness	3	National backbones underway (SCPT, SOCOF) but low population coverage (55%).
USF & Licensing	2	USF entity exists on paper but inactive; no rural coverage obligations in operator Licenses.
Affordability	3	Full tariff freedom and some operator-led regional offers, but no formal rural or consumer subsidy programmes.
Financial Incentives	2	Promised incentives are still under study; no tax breaks or fee waivers implemented.
Market Demand & Adoption	2	Low overall coverage (55%), high unserved rate (66%), and no clear rural-penetration statistics hamper uptake.
Digital Skills & Literacy	3	Ambitious digital-education goals exist, but execution details and metrics remain undefined.
Innovation & Pilots	3	Operators pioneering solar-hybrid BTS and LEO/MW backhaul; regulatory pilots lacking but commercial innovation underway.

Overall Readiness: 2.7 / 5

The DRC demonstrates solid policy intent and growing operator-led innovation, but readiness is constrained by low coverage, an inactive USF, lack of rural-explicit obligations, and limited fiscal or spectrum incentives. Infrastructure-sharing rules are a bright spot, but stronger regulatory enforcement and operationalization of USF mechanisms are needed to stimulate sustainable rural broadband expansion.

Regulator's Perspective

DR Congo's Plan National Stratégique de Développement (PNSD 2050) sets ambitious digital goals (≥ 50 % fiber-homes; ≥ 90 % mobile-internet). A Universal Service Fund (FDSU) is legislated but not yet operational, and fiscal-exemption measures remain under review. No spectrum bands or special licensing procedures are dedicated to rural broadband, though a draft decree for rural-area fee incentives is in discussion. Infrastructure-sharing regulations permit

both passive and active sharing. Public fiber backbones (SCPT, SOCOF) span from Moanda towards central/southern provinces. The FDSU is intended to subsidize "last-mile" rural projects; PPPs are recognized as crucial. Operators face no tariff constraints beyond mandated price floors, and no end-user subsidy schemes currently exist. Key regulatory challenges include non-operational USF, pending fiscal-exemptions, high rural unserved rates (66%), and complex rural KPI enforcement.

Policy recommendations emphasize:

1. Operationalizing the USF immediately
2. Implementing rural tax exemptions on equipment & devices
3. Expanding TV White Spaces regulation for spectrum access
4. Enshrining rural-coverage obligations in license terms
5. Accelerating PPP frameworks and funding mechanisms

Table 42: DR Congo - Operators' Perspectives

Dimensions	Operator 1	Operator 2
Profile & Coverage	2G/3G/4G + FWA; 15% rural customers; serves Kwilu, Kwango, Kasai Central/Oriental, Tanganyika, and Greater Kivu peripheries.	Voice, LTE data, satellite internet, SMS/VAS; 28.2% rural subscribers.
Partners	No response	Ongoing FSU project; collaboration with ADN.
Infrastructure	20% rural coverage; 98% rural towers leased under sharing agreements.	No response
Business Models & Tariffs	Prepaid daily/weekly/monthly bundles; "ultra-low-cost" solar-hybrid sites; LEO/MW backhaul; local caching to cut OPEX. No rural-specific subsidies.	Prepaid & PAYG usage-based pricing; low-cost site rollouts; region-specific offers; special rural tariffs in selected areas.
Financing & Incentives	USF-funded capex/opex subsidies; duty exemptions; no License -differentiated rates.	Infrastructure sharing; basic-infrastructure support (power, roads); project financing via USF.
Challenges	Lack of grid power; impassable roads; no fiber; insecurity; very low ARPU; high OPEX.	Insecurity; high transmission costs; site-access issues; energy supply constraints; heavy fiscal levies; low ARPU.
Innovation	No response	Renewable-powered Rural Star; satellite plug-and-play base stations; FH backhaul.
Needs & Next Steps	VAT/customs exemptions on rural equipment (antennas, CPE, solar panels); discounted rural spectrum fees; USF activation.	Reduce spectrum fees; infrastructure-sharing incentives; tax exemptions; operationalize USF and

	Next Steps: Roll out further low-cost rural sites using solar hybrids and LEO; collaborate on USF implementation.	mapping/coordination frameworks; enable LEO pilots (e.g. OneWeb).

Summary of Challenges & Opportunities

- **Challenges**
  - USF (FDSU) is not yet operational
  - No rural-specific spectrum bands or licensing procedures
  - High unserved rate (66 %), limited fiber rollout (25 %)
  - Absence of end-user subsidies and fiscal incentives
  - Difficult terrain, power shortages, security risks

- **Opportunities**
  - Operationalize **FDSU** with OBA tenders (CAPEX + time-bound OPEX) for rural sites and institutions.
  - Introduce rural spectrum fee credits; allow TVWS/dynamic access and expedited refarming.
  - Permit **LEO/MEO backhaul** and upgrade long microwave hops for remote corridors.
  - Enforce passive sharing and pilot neutral-host/active RAN sharing (MOCN/MORAN).
  - Expand **open-access** wholesale on any publicly supported backbone segments.
  - Duty relief/financing for entry smartphones & FWA CPEs; Community Digital Centres to lift usage.
  - Standardize **solar-hybrid** with security hardening and incident-response protocols.

Next Steps

- Activate the USF with clear disbursement rules for rural buildings.
- Enact tax & customs exemptions on rural-area telecom equipment.
- Formalize rural spectrum incentives via the pending decree.
- Introduce TV White Spaces pilots in underserved provinces.
- Mandate rural-coverage KPIs in all license renewals.
- Expand PPP frameworks to co-finance towers, fiber, and power solutions.
- Support solar-hybrid and caching pilots to lower rural OPEX and improve service continuity.

Dimension	Key Question(s)	Regulator Excerpt	Operator 1	Operator 2
Policy & Regulation	Q1–Q4: Strategies;	PNSD 2050 sets ≥ 50 % fiber & ≥ 90 % mobile	No rural specific policy beyond	National licenses only; FSU project

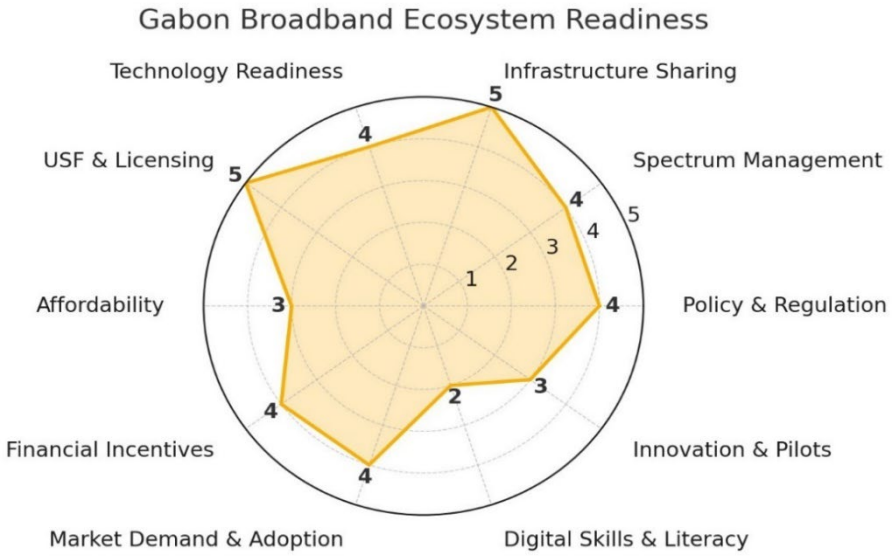
	targets; role; barriers	internet goals; USF (FDSU) legislated but not operational; fiscal exemptions under review; rural licenses remain national.	PNSD; FSU body exists but inactive.	ongoing but not yet delivering subsidies.
Spectrum Management	Q5–Q8: Bands; fee incentives; TVWS; process	No rural reserved bands; draft decree under discussion for rural fee incentives; TVWS/dynamic sharing not yet applied; no special procedures.	Uses 800 MHz LTE; awaiting rural fee incentives.	Spectrum costs remain high; lengthy approval processes; requests rural fee relief.
Infrastructure Sharing	Q9: Passive/active sharing	Passive and active sharing allowed under telecom regulations.	98 % rural towers leased under sharing agreements.	No specific sharing regs beyond general law; sharing pilots implicit in FSU backbone deployments.
Technology Readiness	Q10: Govt led infrastructure projects	Public fiber backbones (SCPT, SOCOF) deploying from Moanda to south via central provinces.	Rural coverage at 20 %; no fiber in many districts; deploying low cost sites.	Backbone builds under SCPT/FSU; satellite internet partnerships in pilot phase (OneWeb).
USF & Licensing	Q11–Q12: USF/PPP role; rural obligations	FSU to subsidize last mile rural builds; PPPs important; no rural coverage clauses in national licenses.	Government/donors fund backbone & towers; operators deliver services.	FSU project active; ADN partnership; no license based rural obligations.

Affordability	Q13–Q14: Pricing constraints; subsidies	Operators free to set tariffs within regulatory price floors; no end user subsidy programmes yet; USF user support in prep.	Prepaid bundles only; no rural specific subsidies.	Prepaid and PAYG tariffs; region specific offers; special rural tariffs in pilot areas.
Financial Incentives	Q15–Q16: Operator incentives; tax breaks	All financial incentives under study; no tax exemptions yet.	Seeks VAT & customs exemptions on rural equipment; USF activation.	Calls for tax and customs duty relief; operationalize FSU.
Market Demand & Adoption	Q21–Q23: Coverage; rural penetration; unserved	Population 55 % covered; unserved 66 %; rural penetration ND.	15 % of subscribers rural; 20 % rural geographic coverage.	28.2 % of subscribers rural; 75.8 % rural communities claimed covered (operator estimate).
Digital Skills & Literacy	Q27: Literacy & gender targets	National plan to embed digital education in schools and create ICT curricula and training centers.	N/A	N/A
Innovation & Pilots	Q7 & Q20: TVWS/dynamic sharing; innovation	No TVWS/dynamic sharing applications yet; FSU pilot frameworks pending.	Solar hybrid sites; ultra low cost rural BTS; LEO & MW backhaul; caching/local traffic optimization.	Solar powered base stations; OneWeb rural pilot; low cost site rollouts.

10. Gabon's Broadband-Ecosystem Readiness Framework

	Key Indicators
Population	
Broadband Coverage	3G 97.18% / 4G 97.03%
Rural Broadband Penetration	3G 85.90% / 4G 85.13%
Unserved Population	3G 2.82% / 4G 2.97%
Average Broadband Speed	Uplink 29 Mbps / Downlink 65 Mbps (best-case) and Uplink 16 Mbps / Downlink 40 Mbps (alternate)
Fiber (FTTH) Subscriptions	≈ 100 000 lines for 2.4 M population
Universal Service Fund (USF) levy	2 % of operators' revenue
Policy targets	90 % overall broadband penetration by 2032 90 % 2G/3G/4G rural coverage by 2028

Radar-chart visualization of Gabon's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Gabon's broadband ecosystem readiness** across ten key dimensions.

Table 43: Gabon's Broadband Readiness Scores & Rationale (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Clear national & rural coverage targets; USF levy mechanism; government subsidy framework, but rural classification complexity remains.
Spectrum Management	4	Full IMT spectrum licensing with rural fee discounts; no dynamic-sharing; straightforward assignment via national License bands.
Infrastructure Sharing	5	Mandatory passive & active sharing with regulated tariffs; high ownership incentivizes neutral tower-cos.
Technology Readiness	4	Diverse technology mix (2G/3G/4G, LEO satellite, FH); strong USF-funded rural project.
USF & Licensing	5	USF provides both capex and opex subsidies; licensing includes explicit rural coverage clauses.
Affordability	3	Tariff freedom fosters competition; absence of consumer-level rural subsidies limits targeted affordability.
Financial Incentives	4	USF capex/opex support; duty exemptions for rural operators; no additional fiscal incentives beyond USF.
Market Demand & Adoption	4	High overall coverage metrics; rural coverage strong but pockets of unserved persist; potential growth via USF and private rollout.
Digital Skills & Literacy	2	No formal digital-education or gender-inclusion targets, though operator–UNICEF school programs exist.
Innovation & Pilots	3	Pilot LEO satellite and solar-powered USF small-cells underway; no TVWS/dynamic-sharing; room for broader innovative pilots.

Overall Readiness: 3.8 / 5

This reflects strong policy support, infrastructure sharing mandates, USF backing, and broad technology deployment, with opportunities to enhance affordability, digital literacy targets, and innovation pilots.

Regulator's Perspective

- **Policy & Regulation:**
  - National Broadband Strategy 2022-2030 aims 90 % broadband by 2032 and 50 % reduction in average internet cost via USF.
  - Rural coverage target: 90 % 2G/3G/4G by 2028 in non-served areas.
  - USF financed by 2 % levy on operator turnover.
- **Regulatory Barriers:**
  - Rural area classification and fiscal exemptions process complexity.
- **Spectrum Management:**
  - Full IMT spectrum (700, 800, 900 MHz, 2.3 GHz) allocated under License ; rural fee discounts offered.
  - No dynamic-sharing or TVWS.
- **Infrastructure Sharing:**
  - Mandatory passive & active sharing across all zones; rates set by regulation.
- **Public Infrastructure Projects:**
  - "Promotion et Développement intégrés…" project provides community Wi-Fi and basic telephony in rural areas via USF.
- **USF & Licensing:**
  - USF grants capex/opex subsidies; License terms include specific rural coverage obligations.
- **Tariffs & Affordability:**
  - Full tariff freedom; no end-user subsidy programs.
- **Financial Incentives & Taxation:**
  - USF-funded capex/opex subsidies; duty exemptions for rural operators.
- **Challenges & Lessons:**
  - High deployment costs, limited operator investment, difficult terrain/access.
  - Solar-powered mini-base stations recommended to reduce opex.
- **Government–Private Collaboration:**
  - Jointly plan deployments and USF subsidy schedules with energy, environment, social ministries.

Table 44: Gabon - Operators' Perspective

Dimensions	Operator 1	Operator 2
Services & Coverage	Mobile 2G/3G/4G, satellite, FH. Rural share: 30 % **Coverage approach:** All regions targeted; very low-pop areas (< 500 inhabitants) handled via USF.	Fixed & mobile telephony; Internet access (2G/3G/4G; satellite; Rural Star LTE Relay). Rural share: 12% **Coverage:** 65.18% of rural communities (75 % by 2028).
Partners	USF/UNICEF digital-schools partnership.	ARCEP (Universal Service) for rural broadband.
Infrastructure	2G/3G/4G (800/900/1800/2100 MHz), LEO satellite, FH. 98 % of rural towers owned.	800 MHz (4G) & 900 MHz (2G/3G/4G), satellite, Rural Star relay. 96 % infrastructure owned; 4 % leased/shared.
Business Models & Tariffs	Uniform national pricing; prepaid/usage-based voice & data; no rural-specific plans; CSR-driven promotions.	Uniform pricing; promotional packages; Rural Star LTE bundles with low entry points.
Financing & Incentives	USF-funded capex/opex subsidies; duty exemptions; no License -differentiated rates.	Infrastructure sharing; basic-infrastructure support (power, roads); project financing via USF.
Challenges	Site acquisition delays (permits/environment); lack of power; poor roads; difficult terrains.	Geographic access; infrastructure costs; low density/ARPU; maintenance/security; environmental constraints.
Innovation	Testing solar-optimized USF sites; exploring LEO satellite for radio access.	Renewable-powered Rural Star; satellite plug-and-play base stations; FH backhaul.
Needs & Next Steps	Spectrum-fee cuts; infrastructure-sharing normalization; tax exemptions; streamlined environmental approvals; USF subsidy scheduling.	Continued USF support; low-cost LTE rollouts; VSAT gateways; solar grants; community-network models.

Summary of Challenges & Opportunities

- **Challenges**
    - High capex/opex due to equipment, energy, terrain and permit delays.
    - Rural area classification ambiguity and fiscal-exemption complexity.
    - No dedicated end-user subsidies or dynamic-spectrum pilots.
- **Opportunities**
    - Activate USF as **output-based aid (OBA)** with milestone KPIs (uptime/throughput) for rural towers and school/clinic links.
    - Introduce **rural spectrum fee credits** and **term extensions** for verified deep-rural sites.
    - Enable **TVWS/dynamic sharing** for community Wi-Fi and campus coverage; fast-track pilot rules.
    - Mandate **open-access** on publicly funded backbone with transparent wholesale price list.
    - **One-stop RoW** and dig-once/common-duct with utilities to cut trench and time costs.
    - Scale **solar-hybrid power** and power-as-a-service to reduce diesel OPEX.
    - Targeted **device/data vouchers** and school/clinic anchor programs to stimulate demand.

Next Steps

- **Achieve 90 % rural 2G/3G/4G** by 2028 via targeted USF funding and duty exemptions.
- **Introduce License -linked rural incentives** (fee discounts, longer tenure) beyond current spectrum rebates.
- Scale solar-powered small-cell deployments to reduce opex in off-grid zones.
- **Streamline permits** by convening energy, environment and ICT ministries under a single rural deploy task force.
- **Pilot alternative technologies** (LEO satellite, LTE relay) in hardest-to-serve communities.
- **Strengthen PPP planning** with joint roll-out schedules and multi-year USF subsidy commitments.
- **Standardize infrastructure sharing** as a regulated industry norm, with published rate cards.

Dimension	Key Question(s)	Regulator Excerpt	Operator 1	Operator 2
Policy & Regulation	Q1–Q4 – Strategy; rural	"90 % broadband by 2032; 50 % cost	"We cover all regions;	"ARCEP-backed USF projects for

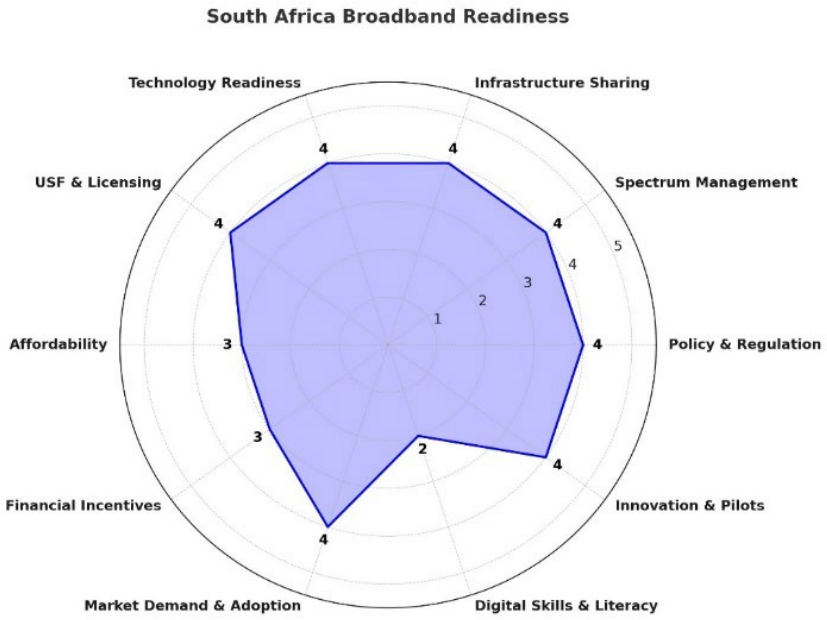
Dimension	Key Question(s)	Regulator Excerpt	Operator 1	Operator 2
	targets; gov't role	reduction via USF. 90 % rural 2G/3G/4G by 2028. USF funded by 2 % levy."	USF/UNICEF digital-schools partnership."	rural broadband."
Spectrum Management	Q5–Q8 – Bands; incentives; TVWS; process	"IMT spectrum (700–2.3 GHz) allocated in rural zones; fee discounts for rural use; no TVWS/dynamic-sharing."	"Deploy 2G/3G/4G (800/900/1800/2100 MHz); LEO satellite & FH."	"800 MHz & 900 MHz for 2G/3G/4G; Rural Star relay; satellite backhaul."
Infrastructure Sharing	Q9 – Passive/active sharing	"Mandatory passive & active infrastructure sharing; regulated tariffs."	"98 % rural towers owned by us."	"96 % infrastructure owned; 4 % leased/shared."
Public Projects	Q10 – Govt-led fiber/Wi-Fi	"'Promotion et Dév. intégré…' project enables basic telecom & community Wi-Fi in rural wards via USF."	—	—
USF & Licensing	Q11–Q12 – USF/subsidy role; rural License req	"FSU grants capex/opex subsidies; License mandates rural coverage clauses."	"USF-funded project will cover low-pop zones under universal-service scheme."	"USF financing; infrastructure sharing with government."
Affordability	Q13–Q14 – Tariff freedom; end-user support	"Operators free to set tariffs; no rural-specific subsidy programs."	"Uniform pricing; CSR-led promotions; no rural-only plans."	"Uniform pricing; promotional bundles; no designated rural packages."
Financial Incentives	Q15–Q16 – Operator incentives; tax breaks	"USF subsidizes capex/opex; rural operators exempt	"USF/LEO subsidies; duty exemptions applied."	"Infrastructure sharing; base-infrastructure support; no

Dimension	Key Question(s)	Regulator Excerpt	Operator 1	Operator 2
		from customs duties."		additional fiscal measures cited."
Market Demand & Adoption	Q21–Q23 – Coverage; rural penetration; unserved	"3G: 97.18 % pop cover, 85.90 % rural; 2.82 % unserved. 4G: 97.03 %, 85.13 %, 2.97 % unserved."	"30 % of our customers are rural; low-pop (< 500) areas via USF."	"12 % rural share; 65.18 % rural coverage (→ 75 % by 2028)."
Digital Skills & Literacy	Q22–Q23 – Education & gender targets	"None specified."	"USF/UNICEF partnership for school digitalization."	"No digital-skills targets cited."
Innovation & Pilots	Q7 & Q18–Q20 – TVWS; cost-drivers; solutions	"No TVWS pilots. High opex (energy) highlights need for solar small-cells."	"Deploy solar-optimized USF sites; testing LEO satellite for rural radio."	"Rural Star LTE relay; renewable-powered stations; satellite for backhaul."

11. South Africa's Broadband-Ecosystem Readiness Framework

Key indicators	
National strategy	*South Africa Connect* (Phase 2 in progress).
Coverage (mobile broadband)	99.79% population coverage.
Rural obligations tied to spectrum awards (36 months)	Connect 18,520 schools; 1,764 hospitals & 3,967 clinics; 567 SAPS sites; 8,241 traditional/tribal authority centres with 10 Mbps, uncapped, upgradable.
State Digital Infrastructure Company (planned merger of Broadband Infraco & SENTECH)	To enable minimum 5 Mbps for ~5.83M households, incl. 33,539 community Wi-Fi hotspots, 1,600 VSAT households (EC, KZN, NC).
Spectrum (examples for rural use)	IMT700/750/800/900/1500; TVWS framework (2018); draft Dynamic Spectrum Access regs published.
Infrastructure sharing	Active sharing permitted (policy support in place).
USF/USAAS	Levies (up to ~1% of turnover) and subsidies for underserved areas; competitive tenders envisaged.
Tariffs	No rural price controls: affordability tracked vs. income (UN threshold 2% of GNI p.c.).
Fiber penetration (household access)	3.43% national; 2.77% urban; 0.66% rural.

Radar-chart visualization of South Africa's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **South Africa's broadband ecosystem readiness** across ten key dimensions.

Table 45: South Africa's Broadband Readiness (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	SA Connect Phase 2 and clear coverage obligations create a strong policy spine.
Spectrum Management	4	Rural-friendly IMT bands assigned; TVWS enabled; DSA regs advancing; auctions used.
Infrastructure Sharing	4	Active sharing permitted and encouraged, though enforcement/terms can deepen.
Technology Readiness	4	~99.8% population mobile coverage; rural fiber thin but SDIC/SA-Connect aim to bolster backhaul.
USF & Licensing	4	USF framework with competitive grants; spectrum awards carry public-institution/rural obligations.

Affordability	3	No broad end-user subsidies; affordability guided by 2% income benchmark; pockets of community Wi-Fi/VSAT.
Financial Incentives	3	Capex subsidies indicated; limited tax incentives/opex relief constrain deep-rural viability.
Market Demand & Adoption	4	Large anchor-demand via mandated school/clinic/police connections; household uptake data limited.
Digital Skills & Literacy	2	No explicit national digital-skills/gender targets in the submission; demand-stimulation details sparse.
Innovation & Pilots	4	TVWS live, DSA emerging, community Wi-Fi and VSAT in SA-Connect; PPP learnings leveraged.

Overall Readiness: 3.6 / 5

South Africa has robust policy, spectrum and sharing frameworks with near-universal mobile coverage and strong USF/licensing obligations. Gaps that temper the score are affordability (limited demand-side support), scarce tax/opex incentives for deep-rural, and weakly articulated digital-skills targets.

Regulator's perspective

- Focus on **service obligations** bundled with high-demand spectrum; expansion via **USF** and **open-access hotspots/VSAT**.
- Enabling environment: TVWS regulations (2018), draft DSA rules, active sharing; auction is main path to spectrum.
- Key hurdles: high deployment costs, limited private investment in low-ARPU areas, geographic remoteness, and execution bottlenecks.
- Policy levers flagged: encourage small/community operators, improve infrastructure transparency, streamline permits, and expand targeted subsidies.

Operators' perspective:

No operator questionnaire response received for Rwanda.

Summary of Challenges & Opportunities

- **Challenges**
  - Rural deployments entail high CAPEX and OPEX.
  - Backhaul and power costs remain significant.
  - Low demand density limits investment returns.
  - Fiber rarely extends beyond urban centers.
  - Right-of-way and permits are persistent hurdles.
  - OPEX sustainability declines post-subsidy.

- **Opportunities**
  - Service-obligation programs can drive rural builds.
  - Community Wi-Fi at scale can expand affordable access.
  - TVWS and DSA pilots offer innovative spectrum use.
  - Active sharing and MORAN/MOCN reduce deployment costs.
  - VSAT and LEO backhaul enable deep-rural connectivity.
  - SDIC support can underwrite backbone and last-mile economics.

Next Steps

- Fast-track **DSA/TVWS operationalization** for rural pilots.
- Use USF to **de-risk opex** (e.g., power) and incentivize **active sharing** outcomes.
- Align **municipal wayleave & fees** under a single window for SA-Connect rollout.
- Prioritize **school/clinic anchor-tenant** models to catalyze village demand.
- Expand **community Wi-Fi** and **open access** hotspots linked to fiber/VSAT ring-fencing.

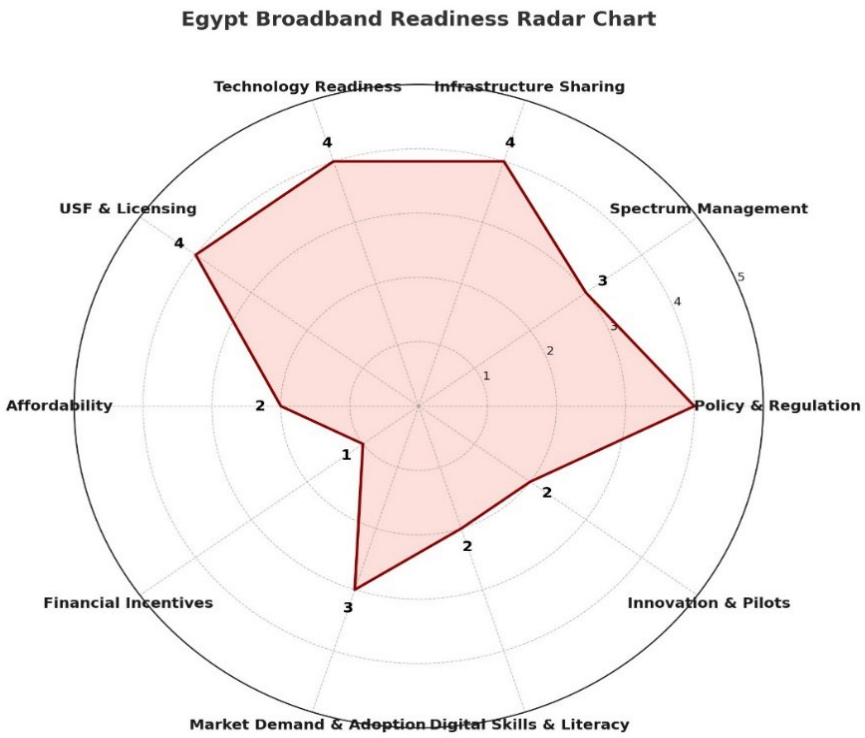
Dimension	Key question(s)	Regulator excerpt
Policy & Regulation	What national strategies and rural targets exist? What barriers?	**SA Connect** is the national broadband programme (Phase 2). Policy instruments include spectrum-linked service obligations for public institutions and the planned **State Digital Infrastructure Company (SDIC)** combining Broadband Infraco + SENTECH to extend open-access backbone and last-mile enablement.
Spectrum Management	Rural bands? Incentives? Process? TVWS/DSA?	Rural-suitable IMT bands (e.g., **700/750/800/900/1500 MHz**) are planned/assigned. **TV White Spaces regulations (2018)** exist; **Dynamic Spectrum Access** regulations have been published in draft. High-demand IMT assigned via **auction**; TVWS authorized under the existing framework.
Infrastructure Sharing	Active/passive? Rules and practice?	**Active sharing permitted**; policy tools encourage sharing to lower costs and speed coverage expansion in underserved municipalities.
Technology Readiness	Current coverage & speeds; tech mix suitable for rural?	**Mobile broadband coverage ~99.79%** (population). **Fiber penetration**: **3.43% national; 2.77% urban; 0.66% rural**. (No regulator split for rural/urban speeds provided in the submission.)
USF & Licensing	USF role? License obligations? PPPs?	**USAF/USAASA** framework: licensee contributions (up to ~1% of turnover) fund competitive grants/tenders for underserved

		builds and community access. **Spectrum awards carry rural/public-institution coverage obligations** (e.g., schools, clinics, police, traditional authorities) within **36 months**.
Affordability	Tariff rules? End-user support?	No retail price caps; affordability aligned to the **UN Broadband Commission 2% of income** benchmark. No nationwide rural end-user subsidy indicated in the submission.
Financial Incentives	CAPEX/OPEX subsidies? Tax relief?	Indicated **CAPEX subsidies** for rural rollout via universal-service mechanisms. No specific **tax exemptions** for rural projects were reported.
Market Demand & Adoption	Rural adoption, addressable demand, anchor tenants?	Large **public-institution connectivity obligations** (schools, clinics, SAPS, traditional authorities) and **community Wi-Fi**/VSAT components signal anchor demand and potential for local uptake; direct rural adoption metrics not provided.
Digital Skills & Literacy	National targets or programs to stimulate usage?	No explicit digital-skills or gender-equality targets were included in the regulator submission for SA; (affordability indexed to income share only).
Innovation & Pilots	TVWS/DSA pilots, neutral-host, new models?	**TVWS framework (2018)** in force; **DSA** draft published; SA-Connect phases include **community Wi-Fi hotspots** and targeted **VSAT** for hard-to-reach areas; emphasis on infrastructure sharing and PPPs in lessons learned.

12. Egypt's Broadband-Ecosystem Readiness Framework

	Key Indicators
National Broadband Strategy (2022 -)	Target ≈ 65% of households subscribed to fixed broadband, with 90% of connected HHs at ≥50 Mbps; pillars include Rural projects (Decent Life, USF), Greenfield Urban, Brownfield Urban
Rural reach programs	Decent Life (≈ 4,500 villages), USF (≈ 60k units/year) and broader goal to improve internet & mobile connectivity for ~60 million people
Coverage (mobile)	4G: ≈ 95% of populated areas at 50 Mbps; data (4G) 93% (Apr-2025); voice (2G/3G) 99% (Dec-2025) in cities & rural
Fixed broadband	≈ 62.5% of households (current)
Infrastructure sharing	Fixed: Active/open-access; Mobile: passive sharing

Radar-chart visualization of Egypt's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Egypt's broadband ecosystem readiness** across ten key dimensions.

Table 46: Egypt's Broadband Readiness Scores (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Strong national strategy (2022), with explicit rural pillars (Decent Life, USF) and household/speed targets.
Spectrum Management	3	Same national process and bands; no rural-specific incentives or TVWS/DSA detail provided.
Infrastructure Sharing	4	**Active open-access** (fixed) and **passive mobile** sharing in place, good foundations for cost reduction.
Technology Readiness	4	High 4G population coverage (~95%) and substantial fixed HH penetration (~62.5%); rural last-mile remains uneven.
USF & Licensing	4	Active **USF** subsidies (mobile + some FTTH) and **license obligations** for mobile roll-out.
Affordability	2	No end-user subsidy programs reported; affordability flagged as a constraint in deep-rural.
Financial Incentives	1	No CAPEX/OPEX tax incentives beyond USF; no special fiscal relief for rural deployments.

Market Demand & Adoption	3	Large nominal addressable base (≈60 m) and village program; concrete rural adoption metrics not provided.
Digital Skills & Literacy	2	No explicit national digital-skills/gender targets cited in the submission.
Innovation & Pilots	2	Little evidence of TVWS/DSA or neutral-host pilots; recommendation to broaden sharing, but specifics absent.

Overall Readiness: 2.9 / 5

Egypt shows strong policy direction, high mobile coverage, and active USF/licensing levers. Readiness is tempered by limited affordability measures, lack of rural-specific spectrum incentives, and sparse detail on digital-skills programs and innovation pilots.

Regulator's Perspective

- Government funds rural buildings via **USF**; **Decent Life** program drives village coverage.
- Fixed open-access and mobile passive sharing encouraged/used.
- **License obligations** apply to mobile (roll-out plans).
- Key pain points are permits, high CAPEX/OPEX, low ARPU, and limited commercial returns; recommends infrastructure sharing and incentives/subsidies.

Operators' Perspective

No operator questionnaire response received for Egypt.

Summary of challenges & opportunities:

- **Challenges**
  - Multi-layer permitting, trenching/duct approvals; deep-rural economics (low ARPU, high CAPEX); absence of demand-side subsidies; no rural-specific spectrum incentives.

- **Opportunities**
  - **Scale USF and Decent Life** to fiberize clusters and add last-mile 4G; expand **open-access** wholesale and neutral-host in low-density zones; streamline **one-stop permitting**; targeted device/program subsidies; pilot **MOCN/RAN-sharing** where feasible.

Next Steps

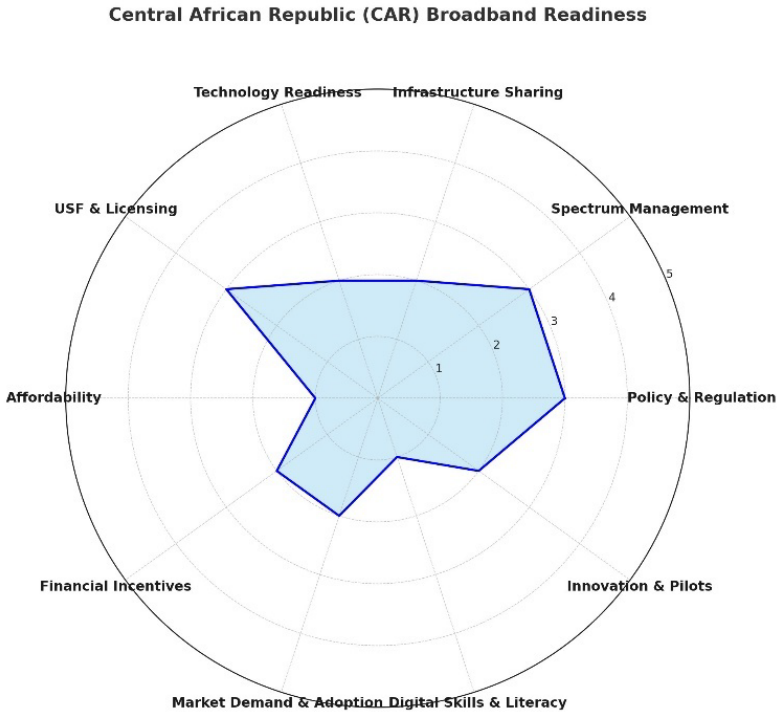
- Establish **single-window** rights-of-way process for rural trenching/ducts.
- **Targeted USF**: bundle CAPEX with limited OPEX support for first 3–5 years in deep-rural.
- Consider vouchers / device financing for low-income HHs; expand community Wi-Fi.
- Explore **dynamic spectrum/TVWS** pilots; formalize **open-access** rules and SLAs for fixed.
- Improve **measurement** (clear definitions for "fiber penetration", rural adoption, speeds).

Dimension	Key question(s)	Regulator excerpt
Policy & Regulation	What national strategies and rural targets exist? What barriers?	**NBS 2022–:** HH fixed BB ≈65% target; 90% of connected HHs at ≥50 Mbps; pillars include **Decent Life** & **USF**. Barriers: multi-permit trenching; fragmented approvals.
Spectrum Management	Rural bands? Incentives? Process? TVWS/DSA?	Same spectrum as elsewhere; **no rural-specific process** or incentives; no answer on TVWS/DSA; spectrum process not specific to rural.
Infrastructure Sharing	Active/passive? Rules and practice?	**Fixed:** active sharing via **open access**; **Mobile:** passive sharing.
Technology Readiness	Current coverage & speeds; tech mix suitable for rural?	Mobile: **4G 95%** of populated area (50 Mbps); data 4G **93% (Apr-2025)**; voice **99% (Dec-2025)**. Fixed HHs ≈**62.5%**.
USF & Licensing	USF role? License obligations? PPPs?	**USF** subsidizes mobile coverage; some **FTTH grants**; **mobile license obligations** include roll-out plans to cities/roads.
Affordability	Tariff rules? End-user support?	Operators propose tariffs for **NTRA approval**; **no end-user subsidy** (rural/satellite) reported.
Financial Incentives	CAPEX/OPEX subsidies? Tax relief?	**No financial/tax incentives** beyond USF noted in this section.
Market Demand & Adoption	Rural adoption, addressable demand, anchor tenants?	Programs aim to improve connectivity for **~60 million** people; Decent Life targets **4,500 villages**; HH fixed ~**62.5%** overall.
Digital Skills & Literacy	National targets or programs to stimulate usage?	Not specified; lessons note need for **collaborative regulation** and stakeholder alignment.
Innovation & Pilots	TVWS/DSA pilots, neutral-host, new models?	Recommendation to expand **infrastructure sharing**; no specific innovation pilots cited.

13. Central African Republic's Broadband-Ecosystem Readiness Framework

Key Indicators	
National strategy (2022–2030)	Target 70% broadband penetration by 2030; rural focus via PPP and USF.
Rural targets	≥80% of rural communities by 2028; two new fiber licenses granted (east & center).
Government role	USF subsidies, infrastructure-sharing order in place; (stated wish to facilitate Starlink for nationwide reach).
Barriers	Taxation of telecom equipment imports; TVWS still only "in project".
Spectrum	700/800/2300 MHz used for rural; fee reductions & 15-year 4G licenses; assignment by administrative / first-come, first-served.
Infrastructure sharing	Passive sharing policy (active not yet).
Public projects	Rural Fiber Initiative underway.
USF/PPP	PPPs encouraged for shared infrastructure; USF available (no rural license obligations).
Tariffs & affordability	Tariff freedom; no end-user subsidies; no affordability index.
Indices	Population coverage (BB) ~10%; rural penetration 7%; unserved 92%; speeds Urban ~24/9.5 Mbps DL/UL, Rural ~12.7/7.9 Mbps; fiber penetration 14.5% national (urban 5.45%, rural 1.81%); satellite rural coverage 90.9% (NGSO).

Radar-chart visualization of CAR's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **CAR's broadband ecosystem readiness** across ten key dimensions.

Table 47: CAR's Broadband Readiness Scores (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	3	Clear national strategy and rural targets with PPP/USF, but execution is constrained by import taxation and absence of rural license obligations.
Spectrum Management	3	Rural-relevant bands allocated; **fee reductions + 15-year licenses** help, yet TVWS is not operational, and assignments are administrative/FCFS.
Infrastructure Sharing	2	**Passive sharing** exists, but active sharing not mandated; regulator itself cites lack of effective sharing agreements.
Technology Readiness	2	Nationwide BB coverage only **~10%** (rural **7%**); some LTE/FWA/LEO options emerging but base is very low.
USF & Licensing	3	**USF** available and PPPs promoted, but **no rural service obligations** in licenses lowers certainty of delivery.

Dimension	Score	Rationale
Affordability	1	**No end-user subsidies** or affordability measures; no affordability index; rural poverty likely suppresses adoption.
Financial Incentives	2	Limited to spectrum/fee measures; **no CAPEX/OPEX grants** or tax holidays (explicit "no" on tax exemptions).
Market Demand & Adoption	2	Low national/rural penetration; some operators report sizable rural bases, but overall demand remains thin.
Digital Skills & Literacy	1	**No national programs/targets** reported to stimulate skills or inclusion.
Innovation & Pilots	2	TVWS is still in project; operators exploring **LEO + hybrid FWA** and solar, but few scaled pilots.

Overall Readiness: 2.1 / 5

CAR has a strategy, rural targets, fee-based spectrum incentives, and USF/PPP intent. Readiness is constrained by very low coverage, weak affordability measures, limited (passive-only) sharing, tax friction on equipment, and nascent innovation pilots.

Regulator's Perspective

- Pushes **PPP + USF** to extend coverage; issued **long-duration 4G licenses** and **spectrum fee reductions** for underserved builds; **passive sharing** mandated via order.
- Main bottlenecks: high deployment costs, import taxes on equipment, and the need to expand TVWS rules and strengthen sharing.

Table 48: Operators' Perspective

Dimension	Operator 1	Operator 2	Operator 3
Services & Coverage	Low ARPU outside Bangui; device costs suppress uptake; focus on community/institution-linked bundles to lift usage.	Very limited paying demand beyond main towns; affordability gap persists even where signal exists.	Rural demand best anchored via schools/clinics and public sites; expand agent networks to deepen reach.
Partners	Regulator/USF for KPIs & support; backbone providers for fair access; OEM/retail channels for devices.	Regulator, tower/fiber companies (reference offers); DFIs/USF for blended finance; insurers & local security.	Open-access backbone/fibercos, LEO/MEO satellite providers, power-as-a-service vendors, OEMs/fintechs, local authorities.

Dimension	Operator 1	Operator 2	Operator 3
Infrastructure	Sparse fiber; long microwave hops; satellite costly; diesel-heavy sites with outages/theft; sharing weak; RoW fragmented.	Backhaul gaps and weather outages; generator logistics/vandalism; need active sharing/neutral-host; one-stop RoW (30-day SLA).	Prefer transparent open-access backbone; allow LEO/MEO backhaul; power-as-a-service with SLAs; publish capacity at shared sites; dig-once/common-duct.
Business Models & Tariffs	Retail largely forborne; wholesale terms opaque on existing backbones—seek clarity.	Publish wholesale reference offers (fiber/tower/backhaul); guardrails against discrimination.	Fair wholesale interconnect & backhaul terms; transparent pricing along corridors.
Financing & Incentives	USF not fully operational; request **OBA** with milestone KPIs; spectrum **fee credits** for verified rural sites.	**Blended finance** (40–70% CAPEX + time-bound OPEX); device VAT/duty relief; spectrum fee credits paired with coverage obligations.	USF dashboard & multi-year tenders with clear audit/verification; simplify band renewals; enable TVWS for campuses.
Challenges	Security & vandalism; high site OPEX; device affordability; fragmented permits.	Low affordability; weather-related link instability; vandalism; municipal fee variability.	Low ARPU in deep-rural; opaque wholesale prices; incident response coordination.
Innovation	Interest in TVWS, neutral-host, Open RAN, sat-FWA pilots.	Sandbox Licenses for school connectivity and rural small cells; crowdsourced QoS to validate outcomes.	3–5 structured pilots/year (TVWS schools, Open RAN rural cell, sat-FWA backhaul) with rapid review and published learnings.
Needs & Next Steps	KPI dashboard & independent audits; streamline RoW; clearer wholesale access.	One-stop RoW (30-day SLA); publish reference offers; launch OBA lots with uptime/latency KPIs and fee credits.	Implement dig-once/ common-duct; enable LEO/MEO backhaul; set rapid incident-response protocols; per-site remediation timelines & transparent KPI reporting.

Summary of Challenges & Opportunities:

- **Challenges**
  - Extremely low national broadband coverage; **import taxation** on telecom gear; **power scarcity** and site OPEX; limited **active sharing**; **no rural obligations** in licenses; no demand-side support.

- **Opportunities**
  - Leverage USF with performance-based PPPs; enable active sharing (MOCN/MORAN); fast-track TVWS rules and LEO backhaul in remote corridors; tax/fee holidays on rural sites; clustered Rural Fiber + community Wi-Fi; targeted device/data subsidies.

Next Steps

- Create a **single window** for rights-of-way + duty **exemptions** for rural gear.
- Update infrastructure rules to **mandate active RAN sharing** in low-density zones; publish **reference offers**.
- Launch USF "CAPEX + time-bound OPEX" tenders with coverage + QoS milestones; allow LEO to backhaul.
- Pilot **TVWS** and **neutral-host** models for last-mile; scale **solar hybrid power** standards.
- Pair supply-side builds with community Wi-Fi, anchor-tenant fiber spurs (schools/clinics), and affordability vouchers.

Dimension	Key questions	Regulator excerpt	Operator 1	Operator 2	Operator 3
Policy & Regulation	National strategies & rural targets? Barriers?	**2022–2030 strategy: 70%** BB by 2030; **≥ 80% rural communities by 2028**; PPP + USF; barrier: **equipment taxes**; TVWS expansion recommend ed.	uses PPP; asks **tax relief**; rural plan **95% by 2027**.	works with **USF**; rural plan **80% by 2027**.	requests **USF committee**; rural plan **60% by 2027**.
Spectrum Manageme nt	Rural bands, incentives, process, TVWS/DSA?	700/800/2300 MHz; spectrum fee cuts + 15-yr 4G licenses; admin / FCFS;	Uses 700/800/1800/2 100 + 3.5 GHz (FWA).	Uses 900/1800/21 00 + 3.5 GHz (FWA).	Uses 800/1800/21 00 + 3.5 GHz (FWA).

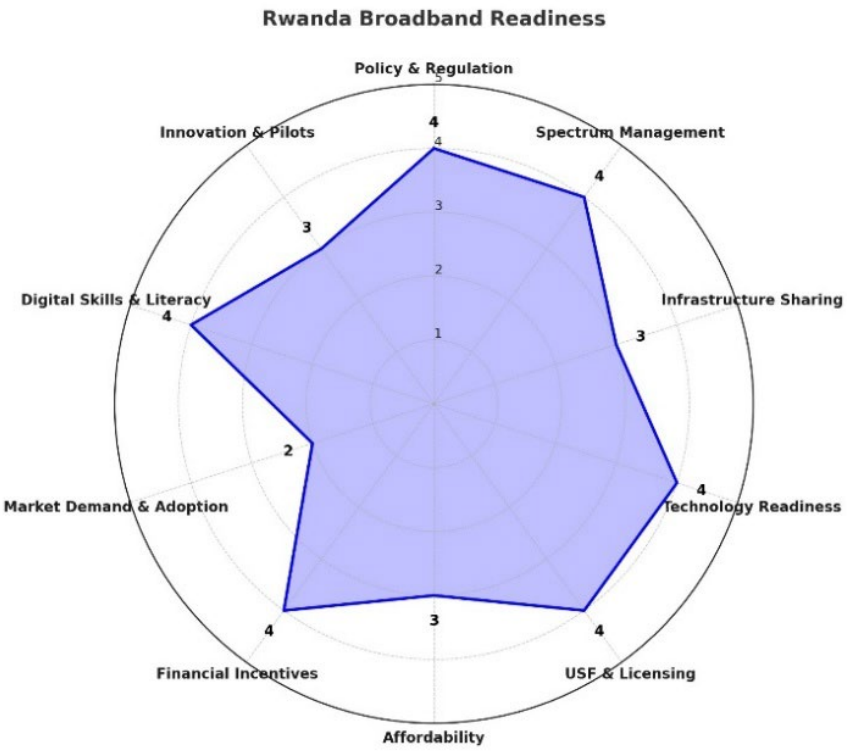
		TVWS "in project".			
Infrastructure Sharing	Active vs passive? How enforced?	**Passive sharing** policy via order; sharing promoted.	Says sharing exists; wants **more active sharing**.	Same: needs more active sharing incentives.	Same: needs more active sharing incentives.
Technology Readiness	Coverage, speed, fit for rural?	BB coverage **10%**; rural **7%**; speeds **Urban ~24/9.5**, **Rural ~12.7/7.9**; satellite rural coverage **90.9%**.	LTE + **LEO/VSAT** + **FWA**; rural cover **~70%** (target **95%**).	2G + **VSAT/FWA**; rural cover **~65%** (target **80%**).	3G/4G + satellite; rural cover **~10%** (target **60%**).
USF & Licensing	USF role, PPPs, rural obligations?	**USF** active; **PPP** encouraged; **no rural obligations** in licenses; one territorial license noted.	Uses gov't incentives/PPP.	Uses **USF**; cross-subsidy.	Requests **USF governance**; cross-subsidy.
Affordability	Tariff rules; end-user support?	Tariff freedom; no end-user subsidies; no affordability index.	No rural-specific plans; standard bundles.	No rural-specific plans; standard bundles.	No rural-specific plans; standard bundles.
Financial Incentives	CAPEX/OPEX subsidies, tax breaks?	Says **no financial incentives** & **no tax exemptions**; (spectrum fee cuts exist under spectrum).	Requests CAPEX/OPEX subsidies, tax relief.	Requests CAPEX/OPEX and tax exemptions.	Requests **tax relief** for rural.
Market Demand & Adoption	Rural adoption,	National BB **10%**; rural **7%**; two new fiber	Rural base **~25%**; cites	Rural base **~54%**; growth via	Rural base **~10%**; growth

	anchors, ARPU?	licenses to expand reach.	**power** & **access** limits.	cross-subsidy.	capped by power.
Digital Skills & Literacy	Programs/targets to stimulate use?	**None reported** (no digital literacy/gender targets).	—	—	—
Innovation & Pilots	TVWS/DSA, LEO backhaul, neutral host?	**TVWS in project**; interest in **Starlink/NGSO**; Rural Fiber Initiative.	LEO + hybrid FWA pilots; solar sites.	**LEO backhaul** + **solar**; local content.	**LEO + FWA**; **solar**; asks neutral backhaul.

14. Rwanda Broadband-Ecosystem Readiness Framework

Key Indicators	
Policies/strategies	*National Broadband Policy & Strategy (2022)* and *ICT SSP 2024–2029* targeting **85% broadband penetration by 2029** with rural focus via **MNO rollout + Universal Access Fund (UAF/USF)**.
Rural target	"**ICT for All**" (no numeric rural-specific target stated).
Government role	USF subsidies, support for infrastructure sharing, community Wi-Fi, Rural Fiber Initiative.
Barriers	No regulatory barriers cited.
Spectrum	700/800 MHz used for rural; TV White Spaces permitted under managed access; administrative assignment process; no spectrum fee/duration incentives specific to rural.
Sharing	**Passive** infrastructure sharing policy.
Tariffs & affordability	Tariff freedom; citizen smartphone program noted; affordability aligned to 2% of GNI benchmark.
Indices	97.2% of inhabited areas covered by towers; rural internet usage 19%; unserved 2.8%; fixed median ~19.3 Mbps (Jul 2025); mobile sample ~39 Mbps DL / 10 Mbps UL; fiber network length ~24,000 km (end-2024); digital literacy target: 100% (age 15+) by 2029; satellite types GSO & NGSO (coverage % unknown).

Radar-chart visualization of Rwanda's broadband ecosystem readiness: Scores are on a 1–5 scale (1 = very low readiness; 5 = very high readiness).



The radar chart presented above provides a summary of **Rwanda's broadband ecosystem readiness** across ten key dimensions.

Table 49: Rwanda's Broadband Readiness Scores (1 = Very low … 5 = Very high)

Dimension	Score	Rationale
Policy & Regulation	4	Robust national policy suites with explicit 2029 target and rural focus; rural target not numerically disaggregated.
Spectrum Management	4	Rural-friendly low bands (700/800 MHz), **TVWS permitted**, clear admin process; no rural-specific fee/duration incentives.
Infrastructure Sharing	3	Passive sharing exists; no mandated active sharing yet.
Technology Readiness	4	**97.2%** of tower coverage of inhabited areas and workable speeds indicate strong supply-side readiness.
USF & Licensing	4	**USF grants**, **PPP** facilitation, and **license rollout plans** provide structured delivery mechanisms.
Affordability	3	**Tariff freedom** plus **smartphone program** help, but rural usage remains low (19%), implying remaining affordability/device barriers.

Dimension	Score	Rationale
Financial Incentives	4	**CAPEX/OPEX support** and **tax incentives** for rural buildings are in place.
Market Demand & Adoption	2	Despite broad coverage, **rural adoption is only ~19%**, signaling demand-side constraints.
Digital Skills & Literacy	4	Ambitious 100% digital literacy (15+) by 2029 target under ICT SSP.
Innovation & Pilots	3	**TVWS allowed community Wi-Fi** active; further scaling/active sharing/neutral host could raise this.

Overall Readiness: 3.5 / 5

Rwanda pairs strong policy, spectrum (incl. TVWS), USF, and incentives with near-universal network footprint; the remaining gap is adoption in rural areas, where affordability, device access, and skills programs must translate into higher usage.

Regulator's perspective

Driving coverage and inclusion through USF grants, PPP facilitation, community Wi-Fi, rural fiber, TVWS allowance, and license rollout plans. Seeking tax breaks, expanded TVWS pilots, smartphone access, and sustained USF investment for rural buildings.

Operators' perspective

No operator questionnaire response received for Rwanda.

Summary of Challenges & Opportunities

- **Challenges**
  - Remaining rural usage gap (19%) despite broad coverage
  - High deployment costs
  - Limited private investment in low-ARPU areas
  - Passive-only sharing
  - Limited affordability instruments beyond device

- **Opportunities**
  - Target deep-rural pockets with **neutral-host/active sharing** and **5G-FWA** for fixed access.
  - Introduce **fee credits** for coverage in hardest cells; widen **dynamic sharing/TVWS** for institutions.
  - Extend fiber spurs and **Community Wi-Fi** from PoPs to schools/clinics with OBA payments.
  - Scale **device financing/vouchers** to convert high coverage into higher usage.

- Promote local content bundles (education/health/agriculture) to lift sustained demand.

Next Steps

- Codify active sharing and publish reference offers; fast-track TVWS pilots.
- Run USF tenders with CAPEX + time-bound OPEX support tied to coverage/uptime KPIs.
- Pair supply builds with **affordable starter bundles** and **device schemes** to lift rural adoption above 19%.
- Extend **backbone spurs** to schools/health centers and expand **community Wi-Fi** coverage.

Dimension	Key questions	Regulator excerpt	Operator 1	Operator 2	Operator 3
Policy & Regulation	National strategy & rural targets Barriers?	**NBP 2022** + **ICT SSP 2024–2029** aim **85%** penetration by 2029; **ICT for All** (no numeric rural target); **no regulatory barriers** reported.	No operator submission received.	No operator submission received.	No operator submission received.
Spectrum Management	Rural bands, incentives, process, TVWS/DSA?	700/800 MHz used for rural; TVWS permitted (managed access); administrative assignment; no fee/duration incentives specific to rural.	—	—	—
Infrastructure Sharing	Active vs passive Enforcement?	**Passive sharing** in place for rural deployments.	—	—	—
Technology Readiness	Coverage & speeds; fit for rural?	**97.2%** of inhabited areas covered by towers; speeds: **fixed median ~19.3 Mbps**; sample mobile **~39 DL/10 UL**.	—	—	—
USF & Licensing	USF role, PPPs, rural obligations?	**USF grants** for last mile; **PPP** facilitation; **license rollout plans** embedded for operators.	—	—	—

Affordability	Tariff rules; end-user support?	Tariff freedom; citizens given a free smartphone; affordability benchmark 2% of GNI followed.	—	—	—
Financial Incentives	CAPEX/OPEX subsidies, tax breaks?	CAPEX/OPEX support exists; tax exemptions/incentives for rural projects YES.	—	—	—
Market Demand & Adoption	Rural usage/adoption; anchors; ARPU?	Rural internet usage ~19% despite broad network coverage; unserved 2.8%.	—	—	—
Digital Skills & Literacy	Programs/targets to stimulate use?	ICT SSP targets 100% digital literacy (15+ yrs) by 2029.	—	—	—
Innovation & Pilots	TVWS/LEO/neutral host/community Wi-Fi?	TVWS allowed; community Wi-Fi and Rural Fiber Initiative underway; satellite GSO/NGSO present.	—	—	—

Annex 2: Questionnaires for Regulators and Operators

Questionaires_for_Annex.docx

Annex 3: Case Studies (India, Hungary, Brazil)

India: BharatNet and National Broadband Mission (NBM)

Policy Interventions

The National Broadband Mission (NBM), launched in 2019 and updated to NBM 2.0 in 2025, focuses on universal, affordable, and high-quality broadband access. Key initiatives include:

- Extending optical fiber connectivity to 270,000 villages by 2030.
- Providing broadband to 90% of anchor institutions like schools and health centers by 2030.
- Improving fixed broadband download speeds from a national average of 63.55 Mbps in 2024 to a minimum of 100 Mbps by 2030.
- Reducing the average disposal time for Right of Way applications from 60 days to 30 days by 2030.
- Increasing the number of rural internet subscribers per 100 population from 45 to 60 by 2030.

Two major government initiatives known as Bharat Broadband Network Limited (BBNL) also called BharatNet and the Prime Minister Wi-Fi Access Network Interface (PM-WANI), launched in December 2020, are being used to achieve these objectives in the NBM.

- The BharatNet project aims to provide high-speed and affordable Internet access to every gram panchayat (village block) across India.[11]

- The Universal Service Obligation Fund (USOF), financed by a 5% levy on telecom operators adjusted gross revenue, has also allocated significant funds to support rural broadband initiatives like the BharatNet.
- The BahratNet architecture is depicted below in figure 8 with OFC connected from the block level to the GP (Village)level with customers served through Wi-Fi hotspots or as enterprise.

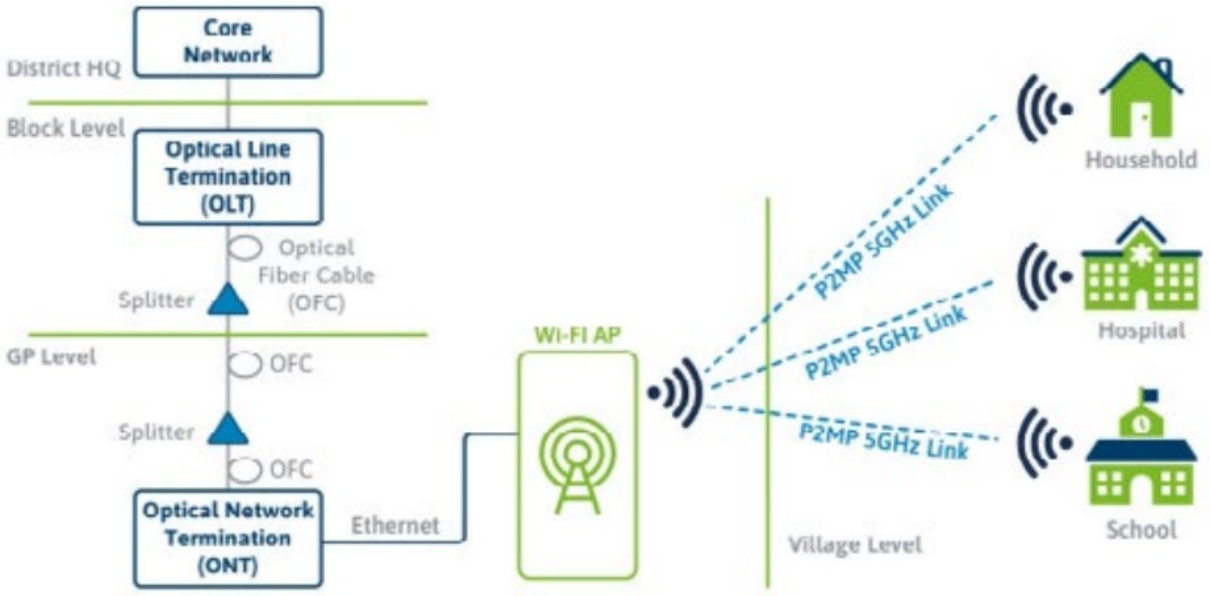


Figure 8: BahratNet Architecture

The PM-WANI scheme aims to provide affordable and reliable internet access through public Wi-Fi hotspots, encouraging local entrepreneurship in rural areas. It empowers small businesses, from tea stalls to mom-and-pop shops, to operate as Public Data Offices (PDOs), providing Wi Fi without licensing fees.[13]

The scheme is as shown in figure 9 along with regulatory considerations in figure 10 below.

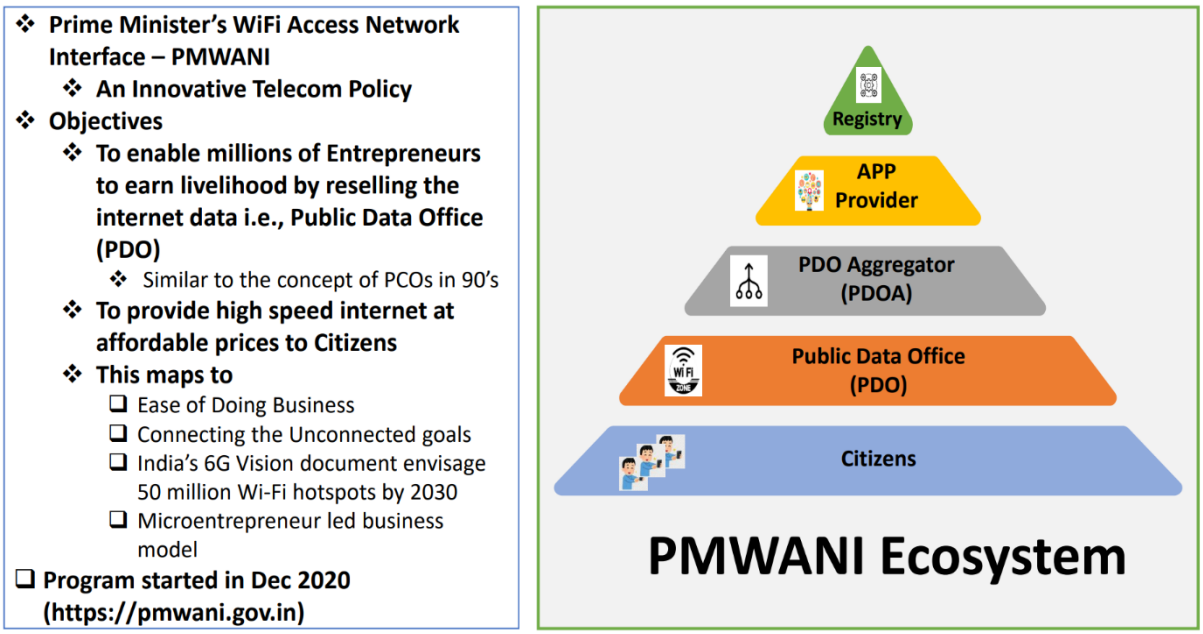


Figure 9: PM-WANI Program Overview

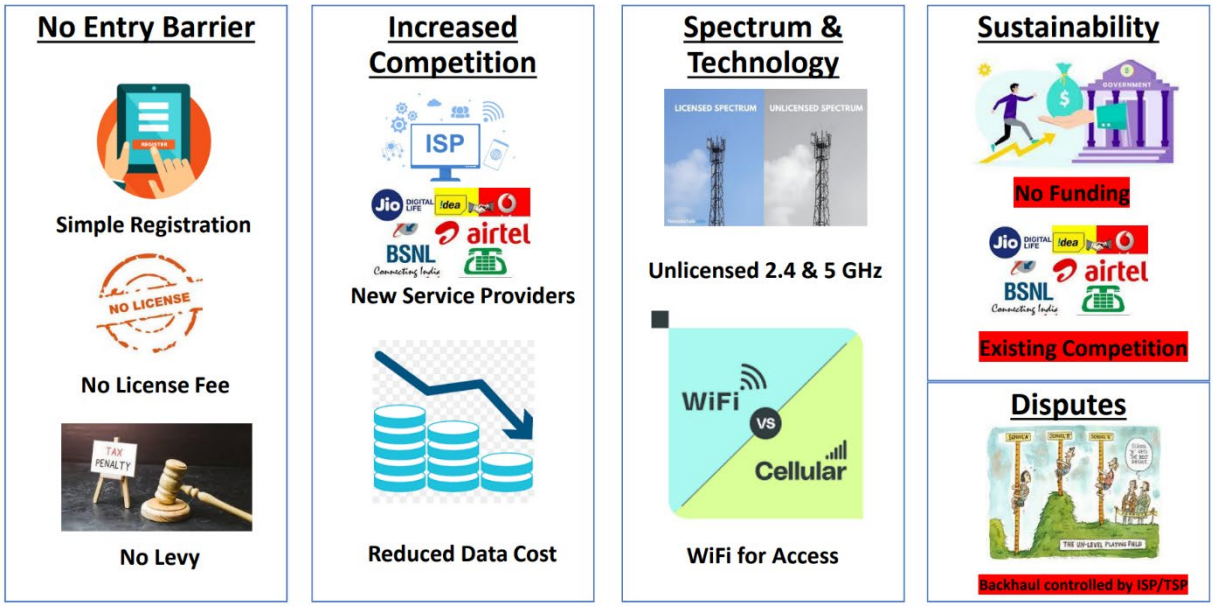


Figure 10: PM-WANI Regulatory Considerations

Rural Broadband Deployment

India's BharatNet is the world's largest rural broadband initiative, aiming to provide 100 Mbps connectivity to all 250,000 Gram Panchayats (village councils), covering approximately 625,000 villages. BharatNet, approved by the Union Cabinet on October 25, 2011, is an ambitious project aimed at providing high-speed and affordable Internet access to every gram panchayat (village block) nationwide.[11]

Magnitude and dimensions of the operation

- Word s largest rural broadband connectivity project through optical fiber
- All 2.5 lakh Gram Panchayats in India to be connected through optical fiber
- Minimum 100 Mbps bandwidth at each Gram Panchayat
- High-Capacity Network Management System and Network Operation Centre
- BharaNet to be non-discriminatory access infrastructure for all Service Providers

The BharatNet initiative, under the Ministry of Communications, seeks to empower rural India, fostering inclusive growth and bridging the gap between urban and rural communities. Under the current BharatNet program, very small aperture terminals (VSAT) have been installed in school buildings in 30% of the 4,200-gram panchayat locations with satellite communications (satcom) connectivity. This initiative is vital for ensuring equitable internet access, particularly in remote and underserved areas, and aligns with India's vision of becoming a digitally empowered society and knowledge-driven economy.

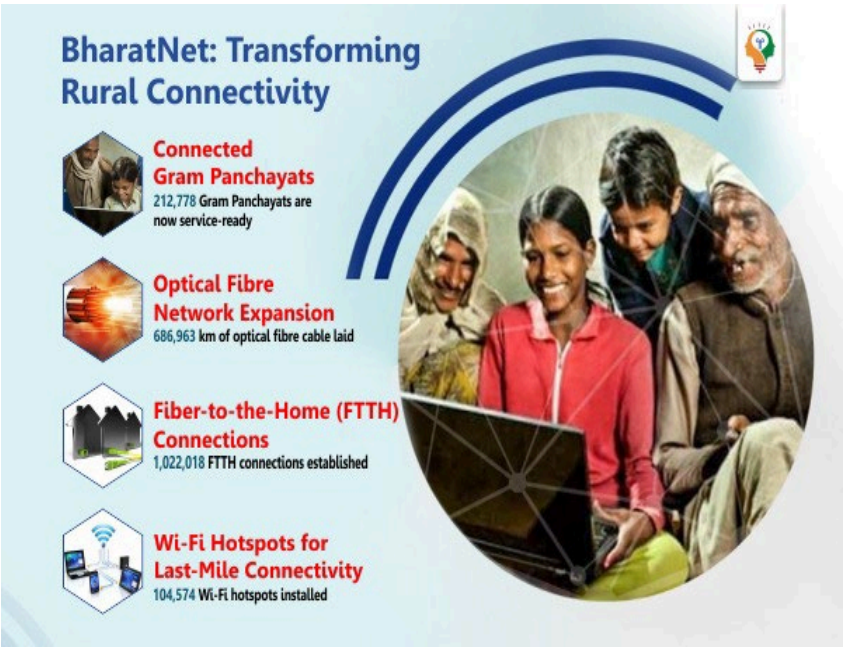


Figure 11: BharaNet Highlights

As of December 2024:

- Over 692,000 km of optical fiber cable had been laid.
- 209,281 Gram Panchayats were operational on optical fiber.
- Approximately 1.2 million Fiber-to-the-Home (FTTH) connections were commissioned.
- 104,574 Wi-Fi hotspots were installed, though only 6% were active.[12]

Inclusive Business and Tariff Models

India has employed a combination of public-private partnerships, entrepreneurial models, and community-based service delivery frameworks to expand rural broadband. Some tariff & Financing Frameworks used are listed below:

- **Device-Inclusive Packages:**

This initiative encourages bundling handset financing with data plans to lower upfront costs, an approach increasingly adopted by public Wi Fi operators.

- **Universal Service Funding:**

The 5% USOF levy on telecom revenue underpins both BharatNet construction and PM WANI, linking funding directly to rural deployment and maintained affordability.

Below are key business models in use:

1. Public–Private Partnership (PPP) Model – BharatNet Phase II.[12]

Model Summary:

- The Government builds and owns middle-mile fiber infrastructure.
- Private players operate and monetize last-mile services to villages.

How it works:

- PPP contracts awarded regionally (ex: Airtel, L&T, RailTel)
- Revenue-sharing or Viability Gap Funding (VGF) mechanisms in place
- Private players lease capacity and serve rural customers via Wi-Fi or fiber.

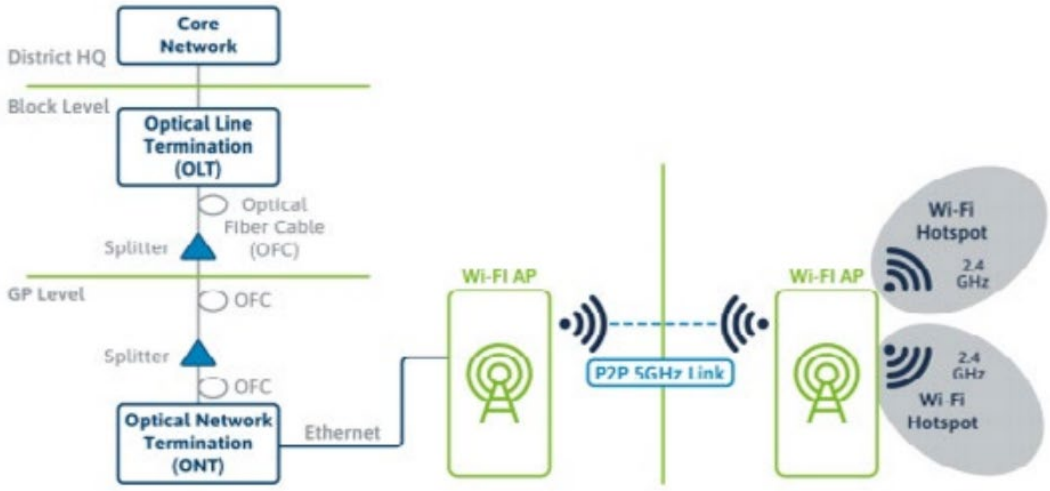


Figure 12: Public–Private Partnership (PPP) Model Architecture.

2. PM-WANI Decentralized Entrepreneurial Model.[13]

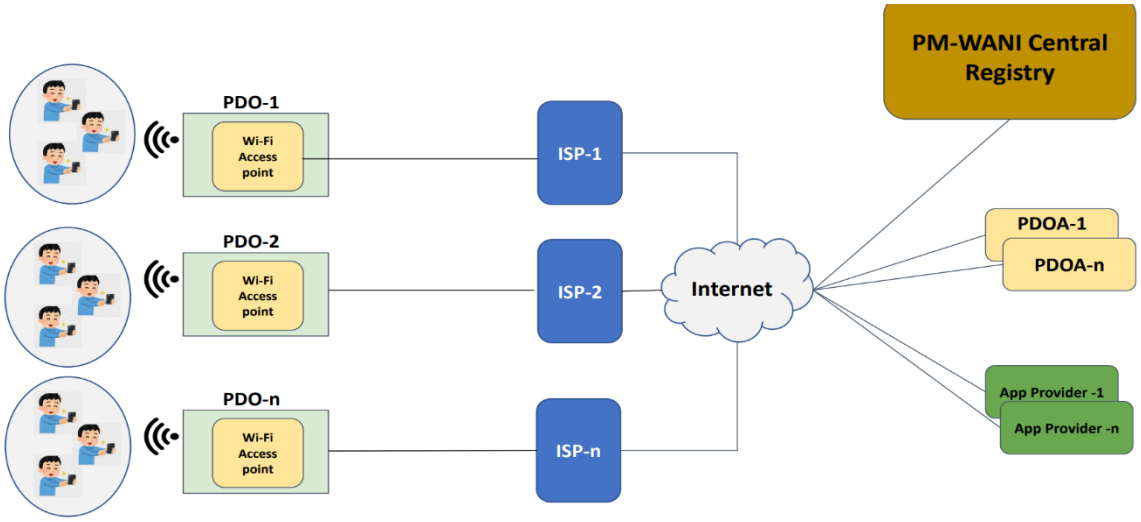


Figure 13: PM-WANI Architecture – Federated and Disaggregated

Model Summary:

- Public Data Offices (PDOs) provide public Wi-Fi in rural areas
- No license or spectrum fees
- Encourages local entrepreneurship

Revenue Model:

- PDOs charge for internet access, supported by affordable prepaid models
- App providers and aggregators monetize through branding and transactions

3. Franchise and Village-Level Entrepreneurship Model

Model Summary:

- Rural individuals/franchisees operate last-mile Wi-Fi or FTTH services using government infrastructure

Revenue Mechanism:

- Service providers offer wholesale bandwidth to franchises
- Franchises offer retail plans to villagers, often bundled with digital services
- Local entrepreneurs deploy routers and earn margins on data packs

4. Satellite-Based Connectivity via Subsidized Access

Model Summary:

- VSAT/satellite services provided to remote schools, healthcare, or Gram Panchayats
- Partially funded or subsidized by USOF

5. Bundled Service Model – Digital Inclusion Platforms

Model Summary:

- ISPs and Common Services Centres (CSCs) bundle broadband with education, telemedicine, e-governance

Revenue Model:

- Subscription or transaction-based fees
- Monetization through digital services rather than broadband alone

Summary Table

S/N	Model Type	Key Stakeholders	Revenue Source	Strength	Example
1	PPP via BharatNet	Govt + Telcos	Viability Gap Funding (VGF), Leasing	National scale	BharatNet Phase II
2	PM-WANI	PDOs, App providers	User fees	Decentralized Wi-Fi	CSC WiFi Choupal
3	Franchise/ Entrepreneur	Local ISPs + CSCs	Retail margins	Community trust	CSC-SPV
4	Satellite Subsidy	USOF, Indian Space Research Organisation (ISRO), Hughes Satellite BB provider	Govt subsidy	Remote areas	VSAT to NE, Islands
5	Bundled Services	ISPs, Startups	Bundled revenue	Demand-driven	Gram Marg

Table 50: Revenue Model Summary Table

Below are key Tariff Models in use:

Examples of tariff models in the table below for rural broadband connectivity in India, particularly under BharatNet, PM-WANI, CSCs, and public-private partnerships.

S/N	Tariff Model	Description	Example & Source
1	Tiered Data Packages	Affordable data plans designed for rural users with low data usage (e.g., 1GB/day, 2GB/week)	PM-WANI pilots in Gujarat & Kerala
2	Freemium Models	Basic internet access is offered for free or subsidized, with paid upgrades for	BharatNet GP Wi-Fi pilots included free 100MB/day in select states

S/N	Tariff Model	Description	Example & Source
		higher speeds or additional services	
3	Revenue-Sharing with Village Entrepreneurs (VLEs)	Tariffs fixed centrally, but margins retained by VLEs or CSC operators to ensure sustainability	CSC Wi-Fi Choupal Model –with ~25%–35% margin to VLEs
4	Daily & Weekly Vouchers	Flexible recharge options designed for daily wage earners and informal sector	RailTel and CSCs offer day/week vouchers for 1–2 Mbps access
5	Bundled Digital Services	Internet bundled with services like telemedicine, e-learning, agri-advisory	Gram Panchayat Wi-Fi Hotspots provide monthly packages bundled with services
6	Government-Subsidized Pricing (VGF-backed)	Operators compensated via Viability Gap Funding (VGF) to keep tariffs low in unviable regions	BharatNet PPP: Tariff commitments include basic 10 Mbps/month in remote areas
7	Community Wi-Fi Tariffs	Single access point serves entire village with unlimited use model	Wi-Fi Choupals (digital community access point) charge/month/family, often shared via local hotspot routers

Table 51: Key Tariff Models

These models demonstrate how India combines subsidized infrastructure, inclusive pricing, and simplified operations to extend rural broadband, offering a replicable framework for developing economies.

Lessons Learned from India's Rural Broadband Initiatives

Theme	Lesson	Example
Policy & Strategy	National digital inclusion strategies provide long-term direction and confidence for investment.	Digital India, BharatNet, PM-WANI guided large-scale deployment.
Public-Private Partnerships	PPPs with Viability Gap Funding (VGF) make rural deployment financially viable.	BharatNet 2021 PPP model included VGF and rural tariff mandates.
Local Entrepreneurship	Leveraging village-level entrepreneurs (VLEs) through CSCs or local franchises ensures community ownership, trust, and operational viability.	CSC Wi-Fi Choupal model enables VLEs to earn by reselling data and services.
Affordable Tariffs	Low-cost, flexible plans suit rural income patterns and expands uptake.	PM-WANI offers daily and weekly vouchers.
Technology Architecture	Open and device-agnostic architecture using interoperable standards stimulates low-cost innovation.	PM-WANI enables any provider to create Wi-Fi hotspots without spectrum or licensing fees.
Infrastructure Diversification	Combining fiber, satellite, and wireless backhaul enables wider coverage.	ISRO's GSAT-11/29 and Hughes networks support remote villages.
Bundled Digital Services	Internet adoption grows when bundled with practical services such as e-governance, e-health, education, and agricultural services, by driving real demand and sustainability.	CSCs provide broadband with e-health, education, and agri-advice.

Table 52: Lessons Learned from India's Rural Broadband Initiatives

Hungary: Superfast Internet Programme (SZIP) and National Digitalization Strategy

Policy Interventions

The **National Infocommunication Strategy (NIS)** 2014–2020 of Hungary is the foundational document that outlines the country's broadband and ICT goals, including its goal that "every household have internet access of at least 30 Mbps by 2018" and build out the national telecom backbone by 2016. The Strategy, funded by EU Structural Funds, aimed to provide at least 30 Mbps broadband to nearly 410,000 households, focusing on areas lacking commercial viability. The SPV for this is known as Hungary's **Superfast Internet Programme (SZIP)**. By the end of 2020, approximately 250,000 households had access to these services.[15]

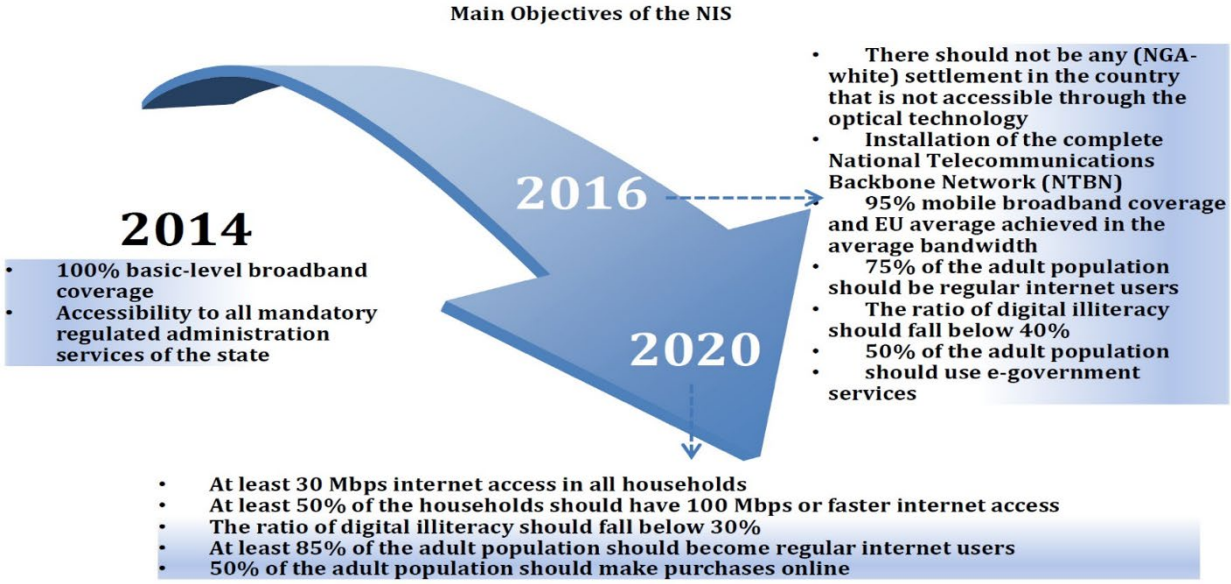


Figure 14: Objectives of National Infocommunication Strategy

National Digitalization Strategy (2022 – 2030)

An additional Policy intervention in Hungary is, National Digitalization Strategy[16] which sets ambitious goals towards:

- Achieving gigabit network coverage for 95% of households by 2030.
- Ensuring 5G coverage reaches 67% by 2025.
- Providing all public education and vocational training institutions with at least 1 Gbps network connections by 2030.
- Developing a nationwide "Gigabit Hungary 2030" network development programme.

These instruments align with EU Digital Decade goals, including minimal bureaucracy and faster rural broadband deployment.

As of 2024, the network coverage for Hungary's **Very High-Capacity Network** (VHCN) is **86%**, while that of households in sparsely populated areas is **75.9%**. **Fiber-to-the-Premises** (FTTP) coverage is **79.86%**, with that of households in sparsely populated areas standing at **68.54%**. **5G** coverage is **85.6%**, while coverage for households in rural areas is **57.9%**.[17] These are depicted in Figure 15 below.

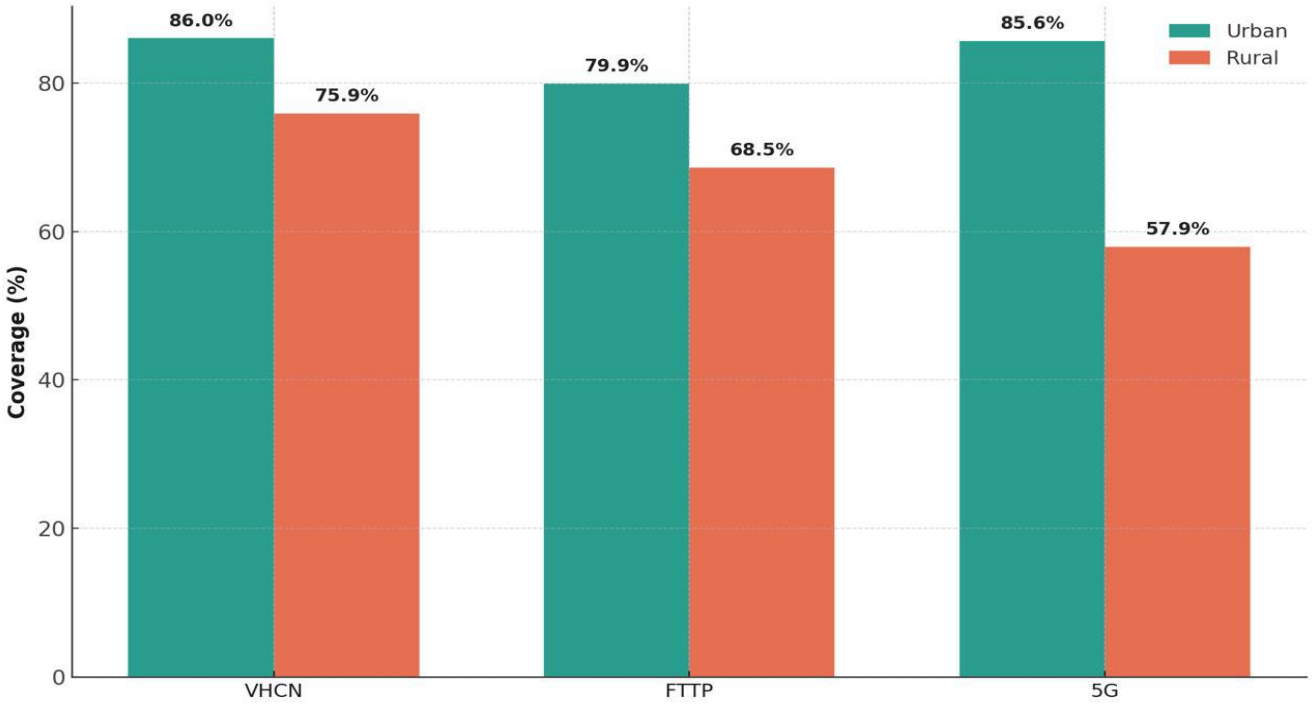


Figure 15: Hungary 2024 Network Coverage: Urban vs Rural

Rural Broadband Deployment

Superfast Internet Programme (SZIP) – Reaching Rural Homes

The implementation of Hungary's largest broadband infrastructure development program to date, is known as Superfast Internet Program (SZIP-1). This program was launched in **September 2014** by the Governmental Agency for IT Development (KIFÜ) which operates under the supervision of the Ministry of Innovation and Technology.

The core **aims** of SZIP-1 are to:

1. **Extend next-generation broadband (≥30 Mbps)** to all underserved households—primarily in low-density villages, farming areas, and remote regions.
2. **Close the digital divide** by ensuring that any household requesting superfast internet (≥30 Mbps) could access it.
3. **Build future-ready infrastructure**, prioritizing FTTH (fiber-to-the-home), open-access frameworks, and comprehensive coverage.
4. **Support broader ICT goals**, including T-work, e-governance, and digital inclusion across homes, public institutions, and enterprises.

Goals and Status (SZIP-2):

The SZIP implementation is currently in Phase 2 (SZIP-2)[18] with the following goals and targets:

- Ensure 100Mbps+ network coverage to 90% of households by 2025.
- Offer more than three times the bandwidth of the previous program.
- Achieve 95% of households with gigabit-capable networks by 2030.
- Extensive 5G deployment coverage of 67% by 2025.
- Focus on providing high-speed internet access to households in areas where it was previously unavailable.

Over **86% of SZIP connections** used FTTH, ensuring future-ready, high-capacity infrastructure.[16] Prioritization was given to remote, low-density settlements and extension to small villages and farms. **22,500 km of fiber** was laid and gigabit access for two-thirds of households achieved, with **3,800** public institutions, including schools and local administrations provided with high-speed optical connectivity by 2022.

Inclusive Business and Tariff Models

Hungary has a couple of business and tariff models deployed to attain the objectives of the NIS and NDS instruments as outlined below:

1. Technology-Neutral, Operator-Led Tendering

Business Model: Under SZIP (Superfast Internet Programme), the Hungarian government issued **district-based** public tenders, funded by EU and national resources.[19] This spurs competition and innovation in rural deployment.
Network operators (e.g., Vodafone, Magyar Telekom) propose technology solutions (FTTH, VDSL, fixed wireless) for each district. Winning bidders build and operate these networks with obligations to serve rural households at or above 30 Mbps.

2. Wholesale & Infrastructure Sharing Mandates

Business Model: The National Digitalization Strategy (2022–2030) mandates non-discriminatory access to passive and active infrastructure (ducts, poles, towers). It enables market access for local ISPs and telecoms operators.[16]
This enables local ISPs and smaller players to utilize existing infrastructure, lowering barriers and fostering competition in rural areas.

3. Flexible Business Solutions for Enterprises & Communities

Business Model: Operators offer portable, easy-to-install home/office and enterprise packages, often via rental routers with trial periods which support SMEs and community adoption of broadband:

• Yettel's OtthonNet/OtthonNet Basic – includes 4G/5G home routers, 1-month free trial, **"Anywhere Mode"** (10 days free national use every 30 days), with extra days available at ~€5/day.

• Yettel's IrodaNet – tailored for SMEs in remote areas, combining 4G/5G with portable routers and optional office connectivity.[20]

4. Affordable Pricing with State Support

Tariff Model: Network operators commit to supply rural broadband at affordable retail tariffs (under 1% of average income), subsidized via state aid without distorting the competitive market. This ensures services are accessible (<1% income) despite low densities.
Example: Vodafone provides 100+ Mbps connections to 18,000+ rural endpoints alongside broader SZIP commitments.

5. Municipal & Enterprise Use Anchors

Tariff Model: Rural broadband plans often bundle connectivity for schools, municipal buildings, and SMEs, improving the financial viability of rural networks by strengthening business cases via guaranteed public demand.
Example: SZIP connected ~3,800 institutions, while Yettel's IrodaNet 4G/5G solution offers fully portable office internet to remote SMEs (up to 50 Mbps basic).[20]

These inclusive models showcase how Hungary blends public funding, operator innovation, shared infrastructure, and affordable pricing to achieve near-universal rural broadband.

Lessons Learned from Hungary's Rural Broadband Initiatives

- Combining EU funding with national strategies such as SZIP can effectively address rural connectivity gaps.
- FTTH-Centric Deployment enhances high coverage of fiber infrastructure (86%) and uptake, which ensures durable and scalable infrastructure for future digital demands.
- Obligations on wholesale access to passive infrastructure reduced duplication and supported competitive rural operators through the infrastructure sharing mandate.
- Setting clear, measurable targets helps in monitoring progress and ensuring accountability.
- State aid schemes are vital for extending services to areas where market forces alone are insufficient.
- A geo-spatial database helped identify underserved districts, improving tendering efficiency and deployment planning precision, via geo-targeting.
- Simplified Administration: Construction permit reforms and harmonized EU-aligned regulations significantly sped up deployment.
- Connecting schools and public offices enhances adoption, raising the return on rural infrastructure investments.

Brazil: Regulatory Reforms and Universal Service Initiatives

Policy Interventions

Brazil has adopted a diverse mix of strategic policy tools and regulatory interventions to expand rural broadband access, especially in underserved areas. These include government-led programs, universal service reform, regulatory incentives, and public-private partnerships, all aimed at reducing the digital divide. These instruments and regulatory interventions are listed below:

1. **National Broadband Plan (PNBL)**

- Launched in 2010, the PNBL aimed to expand national broadband coverage through a public backbone operated by Telebras, the state-owned telecommunications company in Brazil, historically and currently playing a critical role in expanding broadband infrastructure across the country especially in underserved and rural areas.
- The plan facilitated wholesale access for small and regional ISPs and included retail pricing caps to promote affordable access in remote areas.

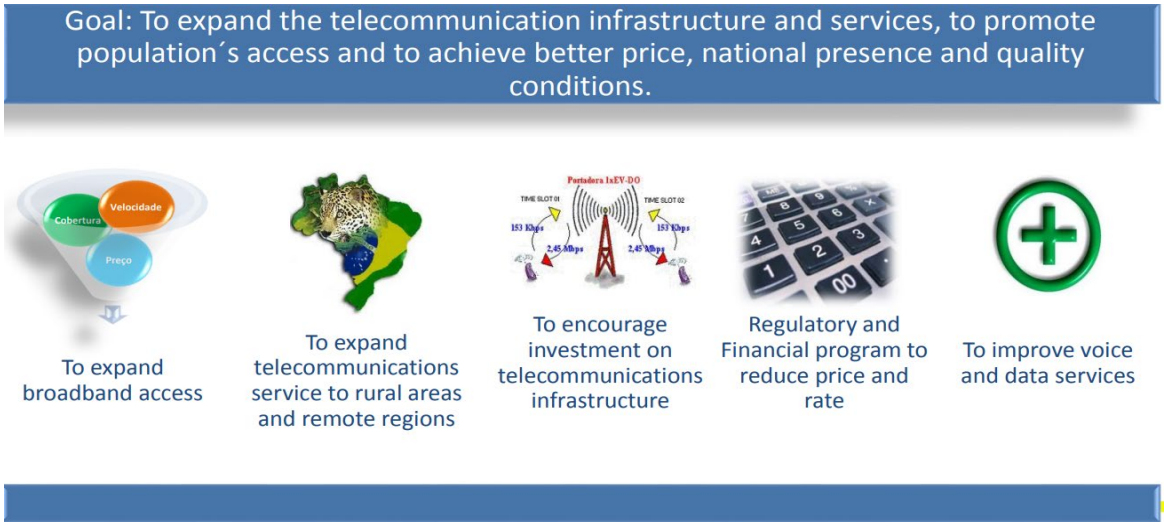


Figure 16: PNBL Goals[21]

In 2018, PBNL was revised by Decree No. 9.612/2018, which provides for broad public telecommunications policies. One of the objectives of the revised policy is to expand broadband networks with adequate quality and speed. It also outlines objectives and guidelines for the Ministry of Communications (formulator of national telecommunications policy) and the National Telecommunications Agency (ANATEL, the sector's regulatory agent).

2. **Wi-Fi Brasil Program (GESAC)**
   Managed by the Ministry of Communications, this initiative provides free broadband internet access via satellite and terrestrial infrastructure to schools, health clinics, indigenous communities, and public spaces. As of 2023, the program had over 17,000 active connection points, especially in rural and remote zones.[24]
3. **Universal Service Fund Reform (FUST)**
   Originally restricted to fixed telephony, FUST was reformed in 2020 (Law 14.109) to allow funding of broadband infrastructure, digital literacy programs, and school connectivity. The law mandates that at least 18% of disbursed resources support internet access for educational institutions.[25]
4. **Spectrum Auctions with Rural Coverage Obligations**
   ANATEL, the national regulator, incorporated rural deployment obligations into mobile spectrum licenses (e.g., 700 MHz and 3.5 GHz). Operators were required to deploy services in underserved municipalities and were encouraged to share network infrastructure (RAN sharing). This approach enabled over 5.6 million new rural mobile broadband connections between 2013 and 2018, adding millions of rural users on 4G and expanding 5G rollout to date.[27]
5. **Credit and Financing through FUST and IDB**
   In 2024, the Inter-American Development Bank (IDB) approved a US $100 million facility for rural broadband deployment. This program supports small ISPs working in towns with

fewer than 30,000 people, using FUST as a co-financing and risk mitigation tool to incentivize private investment.[22]

6. **National Strategy for Connected Schools**
   Launched in collaboration with the ITU and UNICEF (under the Giga initiative), this strategy aims to connect all 140,000+ public schools in Brazil to quality internet by 2026. This demand-anchoring approach not only facilitates educational inclusion but also supports broader infrastructure deployment in rural communities.[26]
7. **Community Network Recognition**
   In recent years, Brazil has taken steps to recognize and support community-based broadband models, especially in regions where commercial viability is low. Legal frameworks now allow small cooperatives and NGOs to deploy and manage local networks with regulatory support.[23]

These evidence-backed interventions from Brazil illustrate how coordinated policy action, funding renewal, and regulatory innovation can expand rural broadband access efficiently, sustainably, and inclusively.

Rural Broadband Deployment

Brazil's rural broadband strategy is shaped by a combination of public investment, spectrum regulation, satellite coverage, and inclusive service models. The following programs illustrate Brazil's multi-pronged approach:

1. Wi-Fi Brasil (formerly GESAC)

Provides free satellite-powered internet access to rural communities, schools, healthcare centres, and public spaces in underserved areas. Over **17,000 active connection points**, including more than 10,000 schools as of 2022. Uses the Geostationary Défense and Strategic Communications Satellite (**SGDC-1) Ka-band** in conjunction with ViaSat to provide rural broadband, especially in schools, clinics, and public facilities in remote areas. Also connected over **1,500 new GESAC points** in Brazil's Amazon and northern regions to schools, healthcare centres, indigenous villages, and rural settlements using SES-17 satellite in collaboration with Telebras.[24]

2. National Broadband Plan (PNBL) via Telebras

Deploys national fiber backbone and wholesales to regional ISPs to deliver affordable broadband services to remote regions.

3. IDB–FUST Rural Credit Program (BR-L1619)

A **US $100 million credit line** approved in 2024 to support small ISPs in towns under 30,000 people. FUST funds are used for co-financing and risk mitigation. Targets connectivity expansion for ≈2.5 million people.

4. Community Telecentres & Literacy Hubs

Initiatives like *Telecentros.BR*, *Internet para Todos*, and *Conecta Biblioteca* provide digital access points, skills training, and community ICT services in rural and peri-urban areas. Local NGOs and municipalities operate centres under national digital inclusion strategies.[24]

Brazil has made significant progress in rural broadband access, with rural household connectivity reaching 81 % in 2023—a sharp rise from 35 % in 2016. Yet nearly 6 million households remain unconnected, largely due to cost, digital literacy, and skill barriers. While fiber infrastructure is widespread (93.9 % population coverage), rural backhaul gaps continue in certain regions. Both mobile and fixed broadband usage in households continue to grow.[32]

Brazil Household Internet Penetration

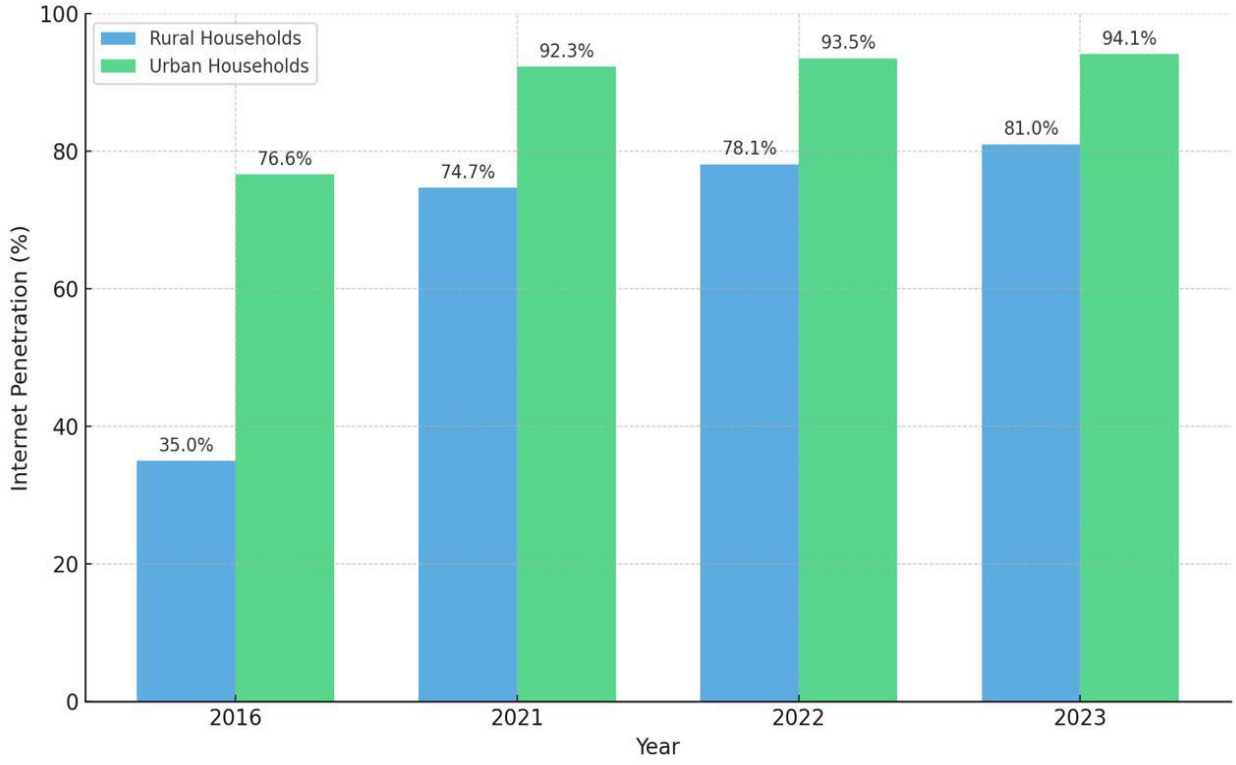


Figure 17: Brazil Household Internet Penetration

Inclusive Business and Tariff Models

Brazil's rural broadband strategy relies on a mixed ecosystem of business models, including PPPs co-financed by development banks, community-led ISPs, and demand-anchored deployments such as the GIGA school connectivity program. Mobile operators fulfill rural coverage obligations under ANATEL's spectrum licenses, while local ISPs aggregate fiber from national backbones to reach smaller towns. Satellite access through the SGDC-1 platform extends Wi-Fi to remote areas.

Business Models for Rural Broadband in Brazil

Model Type	Description	Examples / Actors
Public–Private Partnership (PPP)[22]	Government [e.g., using FUST or Development Bank (BNDES) funds] co-finances network expansion by private ISPs in underserved areas.	Inter-American Development Bank + local ISPs
Community Network Model[23]	Local cooperatives or communities operate their own networks, often with government or NGO support.	Rede Mocambos, Coolab
Universal Service Obligation (USO)[27]	Regulatory licenses include coverage obligations in rural municipalities, enforced by Anatel.	Mobile operators (Claro, Vivo, TIM) covering 700MHz, 3.5GHz
Demand-Anchored Model[24]	Broadband rollout is tied to connecting public institutions (schools, health posts), stimulating local demand.	GESAC program, GIGA initiative

Table 53: Business Models for Rural Broadband in Brazil

Inclusive Business Models Using Tariff Strategies

Business Model Type	Description	How Tariff Models Are Used	Example
Franchise/Village Entrepreneur Model	Local entrepreneurs resell prepaid mobile plans and install Wi-Fi routers in rural areas	Offer prepaid bundles and zero-rated apps to make service affordable	TIM Brazil's "TIM Pré Top" plans + reseller agents
Freemium Anchor Access	Public institutions (schools, health centers) provide free or subsidized Wi-Fi hubs	Free access to zero-rated government/educational content, basic access plans	Brazil's Giga Initiative and public Wi-Fi nodes
Co-op/Community Network Model	Community builds and manages own Wi-Fi/mesh infrastructure; ISPs offer wholesale backhaul	Resell prepaid vouchers with capped data or unlimited WhatsApp	NUPEF networks in Maranhão
Device Bundling Model	Operators sell low-cost smartphones bundled with prepaid data and zero-rated apps	Combines affordable device and low-cost data in a single offer	Claro's phone + rural data kit bundles

Business Model Type	Description	How Tariff Models Are Used	Example
Microcredit + Mobile Model	Users buy service via daily/weekly payments using mobile money or microfinance apps	Supports micro-data bundles or pay-as-you-go plans	Used in small towns through reseller agents

Table 54: Business Models Using Tariff Strategies - Brazil

Tariff Models for Rural Broadband in Brazil

Tariff Model Type	Description	Examples / Application
Prepaid Mobile Data Bundles[28]	Low-cost, daily or weekly prepaid plans with small data volumes. Often include free access to key apps.	TIM Brazil's prepaid plans; Claro's "Prezão"; Vivo Easy
Zero-Rating[29]	Free access to selected platforms (e.g., WhatsApp, Facebook, educational portals) within data bundles.	Claro Flex offers free social media use; school portals zero-rated under GIGA
Subsidized Plans via GESAC[24]	Government-backed free internet access for rural schools, health posts, and communities via satellite.	GESAC program (Wi-Fi Brasil) using SGDC-1 satellite
Social Tariff / Affordable Broadband[30]	Special discount plans for low-income households, often under universal service mandates.	"Plano Popular" (Anatel-mandated); municipal subsidies in Bahia and Amazonas
Franchise Retail Pricing[31]	Village entrepreneurs resell data bundles or Wi-Fi access at retail, with localized pricing structures.	Brisanet and Vero's rural Wi-Fi resellers; TIM's "Frente Digital" in NE Brazil
Usage-Based Tariffs	Tiered pricing based on data consumption (e.g., 1GB, 5GB, unlimited) to match affordability levels.	Common among regional ISPs and mobile operators
Free Basic Internet for Schools[26]	Public schools receive full internet coverage as part of national digital inclusion efforts.	GIGA + FUST funding to connect 140,000+ schools by 2026

Table 55: Tariff Models

While specific tariff structures are not detailed, the government's efforts to reduce taxes and fees for communication services aim to make internet access more affordable, particularly in underserved areas.

Lessons Learned from Brazil's Rural Broadband Initiatives

- Modernizing universal service obligations to include rural broadband and school connectivity subsidies ensures funding aligns with digital development needs.
- Enabling policy environment with regulatory mandates (coverage obligations, infrastructure sharing, backbone access, community network licensing) have been pivotal to accelerating rural rollout while reducing costs.
- Targeted financing programs through empowering small/local ISP providers with access to finance and capacity building enables market-driven expansion in low-density markets.
- School connectivity strategies stimulate demand, rural infrastructure and digital skills, through the creation of institutional anchors which drives usage and justifies backbone investments.
- Community networks provide flexible last-mile access where traditional operators may not venture.