

THE FUTURE OF AFRICAN BACKBONE & METRO FIBRE NETWORKS

The Race to Solve Africa's Last
Major Internet Bottleneck

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& SAMPLE PAGES



AUGUST 2018





- For the past two decades, **the availability of affordable terrestrial fibre capacity has been one of the biggest obstacles to the development of the African Internet**, a problem so complex few markets have managed to solve it, and many despairingly looked like they never might.
- Other digital infrastructure barriers have been gradually removed; **but the terrestrial capacity infrastructure gap has persisted**, stubbornly sustaining a growing African digital divide, one that sees 80%-90% of Internet traffic, usage and benefits accrue to urban, coastal cities, while the African interior remains woefully underpenetrated.
- **There is now urgency.** Long regarded as an established, if not crippling feature in the structure of the African Internet, the terrestrial fibre gap was increasingly looking like a systemic digital development risk.
- **Things are changing.** The need to support 4G and FTTH network coverage and prepare for 5G is transforming metro capacity requirements. Data center operators, cloud providers and global hyperscale Internet companies are upending demand models.
- Private fibrecos such as Liquid Telecom are building extensive cross-country fibre networks. Others, like Dark Fibre Africa and CSquared, are reimagining African metro fibre models and upsetting traditional pricing approaches. And a wide array of China-funded fibre backbone projects are transforming the African wholesale fibre landscape.
- This report, the outcome of years of accumulated research, data, and insights, **provides an unprecedented view into the dynamics underpinning the African terrestrial fibre market.** It is also about how, and where to generate investor value in this mishmash of opportunity and risk. And finally, and perhaps, most of all, it is about whether Africa will, at last, solve the mother of all bottlenecks, and what this means for individual countries' ability to partake in the next industrial revolution.
- **The report explores key questions surrounding the African terrestrial market**, including the state of the current infrastructure, the nature and size of leased metro fibre demand, the scale and impact of government debt-funded fibre backbones, the evolution of metro pricing models, and what, at long last, Nigeria needs to do to unleash its considerable fibre potential.
- **A reference report for all stakeholders and investors in the African connectivity and Internet infrastructure markets.**

Sample key points explored in this report



The insights derived from our research on terrestrial fibre markets are distilled in this report, covering critical key questions and points, including:

- Why the buildout of backbones and the densification of the African metro is now a matter of urgency
- Why African terrestrial fibre economics have historically been so complicated, and what's being done to fix them
- How African metro geographic economics make the metro fibre case harder
- Which wholesale metro markets carry the most upside
- The state of the African fibre infrastructure; how much has been deployed, and by whom
- The African fibre deficit: how much additional infrastructure the continent needs to meet optimal broadband coverage targets, and which markets have the biggest deficits
- What is the size of demand for leased metro fibre capacity, and our long term projections
- What is the impact of global Internet providers on African demand for capacity
- What is the impact of data centers on metro fibre demand
- What has been the impact of government backbones on fibre market dynamics
- The weight of Chinese capital on African fibre buildout
- Which government backbones are true broadband catalysts – and which run the risk of turning into white elephants
- What, in our view, governments can do to maximize their backbone investments
- Who the strongest investment plays are today, in the African terrestrial fibre market
- What specifically makes Liquid Telecom, Dark Fibre Africa and CSquared stand out in this space
- Why we say the African terrestrial fibre deficit has indeed been a market failure – but a government failure too
- Why we say the South African fibre market is ripe for consolidation – and who the acquirers and targets might be
- How Nigerian terrestrial fibre is being held back – and what should be done to fix it
- How Zambia may be small – but a good example of using competition to drive fibre uptake
- And much, much more..

The Corporate/Premium versions of this report include more than 40 supporting charts and data points in Excel format, and/or access to the Xalam terrestrial fibre market visualization dashboards (See Report Specs).



PART 1

THE NUMBERS: OF
SUPPLY & DEMAND FOR
AFRICAN TERRESTRIAL
FIBRE

PART 2

INVESTING IN AFRICAN
TERRESTRIAL FIBRE:
MARKETS AND PLAYERS

PART 3

ADDRESSING SOME
PRESSING, AND VEXING
FIBRE QUESTIONS:
MARKET FAILURE,
GOVERNMENT
BACKBONES

PART 4

COUNTRY FOCUS
ANALYSIS
SOUTH AFRICA, NIGERIA,
ZAMBIA



Markets & Companies Covered



This report focuses on Sub-Saharan Africa at a broad level, with countries covered at varying levels of depth. More than 25 countries and 50+ companies are mentioned in this report. The list below highlights countries and companies covered in depth, or with some regularity.

Markets Covered with Good Depth

- South Africa
 - Kenya
 - Nigeria
 - Ghana
 - Ivory Coast
 - Cameroon
 - Senegal
 - Tanzania
 - Zambia
 - Zimbabwe
- The report includes detailed profiles for South Africa, Nigeria and Zambia (see Table of Contents)
 - Another 10-15 countries are mentioned, with varying levels of depth.

Companies Mentioned*

- Airtel
- Axione
- BCN Nigeria
- BCS
- Broadband Infracore
- Broadbased Nigeria
- Camtel
- Cell C
- Csquared
- Dark Fibre Africa
- Facebook
- FibreCo
- Fibrecom
- Huawei
- I H S
- Liquid Telecom
- MainOne
- Maroc Telecom
- MTN
- Orange
- Phase III
- SCPT
- Seacom
- Soliton Telmec
- Telkom SA
- Vodacom
- Zamtel

*Mentioned multiple times



INTRODUCTION: SOLVING THE MOTHER OF ALL BOTTLENECKS

EXECUTIVE SUMMARY

Key Takeaways – Lots of fibre, and more coming

Key Takeaways – Data centers, government backbones, and the upside of metro networks

Key Takeaways – Investing in African terrestrial fibre: markets and players

Summary Key Charts

PART 1 - OF SUPPLY & DEMAND FOR AFRICAN TERRESTRIAL FIBRE

DIGGING INTO THE (FIBRE) NUMBERS: THE BIG PICTURE

The African terrestrial fibre boom – the half-a-billion kilometer mark was passed in 2016

From a self-provisioning era to a competitive, “open-access” era

A more focused, more specialized business – and the rise of state-owned fibre

From do it yourself to co-investing: African buildout models are evolving

AFRICAN FIBRE DEMAND: BUILDING FOR 4G, PREPARING FOR 5G

Drivers of demand: a Summary View

Building to support 4G

The Rise of 4G – More than 100 networks, towards ~200m connections

The 5G Impact: Not here yet, but already a potential game changer for fibre backhaul

The mobile leased fibre demand equation

Mobile leased capacity demand rising by ~30% annually

AFRICAN FIBRE DEMAND: ALTERNATIVE NETWORKS, HYPERSCALE INTERNET AND THE CLOUD

The emergence of alternative broadband providers

The rise of FTTH

African data center demand: building “power plants with fibre”

The hyperscale are coming – and they need fibre

Fibre Demand Outlook – Leased fibre capacity requirements are projected to triple



PART 2 - INVESTING IN AFRICAN TERRESTRIAL FIBRE

INVESTING IN AFRICAN FIBRE: WHICH MARKETS HAVE THE MOST UPSIDE?

The African terrestrial fibre boom – South Africa leads the way
Africa terrestrial fibre – Not competitive everywhere
African open access deployments – Governments lead the way
Africa Fibre Density – More Fibre is Needed
When open access doesn't really mean open
Where is the upside? A sample market review

INVESTING IN AFRICAN FIBRE: THE RISE OF THE METRONET

Metro fibre: the next big challenge – and opportunity
Metro opportunities are uneven
An improving African metro case

INVESTING IN AFRICAN TERRESTRIAL FIBRE - THE PLAYERS

African wholesale fibre plays – Stars, upstarts, and everybody else
African Fibre Plays – Our wholesale terrestrial opportunity watchlist
Liquid Telecom: From Cape Town to Cairo – an unassailable moat
Liquid Telecom: from pure wholesale to cloud infrastructure play
Liquid Telecom: a growth story in charts
Dark Fibre Africa: Through metro fibre, South Africa's (other) most attractive independent ICT asset
Dark Fibre Africa: with 5G coming, in the right place, at the right time
Csquared: Building value by upending metro tradition

PART 3 - ADDRESSING SOME PRESSING, AND VEXING QUESTIONS

AFRICAN TERRESTRIAL FIBRE: A CASE OF PRIVATE SECTOR FAILURE?

A Vexing, but important question
Market failure, or just not good business?
Charting demand: not all mobile operators are inclined to lease fibre

ARE GOVERNMENT BACKBONES THE SOLUTION?

The rise of the state: Governments control ~30% of SSA's Installed Fibre (excl. South Africa)
African government backbones – who's building, who's financing (China, mostly)
African government backbones – broadband catalysts, or white elephants? It's complicated
How to maximize government backbone assets: Liberalize the metro

HOW MUCH FIBRE (AND MONEY) IS NEEDED?

More fibre needed – and increasingly in the metro
Charting Sub-Saharan Africa's fibre requirements



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SOUTH AFRICA - FIBRE CONSOLIDATION IS COMING

- South Africa market overview
- South Africa terrestrial fibre: some fundamentals
- South Africa's terrestrial fibre market structure: a summary view
- Evolution of South Africa's terrestrial fibre supply – the dominance of open access
- South Africa terrestrial fibre demand
- Charting South Africa's terrestrial capacity demand – Fibre to the Site
- There's more depth here: SA's terrestrial capacity demand projected to triple
- Tier 2 & 3 Provider demand will drive the market
- SA's terrestrial fibre revenue outlook: all about the metro
- South Africa's terrestrial fibre: a market share summary
- South Africa terrestrial fibre: a positional market mapping
- SA fibre market: ripe for consolidation
- Playing the SA fibre market

NIGERIA - WILL THIS (POTENTIAL) FIBRE GIANT EVER RISE?

- Nigeria market overview
- Nigeria terrestrial fibre: some fundamentals
- Nigerian terrestrial fibre supply – Scarcity masquerading as abundance
- Nigerian terrestrial fibre supply – Charts
- The Nigerian Potential – How much fibre does Nigeria need?
- How much (open access) fibre does Nigeria need?
- Why doesn't Nigeria have more fibre? The Rights of Way predicament
- Heavy reliance on the private sector, no government-backed backbone
- The impact of high fibre rollout costs: stunted open access
- Nigeria Fibre – Undeniable Potential, Unreadable Outlook
- Nigeria leased capacity market – a potential 2x-3x larger than the baseline

ZAMBIA - SMALL, WITH UPSIDE

- Zambia market overview
- Zambia terrestrial fibre: some fundamentals
- Zambia – Despite the geographic constraints, a market with upside
- Zambia's terrestrial fibre market structure: a summary view

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PART 1 - THE NUMBERS: OF SUPPLY & DEMAND FOR AFRICAN TERRESTRIAL FIBRE

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 Number of Multi-Tenant Data Centers in Africa – Top Line View
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PART 2 - INVESTING IN AFRICAN TERRESTRIAL FIBRE

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 Africa Terrestrial Fibre – Competitive Context Map - 2017 E
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 Terrestrial Installed Fibre by Model/Primary Purpose of the Networks – 2017 E
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 Kilometers of Open Access Fibre Deployed Over the 2012-17 Period – SSA's Top 17 Countries
 SSA market mapping by network focus and competitive context
 Metro Share of Sub-Saharan Africa Installed Terrestrial Fibre
 Sub-Saharan Africa Country Mapping – Land Area vs. Number of +250k Metros
 SSA FibreCo Mapping – Market Share vs. Market Potential
 Liquid Telecom – Annual Revenue
 Liquid Telecom – Evolution of Fibre Network
 Liquid Telecom Africa Network – Q1 2018
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 SSA Fibre Geographic Challenge – Country Distribution by Number of Mid-Scale Metros*
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PART 3 - ADDRESSING SOME PRESSING, AND VEXING QUESTIONS

Government backbones: the white elephant path
 Government backbones: the market catalyst path
 SSA Fibre Requirement Mapping – Fibre Needed to Meet Targets vs. % of Targets that Have been Achieved – 2017E

PART 4 - COUNTRY FOCUS ANALYSIS

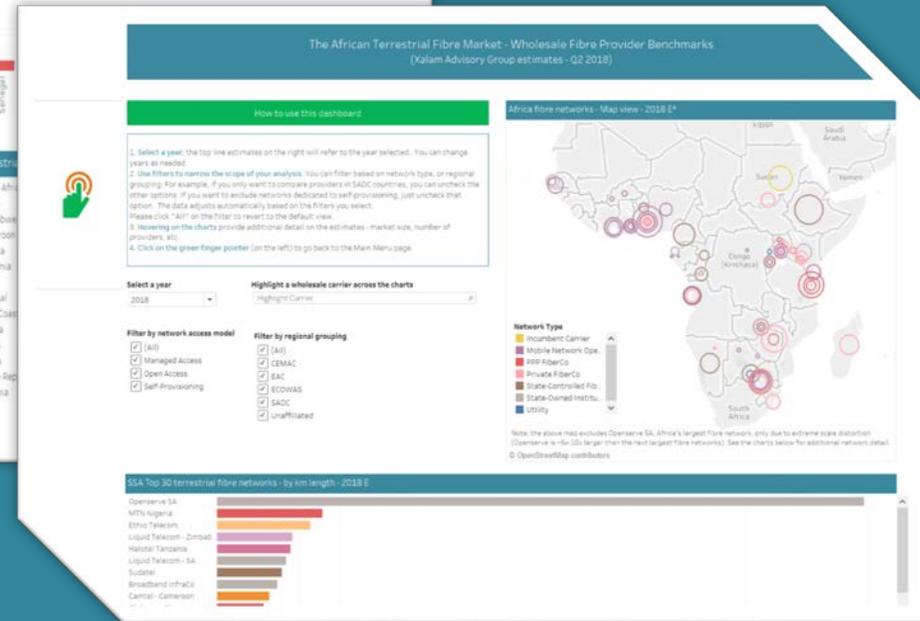
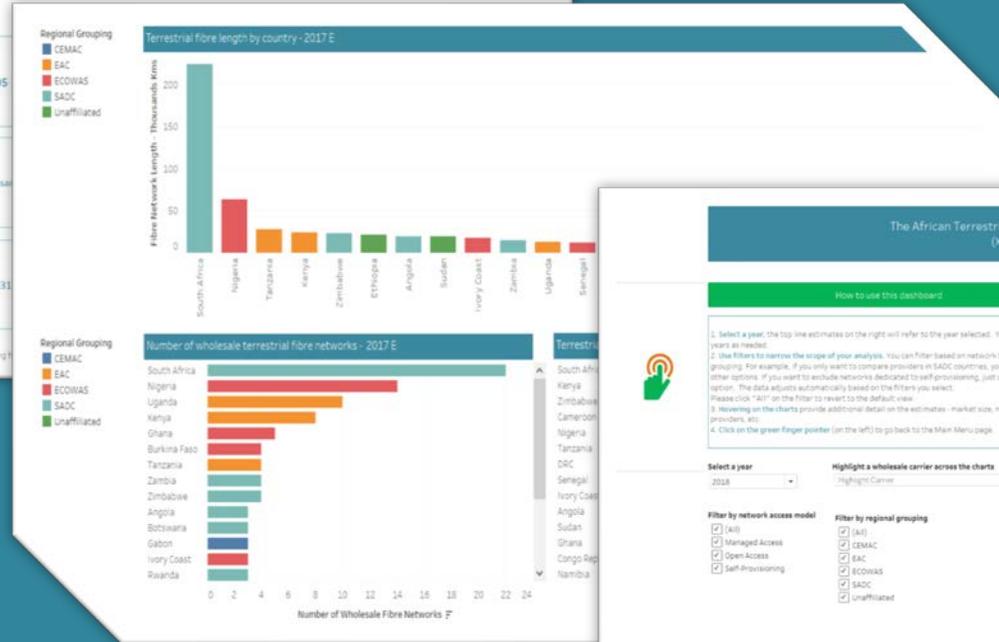
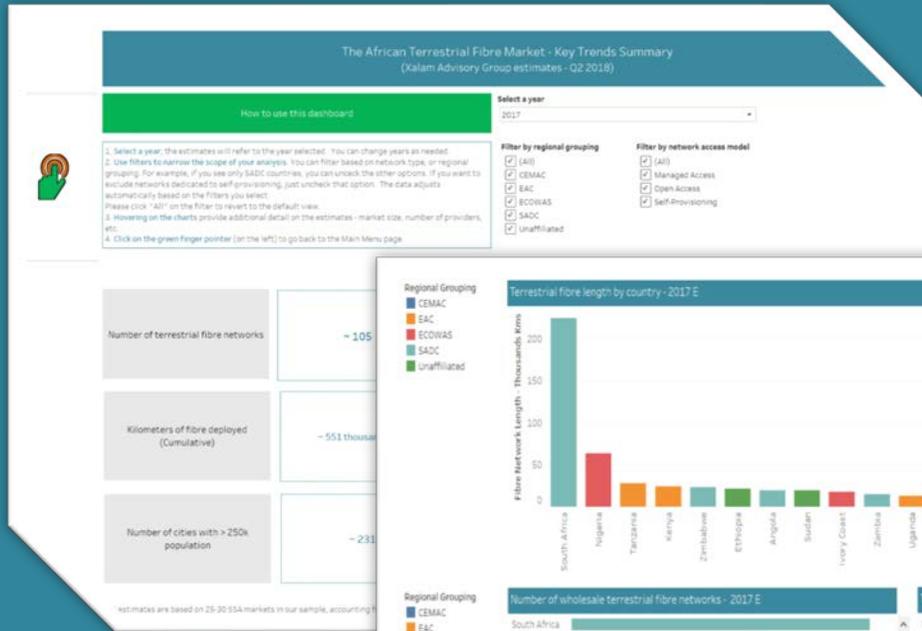
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 South Africa: Evolution of mobile fibre sites, and demand for leased fibre to the site
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Nigeria Metros - +250,000 population
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Zambia Metros - +250,000 population
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 Zambia fibre network share – based on km distance
 Zambia Fibre Network Maps: Zesco
 Zambia Fibre Network Maps: Liquid Telecom

The analysis in this report is powered by the Xalam Africa terrestrial fibre dashboards

- See terrestrial fibre data at country, metro level
- Get full detail on estimated wholesale demand – total sites, 4G/5G sites, fibre sites, data center demand and more
- Filter the data interactively, use maps to visualize metros
- Benchmark wholesale fibre market size and metro fibre pricing across 20+ markets



- A powerful, AWS-based, interactive visualization tool - that transforms how you see and absorb African market data
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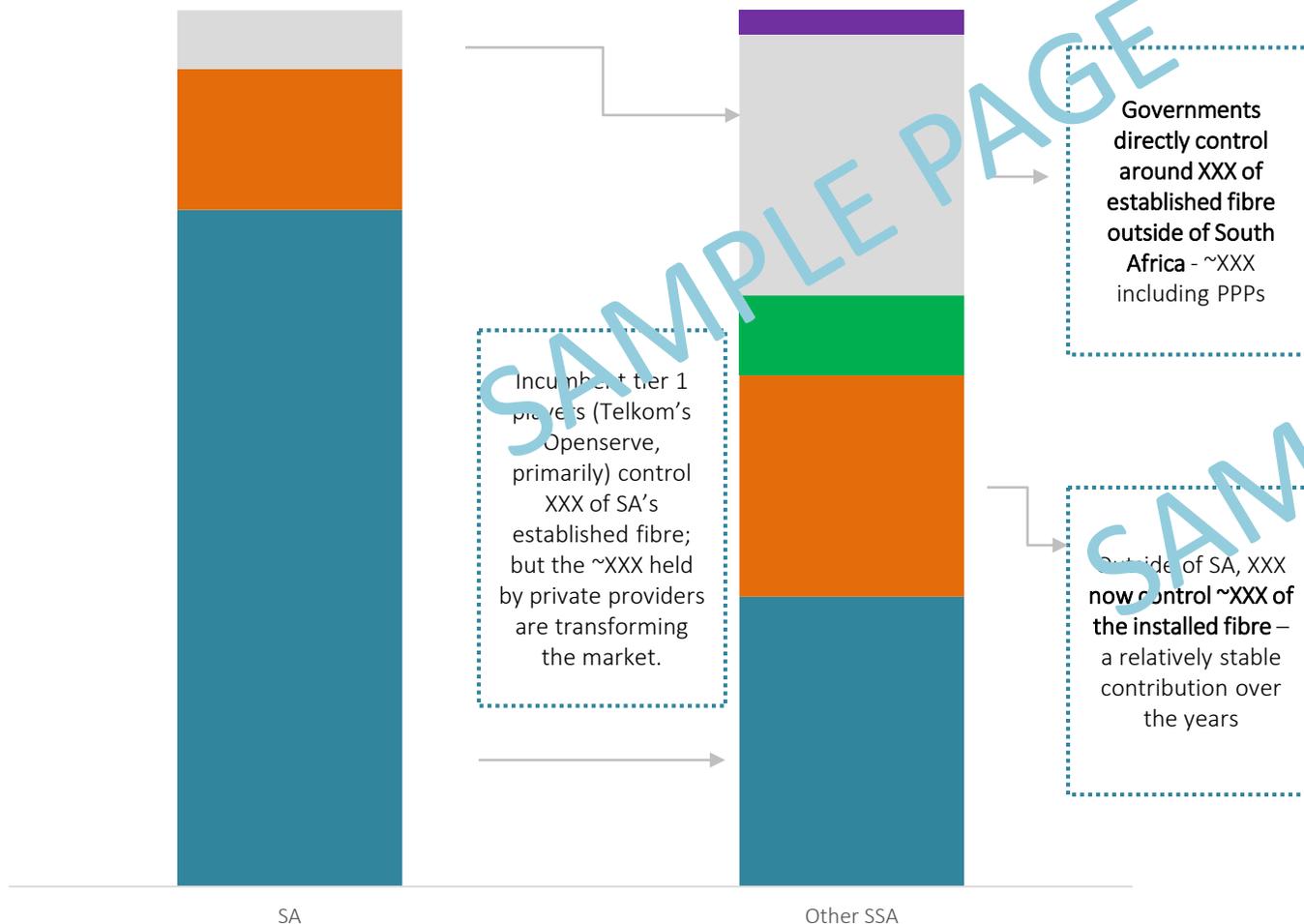
SAMPLE PAGES

The following are sample pages for this report, provided for indicative purposes only, with edits, and in no particular order.



A more focused, more specialized business – and the rise of state-owned fibre

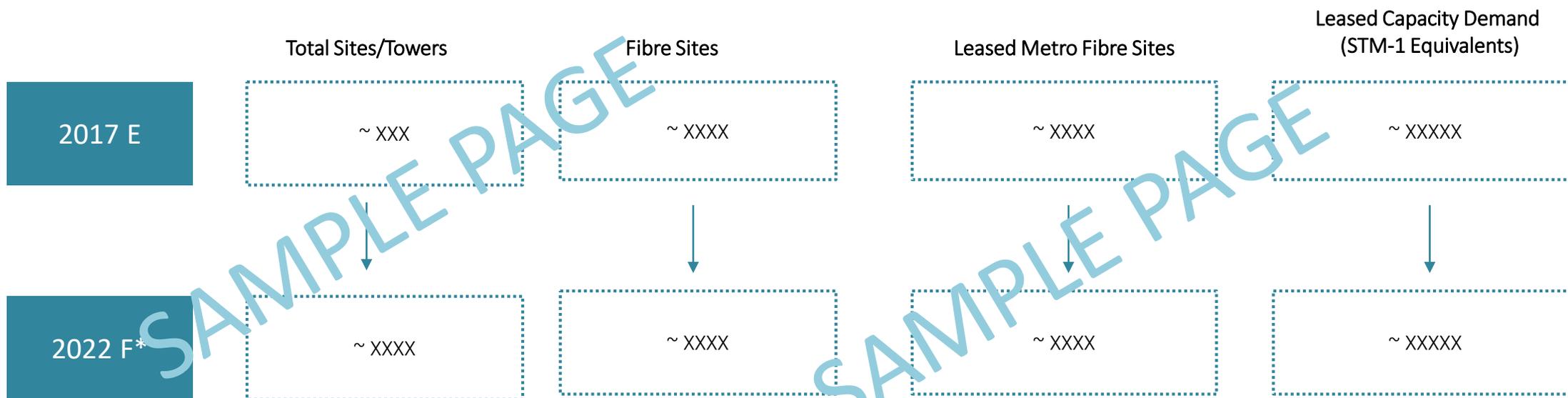
Share of Fibre Networks by Provider Type – South Africa vs. Other SSA Markets – 2017 E



- The African terrestrial fibre market has undergone significant transformation. In 2010, around XXX of the interurban and metro network base was controlled by mobile operators and state-controlled fixed carriers (~XXX in South Africa).
- This was a significant constraint on the terrestrial fibre market, typically translating into high prices for terrestrial fibre capacity, often higher than prices in the more competitive international bandwidth market.
- Between 2012 and 2017, private fibrecos (including public-private partnerships) laid out XXXXX of all new SSA terrestrial fibre, dramatically changing the face of the market. Today, these private fibrecos hold ~XXXX of SSA's established fibre base (vs. XXXX in 2012).
- Also noteworthy is the emergence of governments as key fibre players, most notably outside of South Africa, as more governments step in to compensate for what they perceive as private sector failure in the terrestrial fibre segment. Around XXX of African fibre outside of South Africa is now held by institutions under the control of the state.
- Including PPPs, African governments now have a hand on about XXXX of Africa's terrestrial fibre, a development with significant implications going forward.

The mobile leased fibre demand equation

Charting Demand – From Total Sites to Leased Capacity Demand



The overall fibre site requirements are seeing near-explosive growth



But the evolution of leased capacity demand will be a function of supply volumes and pricing, as well as the propensity of tier 1 mobile providers to outsource

Actual capacity requirements are growing even faster

*These projections take a conservative stance on Nigeria
Source: Xalam Analytics estimates

Not all the same – from open access to largely closed off

Terrestrial Installed Fibre by Model/Primary Purpose of the Networks – 2017 E



*including fibre backbones and metro networks only.

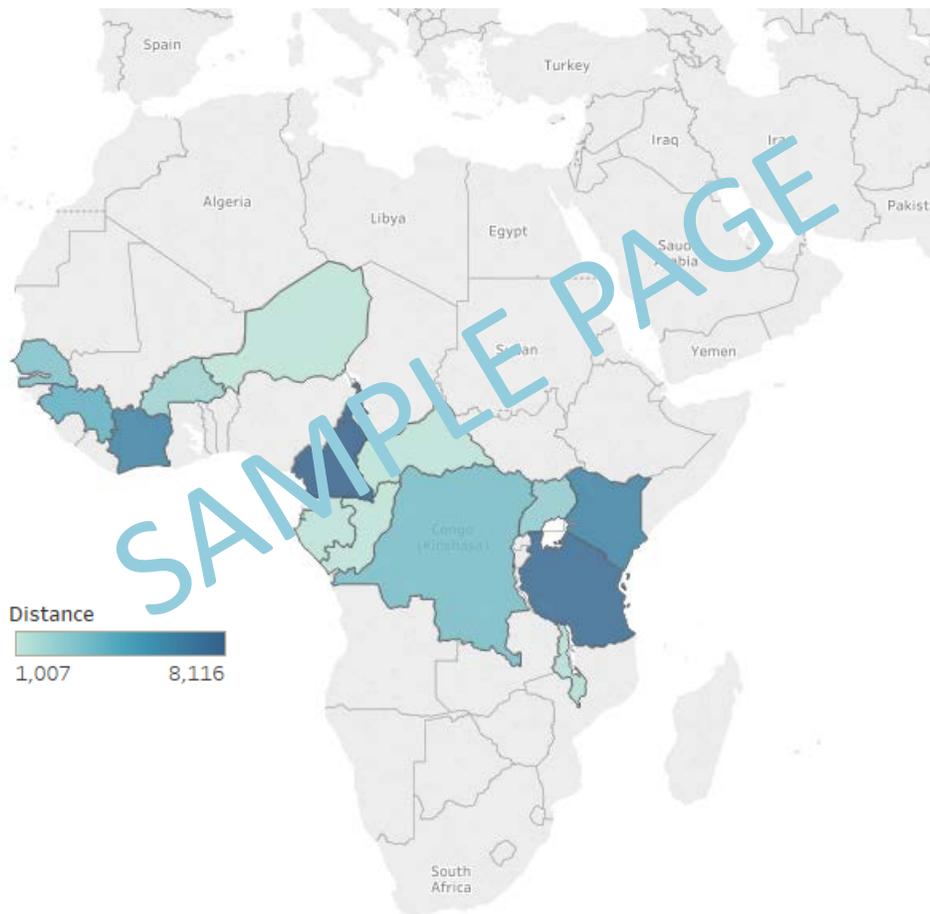
Source: Xalam Analytics estimates

Where is the upside? A sample market review

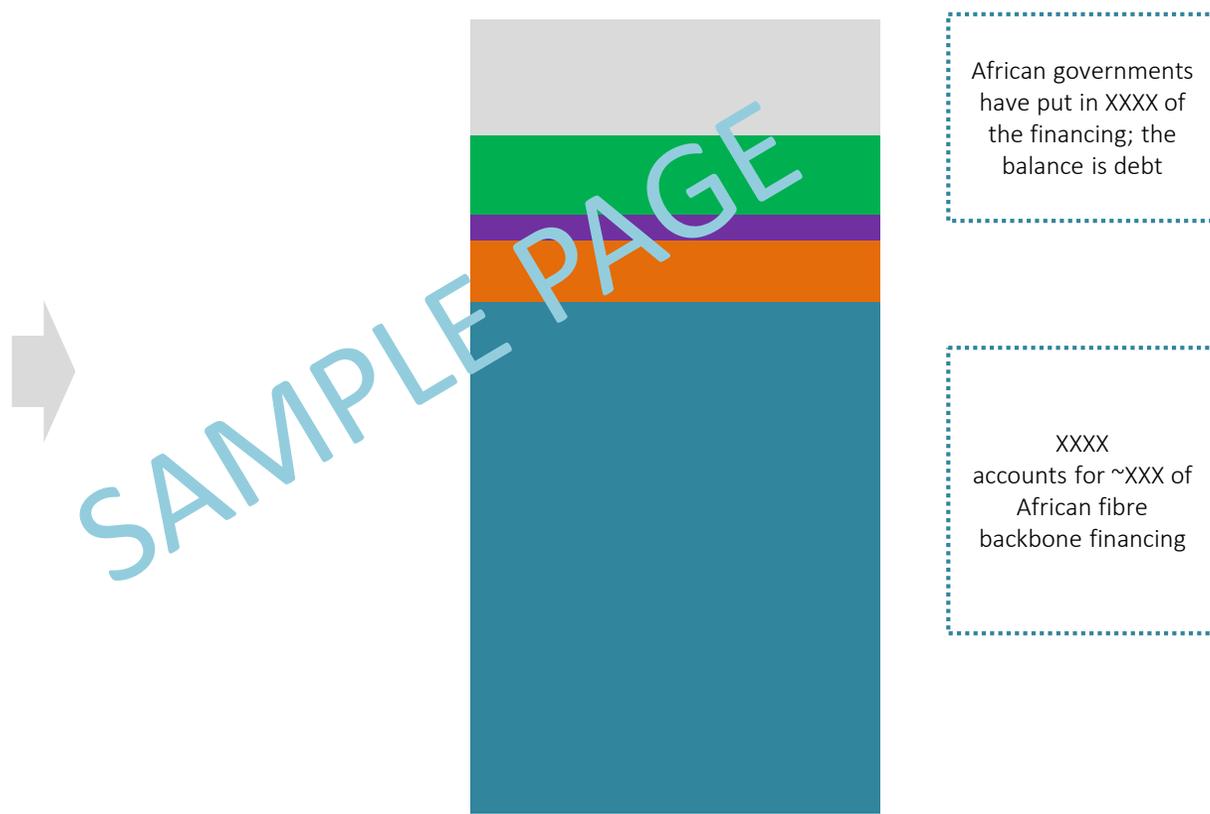
Geographic Attractiveness	Regulation/Competition	Primary Demand Potential	Secondary Demand Potential	Backbone Impact	Dark Fibre Availability	Overall attractiveness

African government backbones – who’s building, who’s financing

Who’s Building: Overview map of Government-built African Terrestrial Backbones – 2017E



Who’s Paying: African government backbones – Sources of Financing



Sources: Government data, press reports, Xalam Analytics estimates

Sources: Government data, press reports

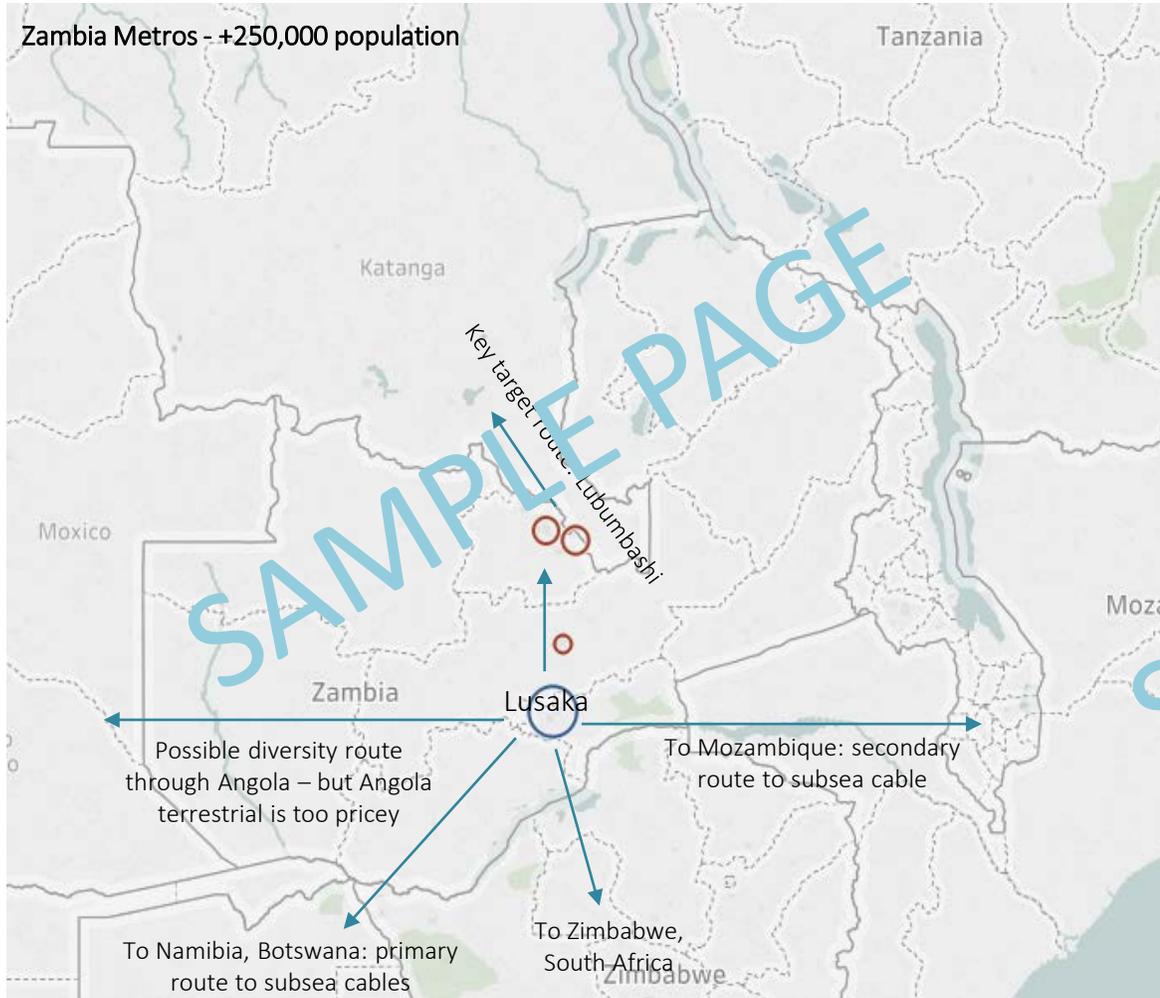
Why doesn't Nigeria have more fibre? The Rights of Way predicament

Why doesn't Nigeria have more extensive fibre infrastructure? The answer to this question is complicated, a mix of market failure, local/state government short-sightedness, and failure of leadership. But addressing this challenge will determine whether Nigeria continues to fall behind on fibre – and ultimately, 4G and 5G. We have identified a number of key reasons.

- **The predominant factor is XXXXX** . Depending on the structure of the project, rolling out a kilometer of backbone fibre in Nigeria is XXXXXX more expensive than in other Sub-Saharan African markets. [.....].
- In some states, RoW fees are among the highest in the world, reaching upwards of XXXX. This would translate in deployment costs of XXXX per km; covering 1000 kms would cost between XXXX and XXXX , an unworkable proposition for most providers.
- XXXXXX
- XXX

Rights of Way Rates in Sample Nigerian States





Metro Market Fundamentals

- XXXX
- XXXXXXXXXXXXXXXXXXXX
- XXXXXXXXXXXX
- XXXXXXXXXXXX

Regulation / State of Fibre Competition

- XXXX
- XXXXX XX XX XXXX
- XXX XX XXX
- XXX XX XXXX

Key Routes

- XXXX
- XXXXXXXXXXXXXXXXXXXX
- XXXXXXXXXXXX
- XXXXXXXXXXXX

Basic	Classic	Premium
PDF + 1-5 Users Licence	PDF + Excel Charts + Corporate Licence	PDF + Excel Charts + Corporate Licence + 1 Month Access to Xalam Fibre Dashboards*
US\$ 1,500	US\$ 2,000	US\$ 2,500
<u>Report Delivered in PDF Format</u>	Package delivered in PDF, Excel, Winzip or Box, including:	Package delivered in PDF, Excel, Winzip or Box, including:
Including: 120 pages 50 Charts & Visuals	<u>Report in PDF</u> – 120 pages & 50 Charts & Visuals <u>A 10-Slide Executive Synopsis</u> <u>40 Charts with underlying chart data in Excel format</u>	<u>Report in PDF</u> – 120 pages & 50 Charts & Visuals <u>A 10 Slide Executive Synopsis</u> <u>40 Charts with underlying chart data in Excel format</u> <u>1-month access to Xalam Terrestrial Fibre Dashboards (a \$1250 value!)*</u>



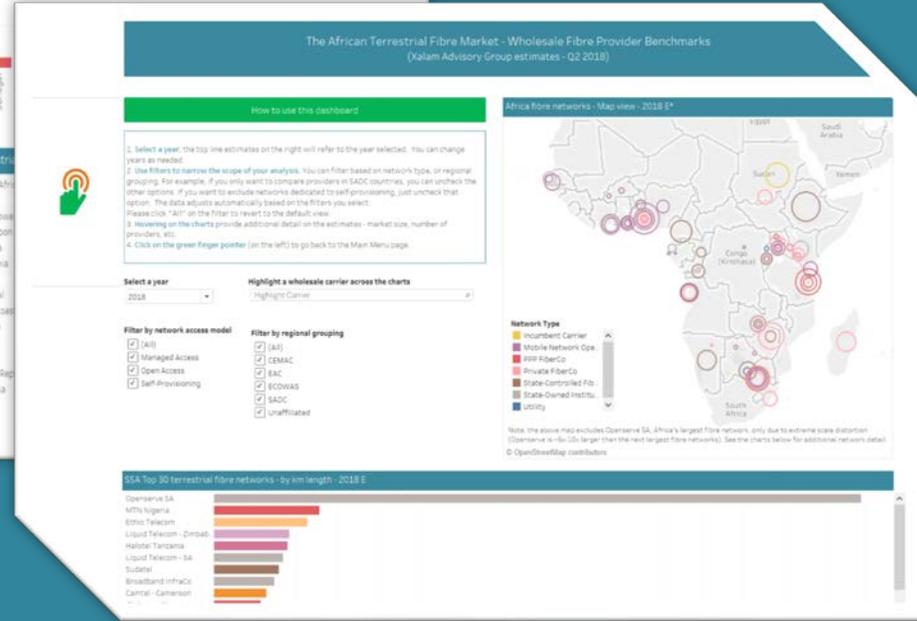
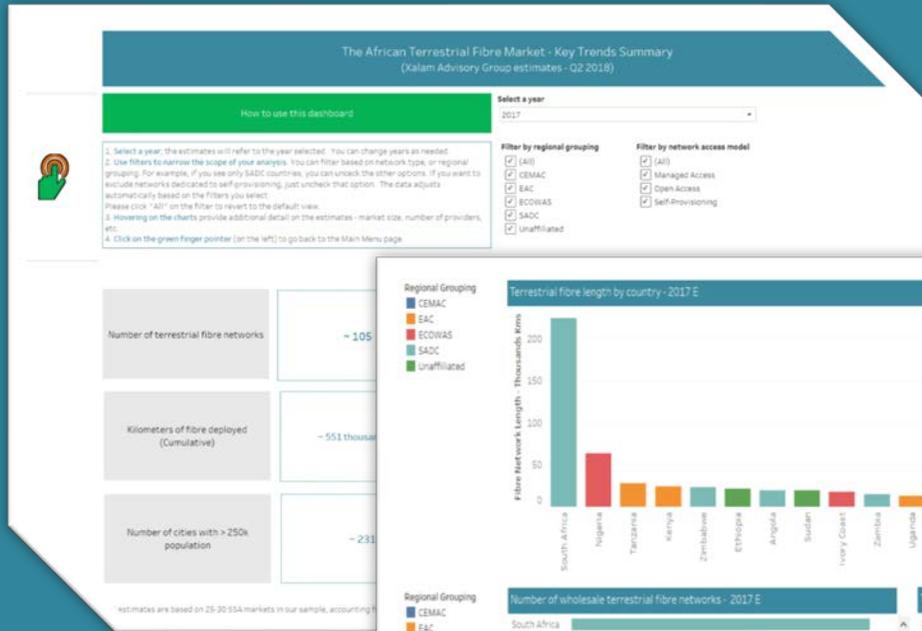
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