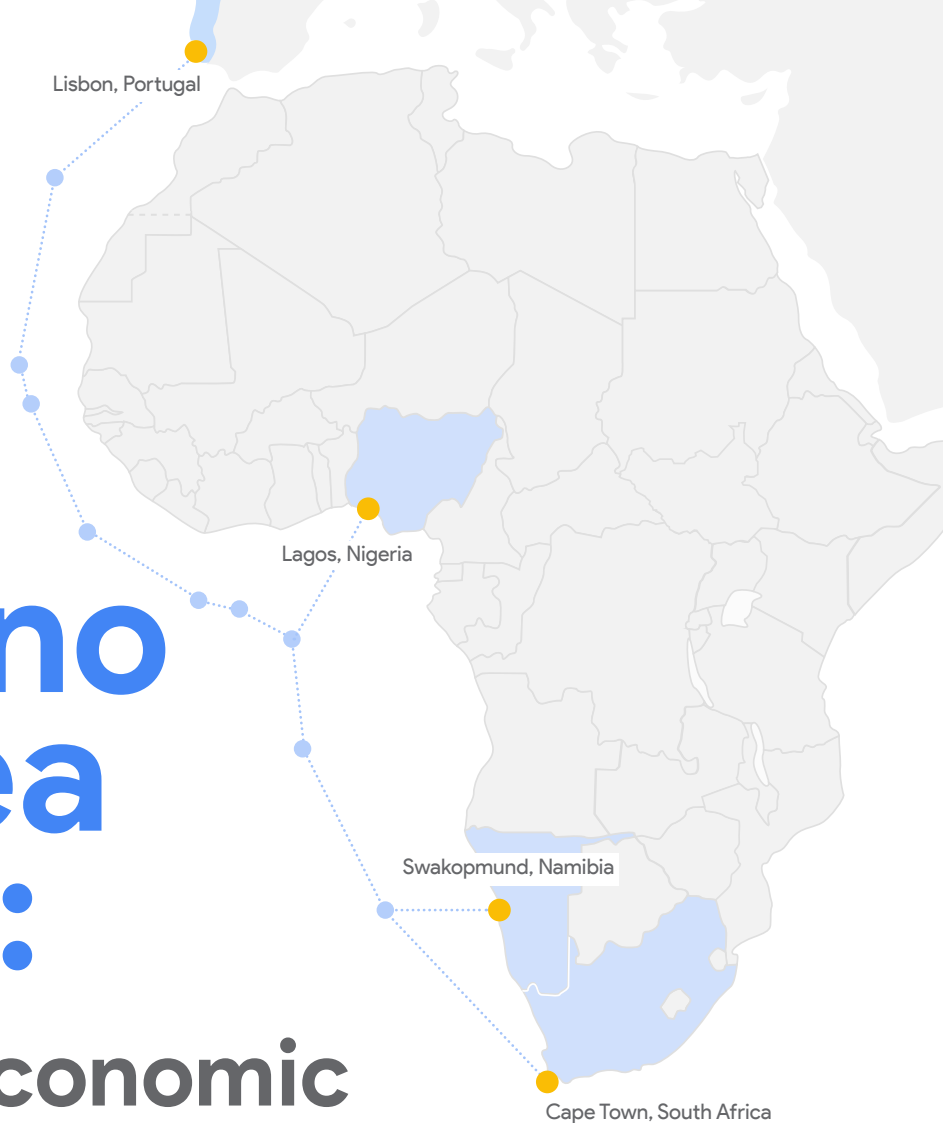




Equiano Subsea Cable:

Regional Economic Impact Assessment



This assessment was commissioned by Google and conducted by Africa Practice with economic modelling assistance from Genesis Analytics. The report is based on Equiano economic impacts assessments for three markets across the continent – Nigeria, South Africa and Namibia. The report will be updated in 2022 to incorporate new economic impact assessment data from additional countries in Africa.

Africa Practice

Africa Practice is a strategic advisory firm operating at the nexus of industry and government since 2003. It advises corporations, investors, and foundations across Africa, enabling them to drive sustainable and equitable development.

Genesis Analytics

Founded in 1998, Genesis Analytics was one of the first economics-based consulting firms in Africa. It uses its technical capabilities to improve decision-making and unlock substantial value for clients and society.



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1 : Executive summary

Equiano - a next-generation subsea internet cable spearheaded by Google - will run from Portugal to South Africa, along Africa's Atlantic Ocean coastline. In 2022, it is expected to land in Lagos (Nigeria), Cape Town (South Africa) and Swakopmund (Namibia), with branching units in place for further phases of the project.

Globally, sub-Saharan Africa remains the most underserved region in terms of internet infrastructure. Penetration stands at 26%, while for the entire continent (including North Africa), it is 40%. Across much of the continent, people lack access that is affordable, reliable and of good quality. Poor connectivity hinders economic growth, poverty reduction, human development and progress towards the Sustainable Development Goals. According to the Broadband Commission for Sustainable Development, USD 100 billion in private and public investment is needed to achieve universal and affordable access to good quality broadband in Africa by 2030.

Equiano will have a direct impact on connectivity in all the countries in which it lands, resulting in faster internet speeds, improved user experience, and reduced internet prices. By 2025, due to Equiano, internet speeds in Nigeria are expected to increase almost six-fold, and to almost triple in South Africa and Namibia. Over the same time frame, internet prices are expected to drop by between 16% and 21% in the three countries. Improved speeds and lower prices are expected to increase internet penetration by 6% points in Nigeria, 8.5% points in Namibia, and 9.3% points in South Africa.

By increasing international bandwidth, Equiano will indirectly¹ broaden access to the

internet, thus contributing to narrowing the digital divide within the countries in which it lands, as well as between them and regions where connectivity is more developed.

Africa's digital transformation and its internet economy - projected to grow from USD 115 billion in 2020 to USD 180 billion in 2025 and USD 712 billion by 2050 - depend on well-developed connectivity infrastructure. Strong connectivity and more affordable and reliable internet access can help countries diversify their economies away from historically dominant sectors, such as agriculture or natural resources, unlocking new pathways to collective prosperity.

Between 2022 and 2025, average year-on-year real economic growth is expected to increase by 0.52% points, 0.41% points and 0.54% points, respectively in Nigeria, South Africa and Namibia due to Equiano. By 2025, real GDP in these countries is expected to be higher by USD 10.1 billion, USD 7 billion and USD 260 million, respectively, relative to what it would have been without the cable.

Improved connectivity also accelerates job creation. Between 2022 and 2025, Equiano should indirectly create 1.6 million jobs in Nigeria, 180,000 in South Africa and 21,000 in Namibia, driven by the expansion of the digital economy and peripheral sectors.

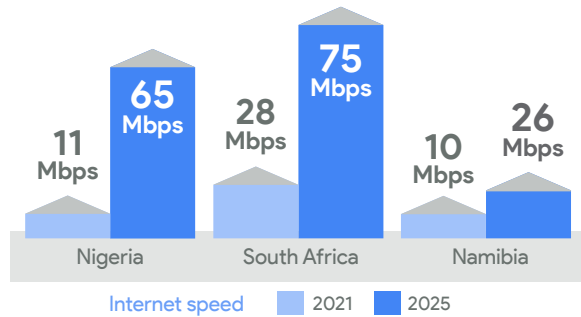
1. See Figure 11 on page 16.

Equiano's key impacts in Nigeria, South Africa and Namibia

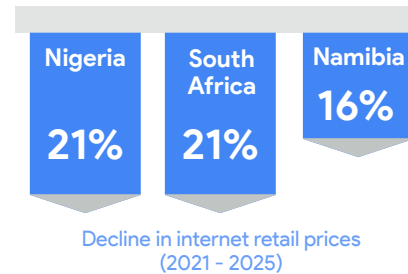
A boost for connectivity



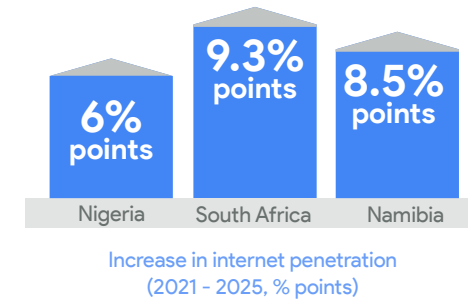
Average internet speeds are set to rise following Equiano's landing



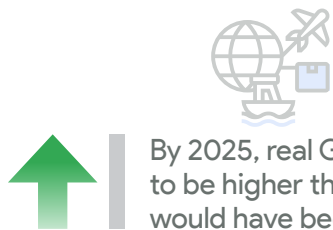
Equiano will also result in major price reductions for consumers, improving affordability of access



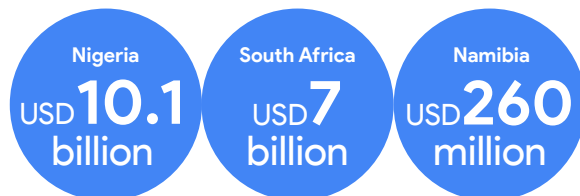
Improved speeds and affordability will result in greater internet penetration



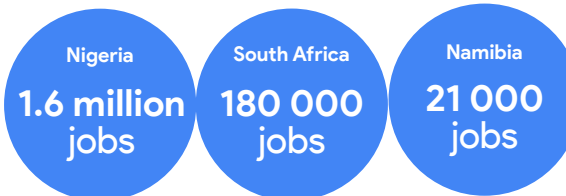
A catalyst for growth, job creation and sustainability



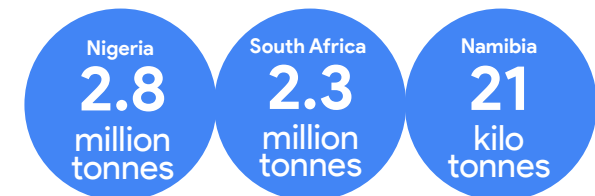
By 2025, real GDP expected to be higher than it otherwise would have been by:



Equiano will boost job creation (2022 - 2025)



Tonnes of CO₂ emissions to be saved (2022 - 2025)



2 : Sector diagnostic

The case for investing in telecommunications infrastructure in Africa



Globally, sub-Saharan Africa is the most underserved region in terms of internet infrastructure. It lags substantially in terms of internet access, with existing infrastructure unequally distributed. Internet penetration² in sub-Saharan Africa stands at 26% - compared with 40% for Africa³ - while the global average is 63%. A vast proportion of the continent's population lives without internet access that is affordable, reliable and of good quality. Sub-Saharan Africa's underdeveloped telecommunications infrastructure thus represents a significant investment opportunity that can also be a crucial driver and catalyst of socio-economic development.

The World Bank and African Union have set themselves the goal of digitally enabling every individual, business and government in Africa with affordable and good quality broadband by 2030. According to the ITU/UNESCO Broadband Commission, governments, development partners and the private sector will need to invest USD 100 billion between 2020 and 2030 to achieve this goal.⁴ Significant investments in infrastructure, including submarine cables, will be needed to realise this ambition. Similarly, progress towards the UN's Sustainable Development Goals (SDGs)

- whether in terms of poverty reduction, economic growth, reduced inequalities or climate action - can be accelerated with improved connectivity across the continent.

Africa's need for better connectivity infrastructure is made evident not only in light of current gaps, but - more importantly - of future ones. The continent is developing rapidly, both economically and demographically, and is becoming increasingly urbanised. Nineteen of the 20 fastest growing countries in the world are in Africa and the continent is predicted to almost double in population over the next three decades.⁵ By 2030, young Africans are expected to make up 42% of the world's youth. By the turn of the next century, a third of all 15-35 year olds on the planet will be in sub-Saharan Africa. The continent's cities are also rapidly growing, with the urban population set to increase by an additional 190 million people over the next five years.⁶

With such a large and growing population of young people, there is a clear need to invest in connectivity today to meet tomorrow's needs.

2. Defined as the share of the population with internet access.

3. Internet World Stats, 2020, Internet Penetration in Africa.

4. Broadband Commission, 2019, Connecting Africa Through Broadband.

5. Population Reference Bureau, 2018, 2018 World Population Data Sheet.

6. United Nations Department of Economic and Social Affairs, 2018, World Urbanization Prospects.

Africa's digital divides

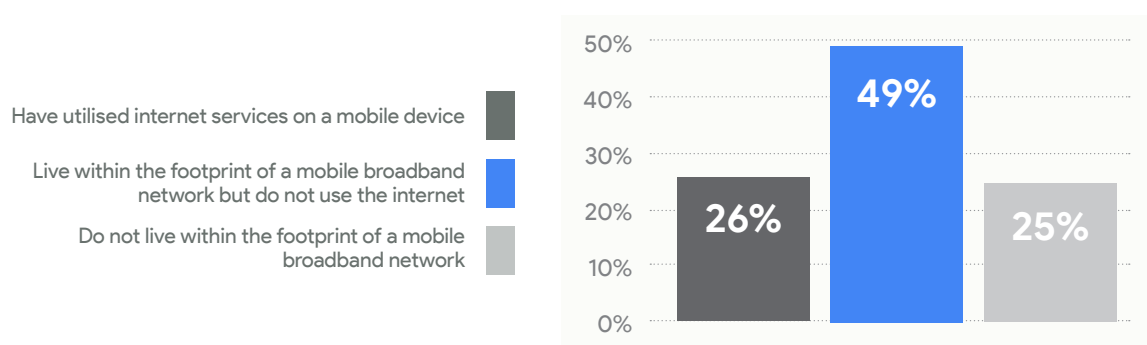
Penetration

There is a vast digital divide between Africa and the rest of the world, and this is particularly pronounced in sub-Saharan Africa. An estimated 780 million people out of Africa's population of 1.3 billion do not have access to the internet, despite an estimated 300 million people gaining access over the last decade. Disparities in access are even higher in sub-Saharan Africa, where 26% of the population - some 272 million people out of 1.1 billion - has used internet services on a mobile device. In comparison, internet penetration in Europe stands at 88% and 94% in North America.

The picture across the continent is far from homogeneous, with significant market disparities hampering access. In the Democratic Republic of the Congo (DRC) and Burundi, for instance, internet penetration barely reaches 10%, while in Kenya it is 85% - above the global average.⁷ Africa's 16 landlocked countries fare worse than those with coastal access because of the lack of terrestrial infrastructure connecting them to submarine cables. Accordingly, internet prices in landlocked countries are significantly higher than in their coastal counterparts.⁸

Access to the internet across the region is hampered by both infrastructural and non-infrastructural barriers. Almost half of Africa's population lives within the footprint of a mobile broadband network, but has not used mobile internet. This internet usage gap is due to three main factors: unaffordability, limited digital literacy, and lack of consumer services.⁹ Affordability itself constitutes a major challenge. Infrastructure development - including the landing of subsea cables - can help boost affordability and increase uptake. Meanwhile, 262 million people across sub-Saharan Africa - 25% of the region's population¹⁰ - are not covered by mobile broadband services. Africa's internet connectivity remains heavily skewed towards mobile access, even though the fixed section of the market is expected to triple in the next three years. At present there are 6.6 million fixed broadband connections, reaching only 0.6% of sub-Saharan Africa's population.¹¹

FIGURE 1 : Broadband access and coverage in sub-Saharan Africa



Source: World Bank, 2020, Africa's Pulse - Charting the Road to Recovery.

7. Internet World Stats, 2020, Internet Penetration in Africa.

8. According to the World Bank's Digital Dividends report from 2016, the average price (per Mbps/s in USD PPP for a month of fixed, residential broadband service) was USD 438 in landlocked countries, compared with USD 206 for coastal countries.

9. GSMA, 2020, The Mobile Economy - Sub-Saharan Africa

10. World Bank, 2020, Africa's Pulse - Charting the Road to Recovery.

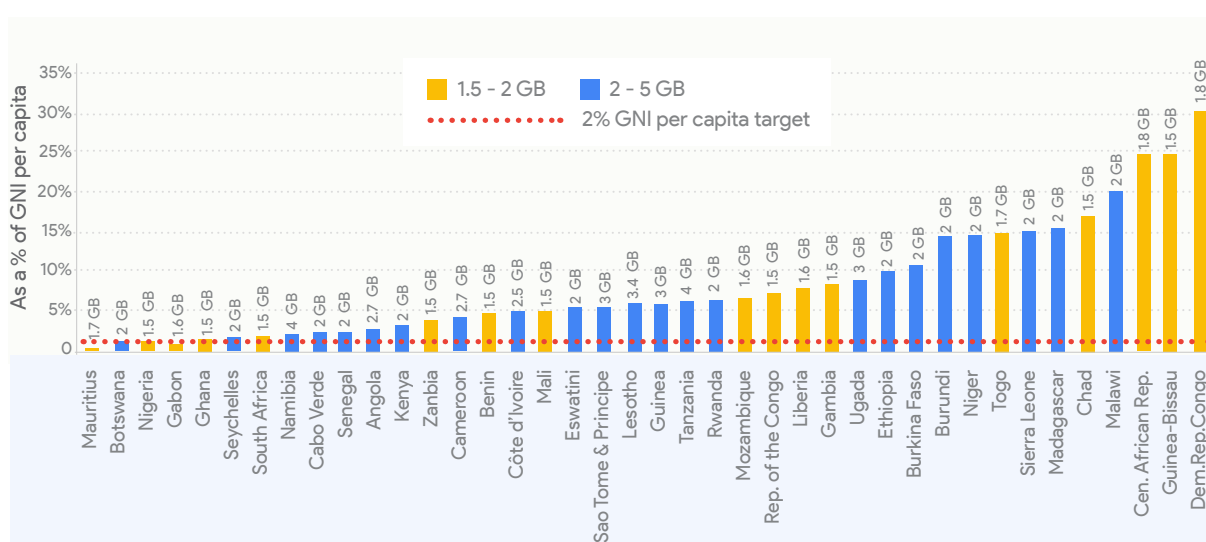
11. East African Business Week, 2019, Fixed Broadband Growth in Sub-Saharan Africa an Opportunity for ISPs.

Reaching these unserved segments of the population will require significant investments to build or expand infrastructure, and improve access and affordability. In parallel, initiatives to boost the affordability of digital devices such as smartphones, tablets and laptops, as well as digital literacy and awareness programmes, are needed to boost adoption of the internet across the region.

Affordability

Africa has the least affordable data in the world compared to its residents' average income. Affordability is a key determinant of internet adoption, limiting how intensively people can use the internet. In 2019, the average cost of 1GB of data was 7.1% of the average individual's monthly salary.¹² In Asia, that figure stands at 1.5%, while it is 2.7% in the Americas. In many countries across the continent, the average cost of data is far higher - in the DRC, 1GB of data represents over a quarter of the average monthly salary, and in the Central Africa Republic, 22%.

FIGURE 2 : Mobile data prices as a percentage of GNI per capita and monthly data allowance in Africa in 2020



Source: ITU, adapted from "Measuring Digital Development, ICT Price Trends 2020"

Figure 2 highlights mobile data-prices as a percentage of Gross National Income (GNI) per capita. In Africa in 2020, only four countries - Mauritius, Botswana, Nigeria and Gabon - had mobile broadband baskets that meet the Broadband Commission's affordability target of 2% of GNI per capita. Thirteen countries have baskets ranging between 2% and 5% of GNI, suggesting they are on track to meet the commission's target by 2025. In 11 African countries, however, mobile data baskets are still out of reach for a large part of the population. They typically cost more than 10% of GNI per capita, in contexts where incomes are already very low,¹³ and further limited by the economic impacts of COVID-19.

12. Borgen Project, 2020, Achieving Universal Internet Access in Africa by 2030.

13. ITU, 2020, Digital Trends in Africa 2021: Information and Communication Technology Trends and Developments in the Africa Region, 2017-2020.

Quality of service

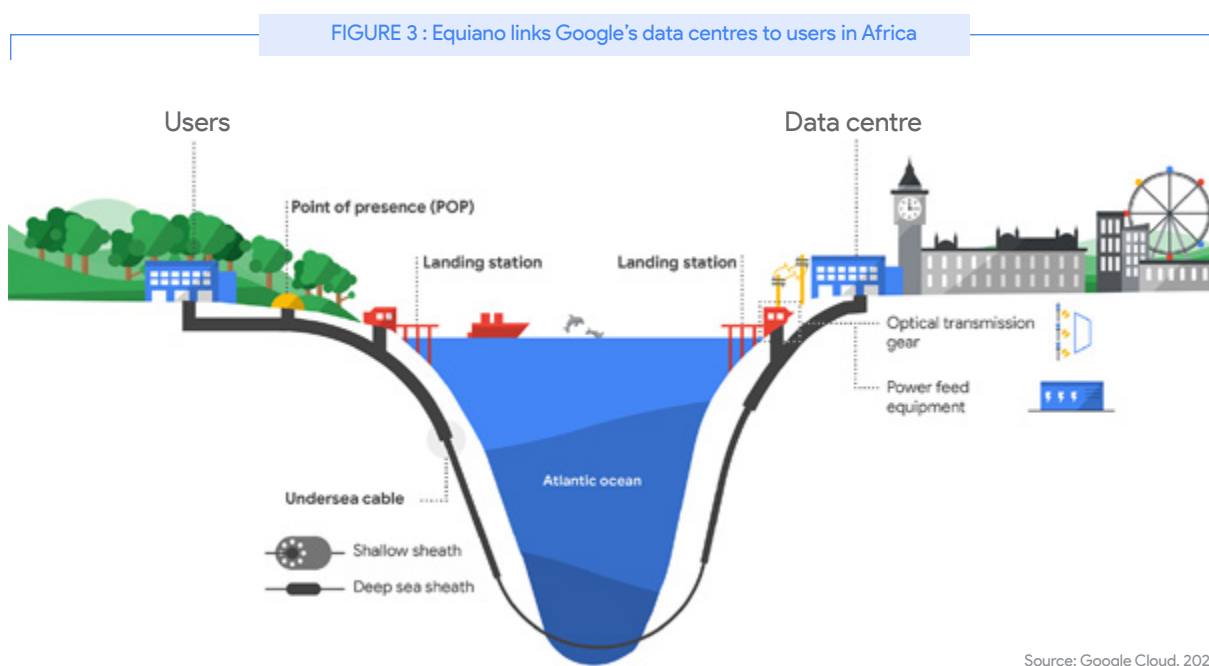
Poor quality of service hinders user experience and the adoption of digital services.

While 2019 was a landmark year in which 3G and 4G began accounting for the majority of connections in sub-Saharan Africa, slow-speed 2G connectivity remains the second most dominant technology behind 3G.¹⁴ 4G has been rolled out quickly over the last few years, but utilisation is only expected to reach less than a third of the sub-Saharan African internet market by 2025.¹⁵ Expanding access to reliable, high-speed internet across the region is central to unlocking its digital potential.

Unreliable and expensive power supply affects the quality of service. This impacts all facets of connectivity and hinders digital development. In effect, without power, there is no internet. This is true across the continent, from the least developed economies to South Africa, where frequent load-shedding regularly disrupts internet access for millions of users. Solving the power-internet gap in Africa will be central to boosting the continent's digital growth in the coming years.

The submarine connectivity value chain

Significant investment and partnerships along the entire value chain can boost connectivity, increase internet penetration, reduce prices and improve quality of service for end users. Submarine cables - while not the only factor at play - are central to unlocking Africa's digital potential and narrowing the digital divide between the continent and more developed regions. The vast majority of online content consumed in Africa is hosted in data centres outside the continent, with submarine cables transporting data between users and data centres through a complex value chain depicted in [Figures 3 and 4](#).









14. GSMA, 2020, The Mobile Economy – Sub-Saharan Africa.

15. IFC and Google, 2020, e-Economy Africa 2020.

We detail Google's contribution to the submarine connectivity value chain in [Figure 4](#).

FIGURE 4 : The submarine connectivity value chain

	 Data centres	 Submarine cables	 Edge locations	 Middle-mile infrastructure	 Internet access networks	 End users
STAKEHOLDERS	Data centre operators, content providers	Content providers, telecom operators, submarine cable vendors	Telcos, IXPs, ISPs	High-capacity, private and public backbone and backhaul operators, intercity networks	ISPs, fixed and mobile broadband providers, telcos, towercos	Consumers, businesses, governments, educational establishments
GOOGLE'S INFRASTRUCTURE ¹⁶	Hyperscale data centres in North and South America, Europe and Asia ¹⁷	Equiano cable system and investments in other cable systems	PoPs in Mombasa, Lagos and Johannesburg, edge nodes in major cities in Africa (Google Global Cache ¹⁸)	Google leases backhaul capacity from vendors and invests in middle-mile technology, such as Taara		
DETAILS	Host, store and process data for dissemination around the world	Deliver data from content providers via submarine cables to PoPs	Exchange internet traffic via peering, while edge nodes and caches reduce latency and costs by bringing data closer to users	Transports traffic from edge locations to internet access networks	Serve end users via wired or wireless connections	Leverage the internet for a wide variety of uses

Africa faces **five main interrelated infrastructure challenges** at all stages of the value chain:



Data centres are predominantly located outside Africa,¹⁹ meaning content for users on the continent has to travel far via international submarine cables or expensive satellite links.



Existing submarine cables are ageing and typically rely on older technology, while many countries lack redundancy. Existing subsea infrastructure will be unable to meet the rising demand for international bandwidth in the coming years.



Edge locations on the continent are not yet fully developed, meaning content has to travel further to end users, increasing cost of access and latency. New and existing IXPs need to grow to ensure content is hosted locally and traffic is routed efficiently.



Middle-mile infrastructure is underdeveloped despite strong growth in recent years. Between 2015 and 2020, terrestrial fibre networks on the continent grew 72% from 622,000 km to 1,072,000 km.²⁰



Internet access networks are not sufficiently dense or developed to provide universal access. Currently, 25% of Africa's population does not live within the footprint of a mobile broadband network.

16. See [Google's Edge Network](#).

17. At the time of writing, Google did not have data centres in Africa.

18. Google Global Cache allows ISPs to serve certain Google content from their own networks, easing congestion within ISPs' networks, reducing the amount of traffic on their peering and transit links.

19. As of 2020, Africa accounted for less than 1% of global data centre capacity, though is rapidly catching up with other continents. Between 2017 and 2020, the continent's capacity doubled according to [Xalam Analytics](#).

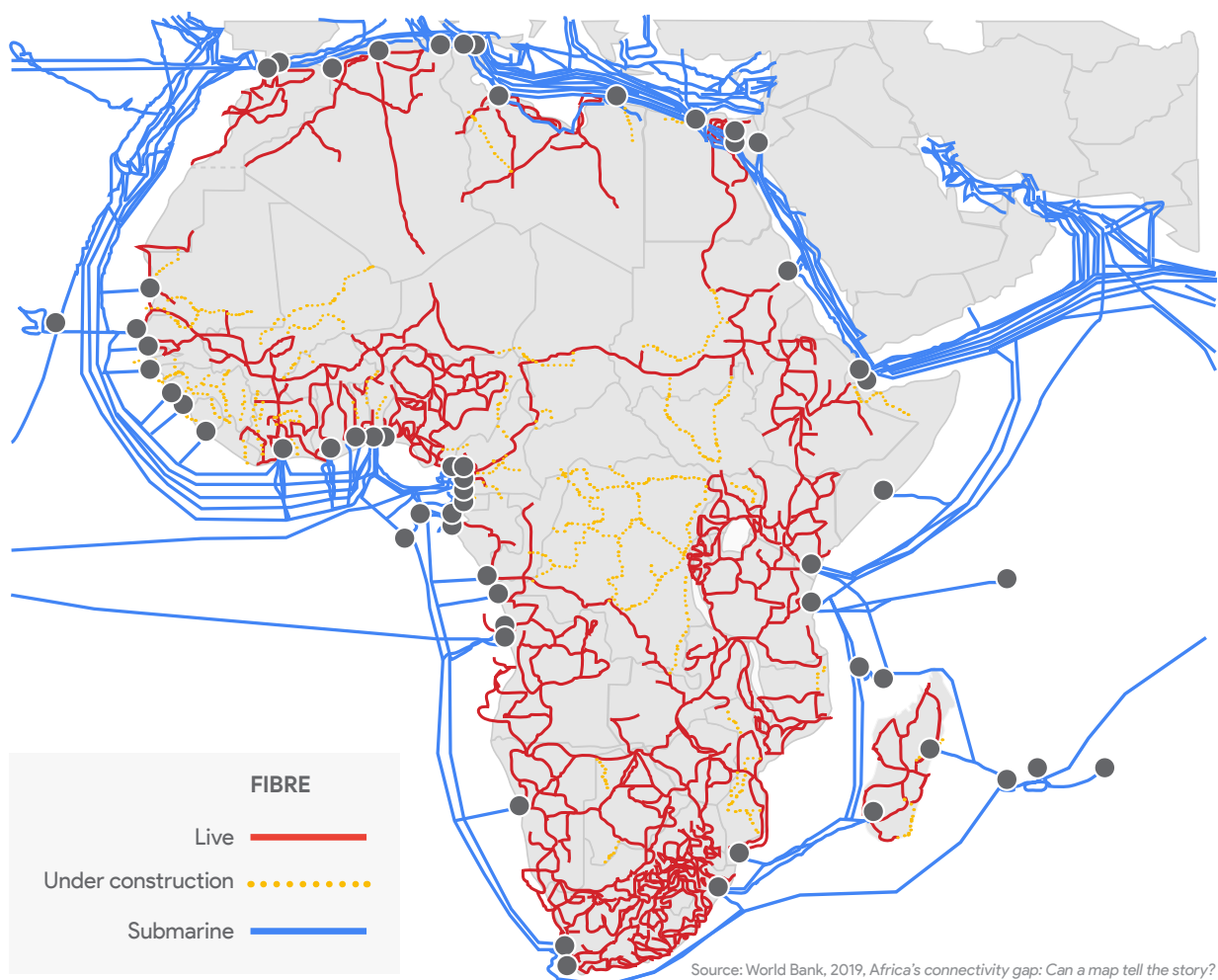
20. Hamilton Research, 2021, Africa Bandwidth Maps.

Bridging the divides: the critical role of submarine cables

Submarine cables are integral to achieving the above transformational objectives – they are the world’s information superhighways and form the cornerstone of the internet. They carry an estimated 97% of global international communications and USD 10 trillion in daily financial transactions.²¹ The remainder of international traffic is satellite-based. High-speed, high-capacity connections - underpinned by submarine infrastructure - are central to today’s hyperconnected global economy. Cables enable high-quality video streaming and conferencing, international phone calls, and support the growth of cloud computing.

At a global level, bandwidth demand is set to almost double every two years²² in the short-to-medium term due to the rise in internet users worldwide, combined with increasingly data-hungry applications and use cases. In the short run, significant investments in subsea cables²³ are needed to meet the rapidly growing demand for international bandwidth, particularly so in Africa, which will continue to experience the highest demand growth globally.

FIGURE 5 : Africa's submarine and terrestrial fibre infrastructure



21. BBC, 2017, Russia a 'risk' to undersea cables, defence chief warns.

22. Subtel Forum, 2020, Submarine Telecoms Industry Report, 2020/2021 Edition.

23. While satellites play a vital role in connecting hard-to-reach areas, submarine cables offer significant advantages: fibre is estimated to transfer data five times faster than satellites and at a much lower cost. Repairing damage to submarine cables is also more straightforward than to orbiting satellites.

CASE STUDY: CABLE DAMAGE AND DISRUPTION TO CONNECTIVITY IN WEST AFRICA

In recent years, West Africa has experienced several cable cuts, resulting in major disruptions to services despite a degree of network redundancy in countries such as Nigeria, which are connected to several cables. In January 2020, cuts to the SAT-3/WASC and West African Cable System (WACS) - both of which run from Europe to Africa - significantly affected telecommunications in Nigeria, Ghana, Senegal and Liberia, leaving businesses and users unable to access reliable internet for over a week.

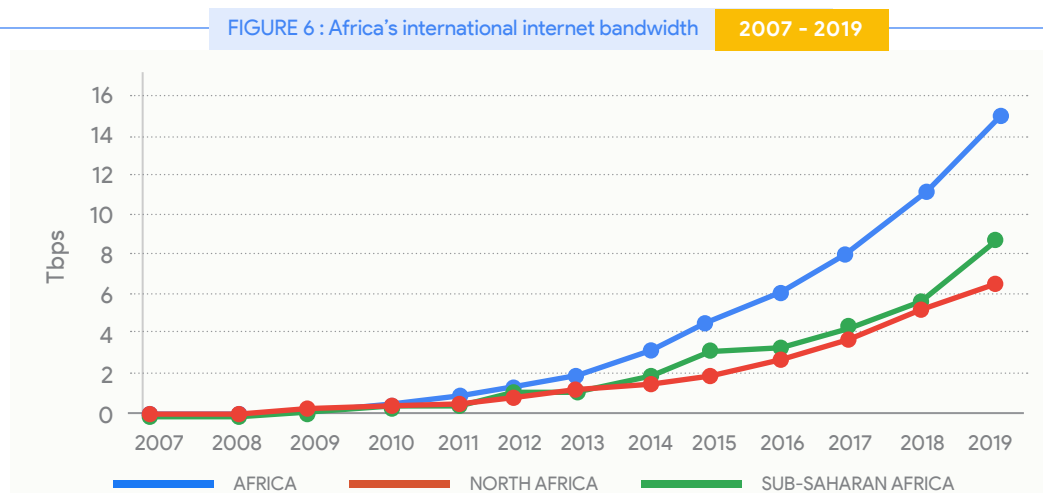
In 2018, the Africa Coast to Europe (ACE) cable was severed by a trawler, dropping connectivity for at least ten countries in West Africa. Mauritania, which relies solely on ACE for its international connectivity, experienced a total internet outage for 48 hours, followed by partial restoration of connectivity.

Having a diversity of cable routes and landing stations provides safety in numbers. In countries that already have several cables - and particularly so in those that rely on a single subsea link - Equiano's landing will reduce reliance on existing infrastructure and boost network redundancy.

Expanding bandwidth

In 2000, the entire continent had less international bandwidth than Luxembourg - a country with a population of 433,000 at the time, compared with Africa's 810 million.²⁴ Since then, significant investments in subsea cables - particularly between 2007 and 2012, when funding totalled more than USD 3 billion²⁵ - have sparked exponential growth in international bandwidth across the continent. Out of Africa's 38 countries with coastlines, 37 have at least one submarine cable landing, Eritrea being the only exception.²⁶ Despite rapid growth in international bandwidth in recent years, the continent lags behind all other regions aside from Oceania, which has only 43 million people, contrasted with Africa's 1.3 billion.

Figure 6 charts this rapid increase in the continent's international bandwidth, while Figure 7 maps out all African countries according to the number of submarine cables they have.



Source: Hamilton Research, 2021, Africa Bandwidth Maps

24. TeleGeography, 2000, Global Telecommunications Traffic Statistics and Commentary.

25. Forden, F., 2015, The Undersea Cable Boom in Sub-Saharan Africa.

26. TeleGeography, 2021, Submarine Cable Map.

FIGURE 7 : Map of Africa with shading indicating number of international cables landing in each country

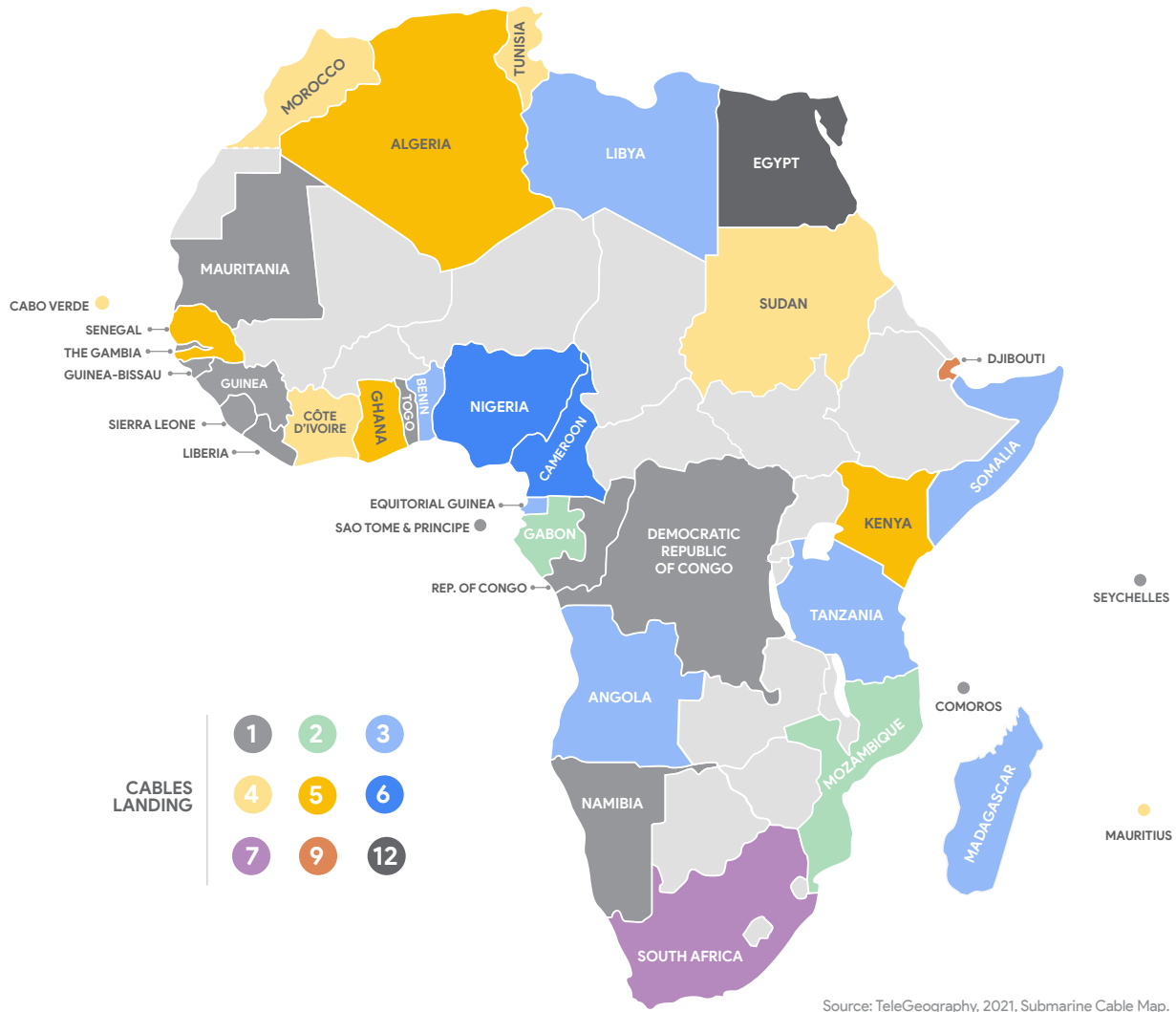
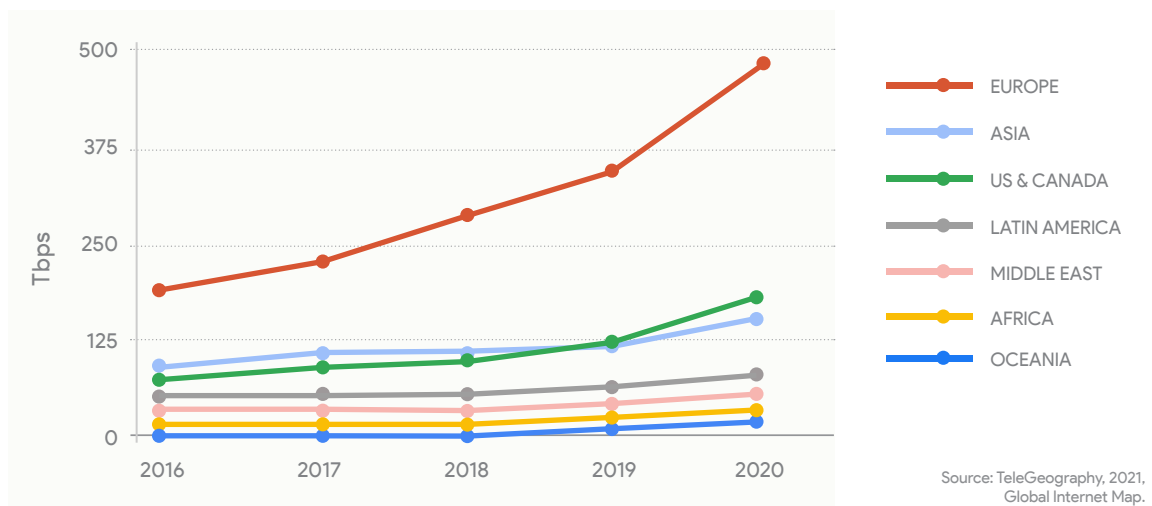


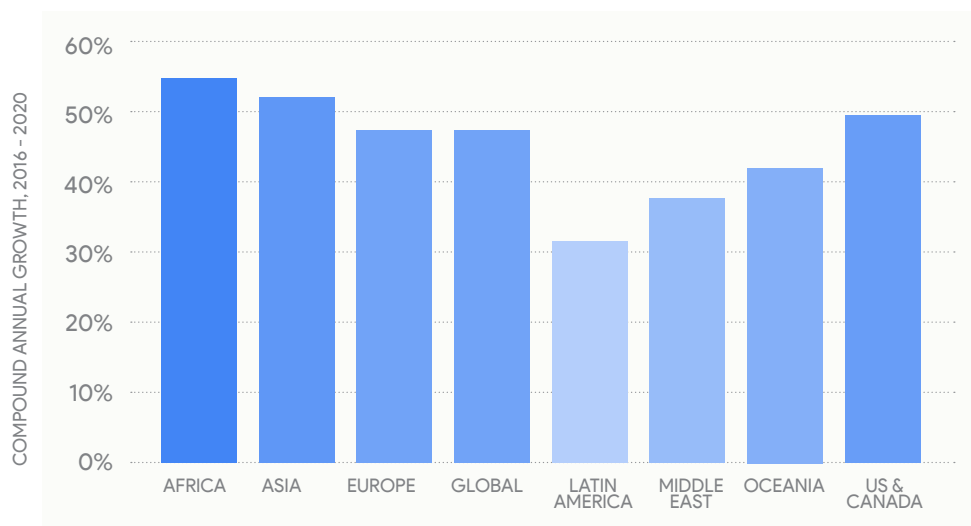
Figure 8 provides a regional comparison of international bandwidth around the world.

FIGURE 8 : International bandwidth by region 2016 - 2020



As Figure 9 illustrates, international bandwidth demand growth has been the strongest on submarine links connected to Africa. Between 2016 and 2020, the continent experienced a compound annual growth rate of 54% and is expected to continue having the highest demand growth over the coming years.

FIGURE 9 : Used international bandwidth growth by region 2016 - 2020



Source: TeleGeography, 2021, International Bandwidth Soars to New Heights.

The next section presents the Equiano project and the rationale for investing in submarine infrastructure. Subsequent sections detail how subsea cables boost connectivity, resulting in faster and more affordable internet access, economic growth and job creation, while catalysing the transition to a greener and more sustainable economy.

3 : Equiano

A landmark investment in Africa

A next-generation project

In June 2019, Google announced the subsea internet cable, Equiano, that would ultimately run from Portugal to South Africa along the Atlantic Coast of Africa. The initial configuration of the cable system will include landings in Lagos, Nigeria and Cape Town, South Africa, with branching units in place for further phases of the project. The first phase is expected to be completed in 2022.

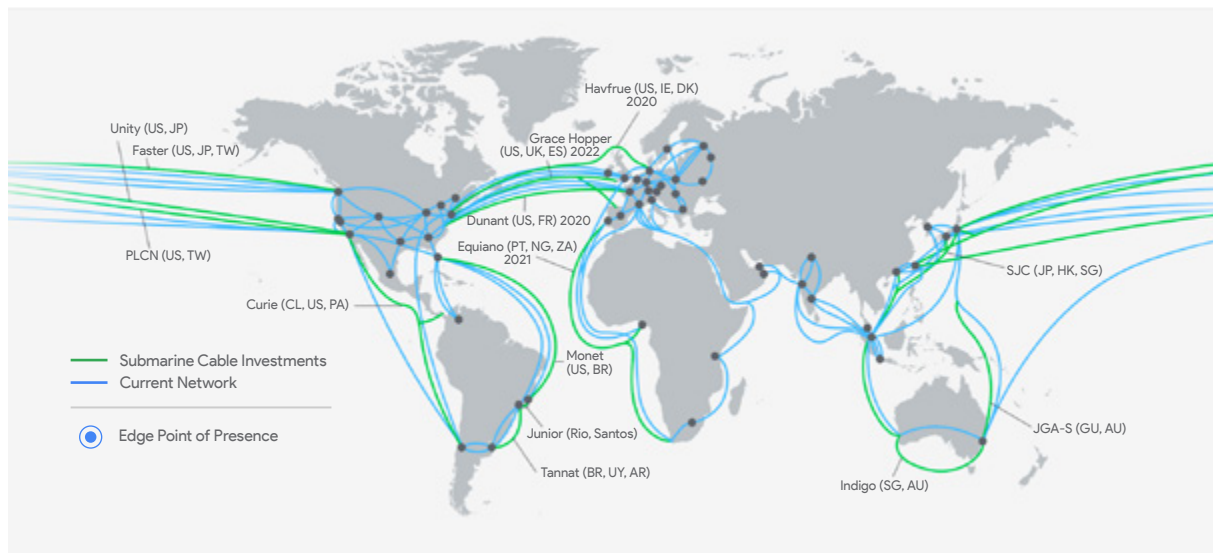
The next-generation Equiano cable will be the first subsea cable to incorporate optical switching at the fibre-pair level, rather than the traditional approach of wavelength-level switching. Equiano will also be the first spatial-division multiplexed (SDM) cable deployed along this route, allowing for a greater design capacity of 144 Tbps. The relative cost of deploying the Equiano cable with respect to its capacity will therefore be lower than the other cables built to date.

Submarine cables form part of Google's broader infrastructure investment strategy

Google is increasingly investing in global network infrastructure - including submarine cables, data centres, fibre networks, PoPs and edge nodes - to match the growing demand from users, and to ensure reliable and quick access to its services. In doing so, Google's investments help connect people, geographies and businesses around the world.

Between 2016 and 2018, Google invested USD 47 billion in capex around the world, including investments to improve its global infrastructure. As of August 2021, the company has invested in 18 cable systems.²⁷ Figure 10 below maps Google's investments in submarine cables and edge PoPs.

FIGURE 10 : Map of Google's global submarine and PoP infrastructure



Source: Google Cloud, 2021

Submarine cables are capital-intensive infrastructure projects that require years of planning from conceptualisation to operation. When considering investments in such cables, Google adopts a long-term, strategic approach, taking into account existing and planned infrastructure, as well as current and future demand for international bandwidth.

27. [Announcing the Blue and Raman subsea cable systems](#)

The decision to invest in Equiano is based on five key factors:



Ageing cable infrastructure

Africa is home to over 20 submarine cables, some of which began operations almost 20 years ago and are nearing the end of their lifecycle. Equiano is a state-of-the-art cable that leverages next-generation technology to provide significantly more capacity than the last set of cables built to serve the continent.



Growing demand for data

Africa's rapidly growing population and internet user base - combined with more intensive use of the internet - mean that the current submarine cable systems will be unable to meet demand beyond the next few years. Investing today means Google is well prepared to serve tomorrow's users.



Better performance

Low latency forms the cornerstone of good user experience. The increased bandwidth Equiano will bring to Africa will allow for more latency-sensitive products to function and be developed.



Redundancy

Africa currently has relatively few submarine cables connecting it to other geographies. The majority of countries on the continent are served by only one or two cables. As outlined in the case study on West Africa above, if or when cables are damaged, break or undergo repairs, users can experience significant connectivity disruptions. Building new cables such as Equiano therefore improves the consistency and reliability of connectivity.



Create diverse and scalable paths to reach more users

As part of the construction design of Equiano, several branching units will be placed on the seafloor along Africa's Atlantic coast. By having more control over the design, construction, and upgrade process of the cable system, Google will be able to quickly deploy additional branches to bring more content closer to end users.

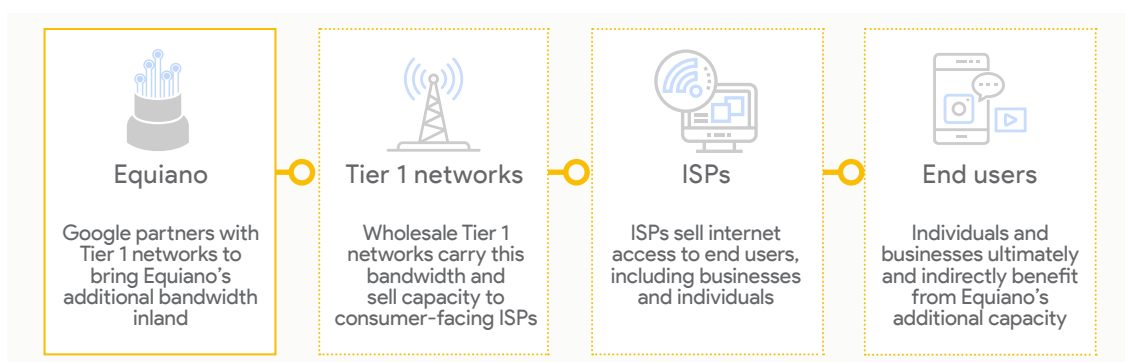
A cable system that serves the wider ecosystem's needs

Most existing submarine cable systems have historically been designed, funded and operated by consortia formed by telecom operators. Nowadays, technology companies such as Google²⁸ are significant investors in cables, often still part of consortia, to address rising global demand for their content.

28. Other technology companies that are investing in submarine cables include Facebook, Amazon and Microsoft.

While Google is financing the construction of the Equiano cable, other partners - namely Tier 1 networks - will be able to use and benefit from the cable's additional capacity. Google does not directly provide broadband access to end users but instead partners with multiple key telecom players such as telcos or infrastructure operators where Equiano lands to ensure that the cable's additional capacity benefits the most end users and businesses across the continent (see Figure 11). This is achieved when key telecom players acquire capacity from the Equiano cable on an indefeasible right of use (IRU) basis. This allows Google's partners to benefit from Equiano's additional capacity over a pre-agreed, long-term time frame for their own use or to lease to third parties. Terrestrial infrastructure players may also avail their fibre routes to Google in exchange for a portion of Equiano's capacity.

FIGURE 11: Equiano's indirect benefits to end users



Source: Genesis Analytics, 2021

Equiano's cable landing stations will operate on an open-access and non-discriminatory model where all terrestrial players can interconnect with them if they wish to do so. By guaranteeing open access, Equiano aims to encourage more efficient and cost-effective equipment, ultimately resulting in better outcomes for consumers, businesses and the economy more broadly.

GROWING THE CONNECTIVITY PIE

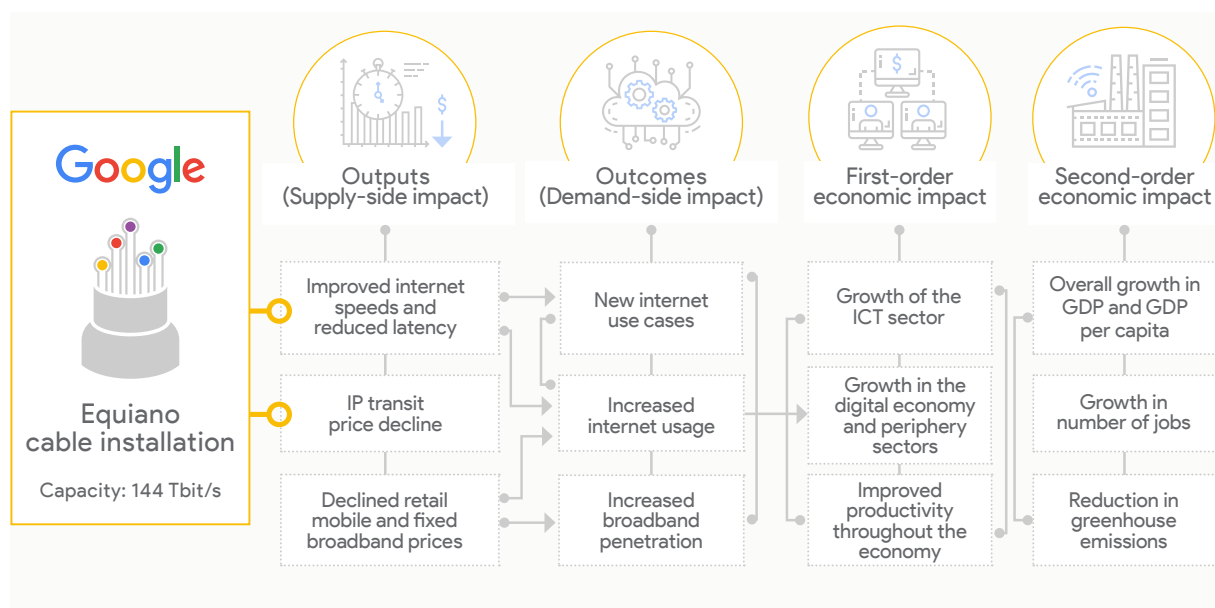
The subsea cable market - and broader international bandwidth ecosystem, which encompasses satellites - has historically been perceived solely in competitive terms, implying that the development of new infrastructure can threaten the position of existing players. In Africa's context, connectivity infrastructure is not zero-sum: the continent needs significant investments in the latest generation high-capacity cables to boost capacity and redundancy. As detailed above, these investments benefit businesses, governments and individuals, ultimately contributing to the growth of the digital economy and accelerating socio-economic development. In parallel to investments in submarine cables, other innovative solutions - such as SpaceX's StarLink, which is set to launch in several African countries in 2022 - can also contribute to boosting connectivity across the continent.

4 : Equiano

A catalyst for connectivity

Equiano will have a direct impact on internet connectivity in all the countries in which it lands, resulting in faster internet speeds, lower latency, and lower wholesale and retail internet prices. The cable system will also spur higher economic growth and accelerate digital transformation, and is expected to contribute to a decline in greenhouse gas emissions. These impact pathways are illustrated in Figure 12 and outlined in the subsections below.

FIGURE 12 : Equiano's economic impact pathways



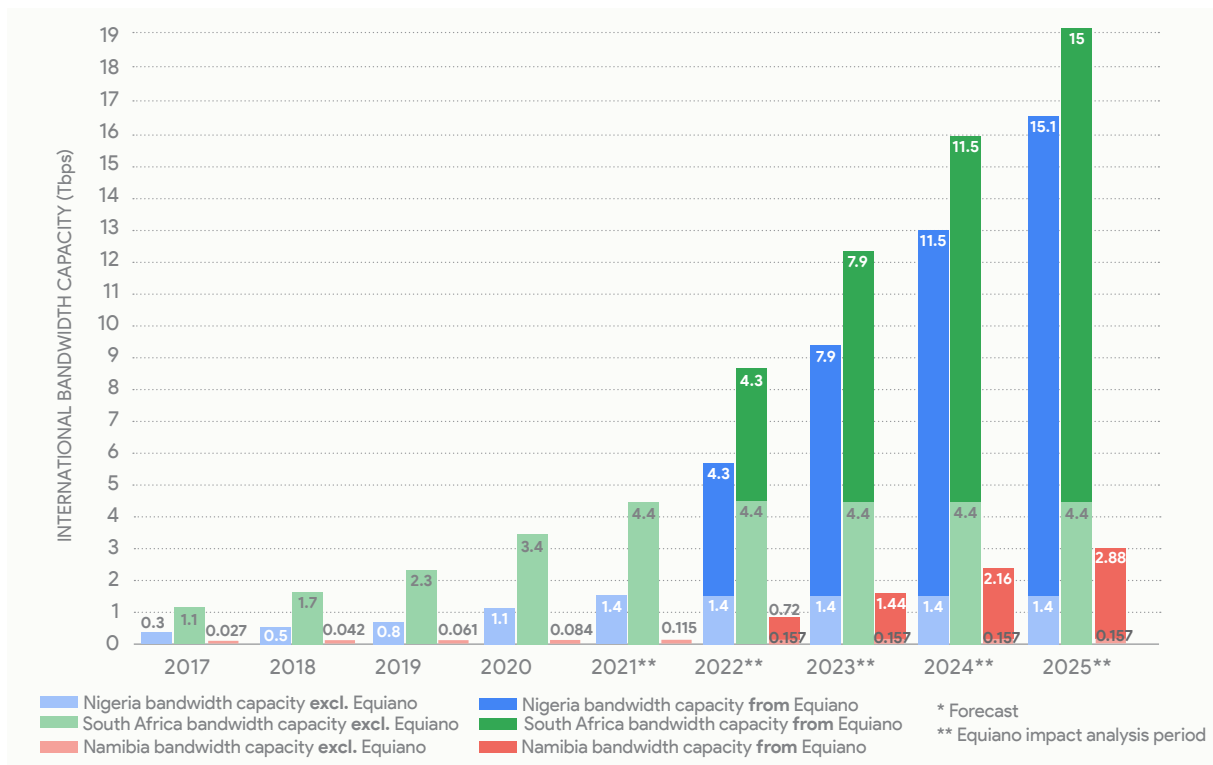
Source: Genesis Analytics, 2021

Changes in the supply-side metrics following Equiano's landing are expected to boost demand, adoption, and usage of the internet by businesses and individuals. In turn, this will contribute to specific sectors which benefit directly from greater internet use, but will also impact economy-wide productivity. These sectoral and productivity effects are the first-order economic impacts of the cable. Ultimately, they will lead to higher economic growth, greater job creation and a reduction in greenhouse emissions - the second-order economic impacts.

Connectivity impact of Equiano

The increase in international bandwidth capacity following Equiano's landing is expected to have an immediate impact on average IP transit prices, speeds and latency. For end users, this will translate to cheaper and more reliable internet access, leading to a substantial growth in traffic and internet penetration in the markets where Equiano lands.

FIGURE 13 : International bandwidth capacity in Nigeria, South Africa and Namibia (Tbps) 2017 - 2025



Source: Genesis Analytics, 2021

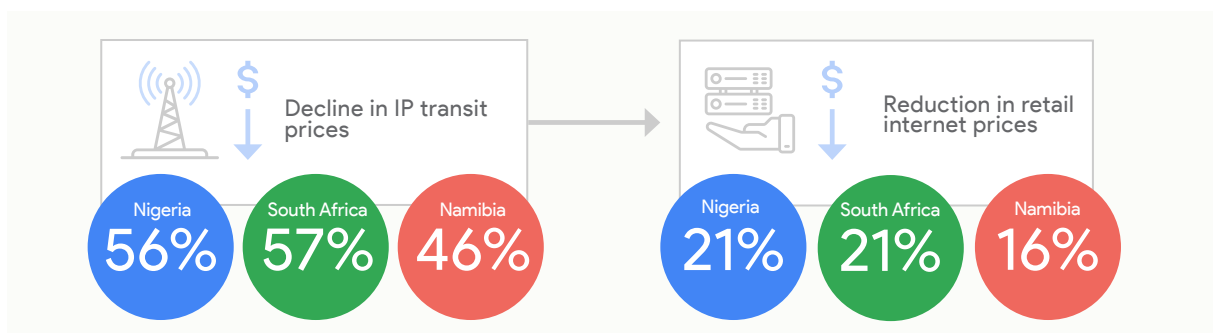
Making the internet more affordable

Africa’s connectivity ecosystem faces a paradox: internet access remains expensive, prohibitively so in many markets, despite many countries having some of the lowest average incomes worldwide. For many people across Africa, affordability of data - in conjunction with the high price of smartphones, limited awareness of mobile internet, and constrained literacy and digital skills - is a major barrier to accessing the internet.

Investments in submarine cables improve the affordability of internet access in Africa.

The cost of long-haul transmission of data is a major determinant of local IP transit prices. Equiano’s landing will create a new, high-capacity route for international data transmission. The cable’s lower installation cost relative to design capacity, as well as increased competition for the long-haul transmission of data, will lead to lower IP transit prices. In turn, lower IP transit prices could be passed on to customers through decreases in internet prices, or indirectly - through the provision of more data, uncapped data limits or higher speeds at the same price.

FIGURE 14 : Equiano’s impact on internet prices 2021 - 2025



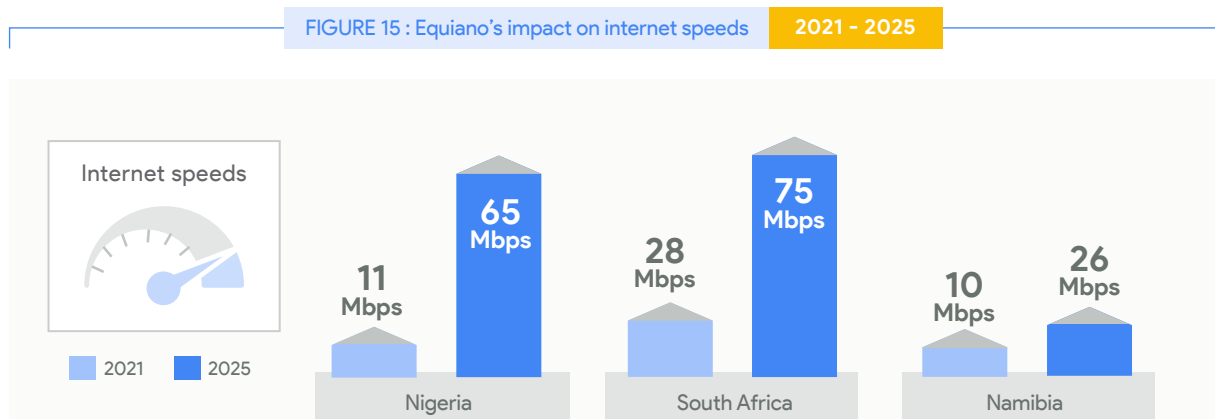
Source: Genesis Analytics, 2021

Accelerating internet speeds

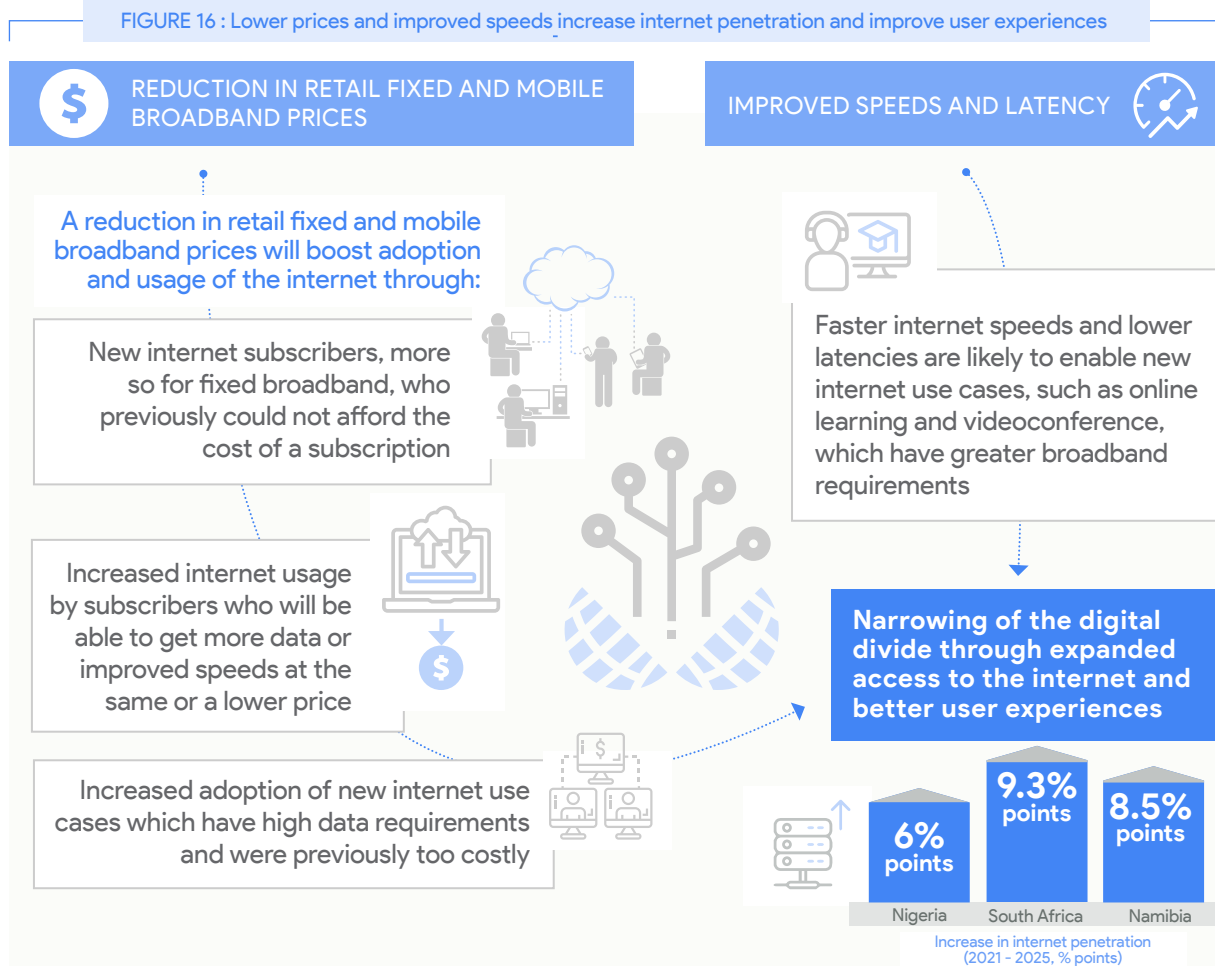
Africa is home to some of the world’s fastest-growing internet markets, but many of them lack the digital infrastructure needed to enable fast speeds. Boosting speeds across the continent is key to unlocking the full potential of the internet and accelerating digital transformation.

Investments in submarine cables boost internet speeds.

The increased international bandwidth capacity from the Equiano cable means that more data can be transmitted within a particular time frame. This will translate into faster internet speeds and lower latency, particularly with regard to non-cacheable content, and in areas in close proximity to a terrestrial fibre optic cable.



Source: Genesis Analytics, 2021



Catalysing network expansion

Submarine cables' impact on speeds and prices described above can catalyse investments by ISPs and infrastructure operators, thereby expanding terrestrial networks. Specifically, lower IP transit prices following the landing of cables such as Equiano improve ISPs' bottom lines, enabling them to invest in the expansion of their networks to reach new customers.

In parallel, greater demand and usage of the internet following Equiano's landing is also expected to increase ISPs' revenues, inducing the expansion of their networks.

Attracting hyperscalers

Well developed digital infrastructure - including submarine cables - is an essential prerequisite for investments in large-scale data centres. In the coming years, major content providers will likely set up hyperscale infrastructure to bring their content closer to African consumers, particularly in large and growing markets such as Nigeria and South Africa. The presence of hyperscalers is set to attract further, sizeable investments in the digital economy across Africa.

Macroeconomic impact of Equiano

Internet connectivity unlocks significant economic opportunities - more so in developing countries than their developed counterparts. A landmark study by the International Telecommunications Union in 2019 found that in Africa, a 10% increase in mobile internet penetration increases GDP per capita by 2.5%. This is higher than the corresponding 2% increase in GDP per capita observed globally.²⁹ Broadband's impacts on growth and development have transformative potential and have been compared to other milestone infrastructural developments in history, such as the advent of railways or electricity.

A 2020 report by Google and the IFC³⁰ estimates that by 2025, the internet economy has the potential to contribute close to USD 180 billion to Africa's economy. By 2050, this figure could rise to USD 712 billion. Achieving this growth requires the right policy environment and significant investments in infrastructure at every stage of the value chain, including in subsea cables.

Boosting economic growth

More affordable and reliable internet access - following the landing of submarine cables such as Equiano - accelerates digital transformation and stimulates the digital economy, boosting GDP and growth rates.

Underpinned by reliable connectivity, the digital economy can be a game-changer for Africa: it represents an opportunity to accelerate growth, industrialise, innovate and improve people's lives. This takes place through a wide range of mutually reinforcing and overlapping pathways, classified below by three key stakeholder categories:³¹

29. International Telecommunication Union (ITU), 2019, Economic Contribution of Broadband, Digitization, and ICT Regulation: Econometric Modelling for Africa.

30. IFC and Google, 2020, e-Conomy Africa 2020.

31. Qiang et al., 2009, Economic Impacts of Broadband.



At the individual level, broadband access plays a crucial role in developing human capital, which is essential for economic growth and competitiveness. It helps people acquire new skills and knowledge that are key to identifying and unlocking new employment opportunities. Improved connectivity also means better access to public services, as well as more affordable products and services from the private sector.



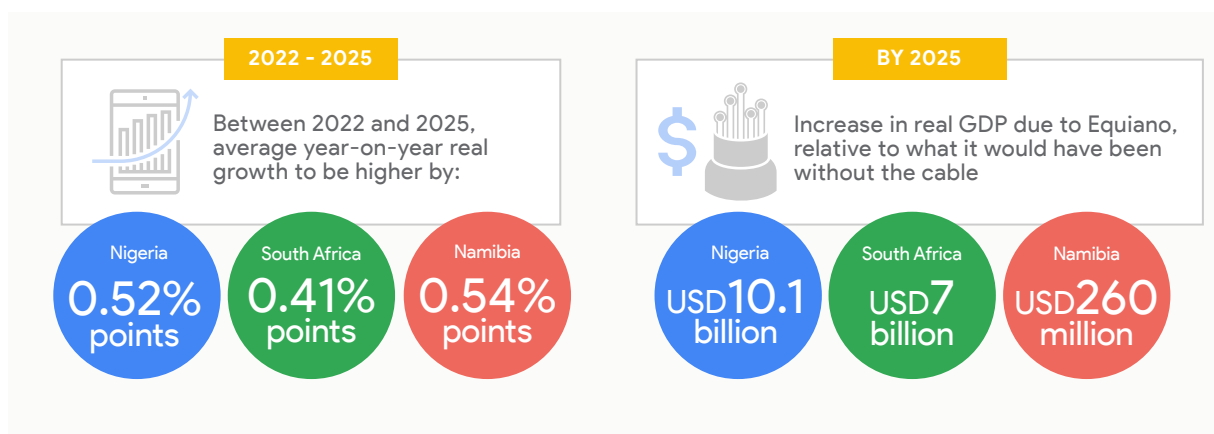
For businesses, broadband access lowers costs, raises productivity, drives innovation, introduces new processes and extends commercial links. Broadband also lowers the cost of international communications, thereby benefiting export-oriented firms. For information-intensive companies in the service sector (the knowledge economy), broadband is an integral part of business models. A wide range of sectors - such as fintech, e-commerce, healthtech, media and entertainment, local transportation, food delivery and business-to-business (B2B) e-logistics - are leveraging internet access and adoption to innovate and lead the way in the continent's digital transformation.³²



For governments, digital transformation can fundamentally improve the way the public sector operates - leading to more efficient service delivery in areas such as health, education or public administration. This, in turn, contributes to a more productive and efficient economy.

For African and other developing economies, attracting investments that boost connectivity can help diversify the economy away from historically dominant sectors such as agriculture or natural resources. This unlocks new pathways to collective prosperity. Improved connectivity and digital transformation can also help strengthen commercial and economic ties between African countries, and between the continent and the rest of the world, thereby narrowing the global digital divide.

FIGURE 17 : Equiano's impact on the economy



Source: Genesis Analytics, 2021

32. IFC and Google, 2020, e-Economy Africa 2020.

DIGITAL DEVELOPMENT, RESILIENCE AND COVID-19

There is a strong link between digitalisation and resilience. A 2021 study by Euler Hermes³³ found that the most digitised economies around the world performed better in mitigating the economic impact of COVID-19. Similarly, in 2020, experts convened by the International Telecommunications Union estimated that countries with the best connectivity infrastructure could mitigate up to half of the negative economic shock of the pandemic.³⁴ Countries with strong connectivity, well developed digital markets, adequate regulation, logistics and digital knowledge were able to respond to the crisis quicker. Their governments leveraged digital platforms to provide financial or health assistance (testing, tracing, vaccine distribution) to companies and citizens. On the supply-side, digitally enabled companies were able to adapt to new ways of remote working.

Across Africa, individuals, businesses and governments embraced digital transformation, ushering in a paradigm shift against the backdrop of the pandemic. According to the World Bank, 25% of firms in sub-Saharan Africa accelerated the use of digital technologies and increased investments in digital solutions in response to COVID-19.³⁵ The pandemic has also catalysed the transition to digital payments. Rwanda, for instance, was able to transition to a cashless system because of its high level of digital development. In the health space, contact tracing apps such as Kenya's Msafari or mHero - a mobile phone-based communications system for ministries of health and workers - were quickly deployed in response to the pandemic. Meanwhile, Togo built a fully digital cash transfer programme, Novissi, serving over 12% of the population in just over a week at the very start of the pandemic. A year later, over half a million Togolese had registered with Novissi. The Togolese government also leveraged digital platforms to roll out its vaccination programme: in under a month, 50,000 people had registered via SMS and the government's easy-to-access website.

The incentive for policymakers across the continent is clear: investing in and encouraging greater adoption of digital tools and solutions can help countries be better prepared for future crises and challenges.

33. Euler Hermes, 2021, Digital-Enabling Countries Proved More Resilient to the COVID-19 Economic Shock.

34. ITU, 2021, Digital Trends in Africa.

35. World Bank, 2020, Africa's Pulse - Charting the Road to Recovery.

Unlocking innovation and improving service delivery

Reliable internet access underpins innovation and entrepreneurship across Africa. For businesses, it leads to lower production costs through digitalisation, enables the expansion of business networks, and accelerates process innovation such as online sales and marketing. In turn, this removes geographical barriers to market entry.

The continent's burgeoning innovation ecosystem relies heavily on connectivity to deliver cutting-edge services across a wide range of sectors. Start-ups across Africa are quickly devising innovative solutions to tackle some of today's most pressing challenges. In Kenya, for instance, Twiga Foods has been bridging the gap between food producers, markets and consumers via a digital platform. In doing so, the start-up has created an efficient, fair, transparent and formal marketplace with over 4,000 suppliers and 35,000 vendors.³⁶ In the health sector, mPharma - a Ghanaian startup that has since expanded to Kenya, Nigeria, Rwanda, Zambia and Ethiopia - is shaking up the USD 50 billion pharmaceuticals market.³⁷ The start-up manages prescription drug inventories for pharmacies and their suppliers, enabling improved access to medication at a reduced cost while assuring and preserving quality.

E-HEALTH'S BOOM IN AFRICA

Africa faces a critical shortage of healthcare workers, including specialists, doctors, midwives and nurses. As of 2017, 46 out of 47 countries in the World Health Organisation's Africa region had significantly fewer than 2.28 physicians or nurses per 1,000 people³⁸ - the minimum threshold to deliver basic health services.³⁹ This represents one of the largest obstacles faced by the continent's health systems. It impacts every facet of healthcare, ranging from child to adult mortality, maternal health, and the diagnosis and treatment of diseases.

Telemedicine - the utilisation of technology such as video calling for consultations - has significant potential in Africa, particularly in rural communities.

- In **Nigeria**, OMOMI, which means "my child" in Yoruba, provides women and mothers access to healthcare advice from their phones. The app allows women and mothers to receive answers to pressing medical issues from professional doctors within minutes. OMOMI now has over 40,000 users and provides a vital service, given an estimated 80% of users have little to no access to healthcare in their local areas.⁴⁰
- In **Rwanda** - the continent's leader in telemedicine - more than two million people use Babyl, an initiative formed between health company Babylon and the government. As of early 2021, the service provides 3,500 remote daily consultations, dramatically increasing access to healthcare.

In both cases, access to reliable and affordable internet is a crucial building block underpinning the delivery of telemedicine services.

36. Twiga Foods, 2021²⁹ | IFC and Google, 2020, e-Conomy Africa 2020.

37. Techcrunch, 2021, Ghana's mPharma Partners with Ethiopian Conglomerate to Enter its Eighth Market.

38. World Bank, 2017, Sub-Saharan Africa Data. World Health Organisation, 2017, Global Health Observatory Data Repository.

39. World Health Organisation, 2006, The World Health Report 2006: Working Together for Health

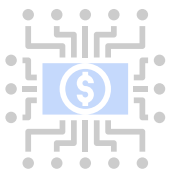
40. OMOMI, 2021.

Several studies have also looked at the link between access to high-speed internet and entrepreneurship in Africa. One found that the likelihood of a household on the continent establishing and operating a non-farm business is 4.7 percentage points higher following the arrival of broadband. The study found that this equated to a 12% increase in the entrepreneurship rate compared with the mean.⁴¹

In the agribusiness sector, digital solutions are increasingly being adopted, resulting in transformational impacts, particularly for smallholder farmers. These include e-commerce platforms linking farmers to customers and e-extension initiatives that provide farm and business advisory services.

Accelerating job creation

Equiano will indirectly create jobs in all the markets in which the cable lands, driven by two main pathways:



Growth of the digital economy and peripheral sectors.

The decline in internet retail prices and improved speeds lead to growing adoption by new users, and more intensive usage by existing ones. In turn, this facilitates the entry of new firms, particularly so in sectors that rely heavily on ICT such as finance and services. Peripheral sectors such as transport and storage also experience growth as a result of the development of e-commerce.

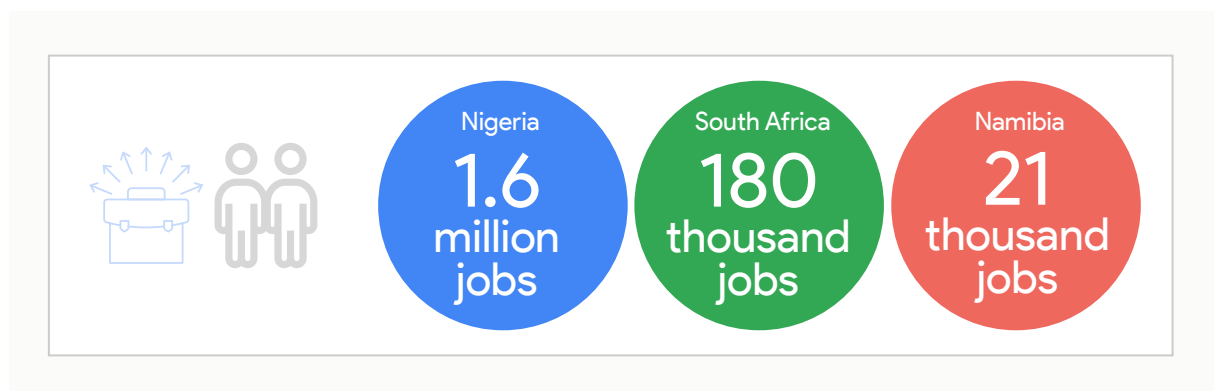


Growth of the telecoms sector.

Rising internet access boosts ISPs' and telcos' revenues, inducing the expansion of their networks, prompting them to hire more.

FIGURE 18 : Cumulative jobs created indirectly due to Equiano

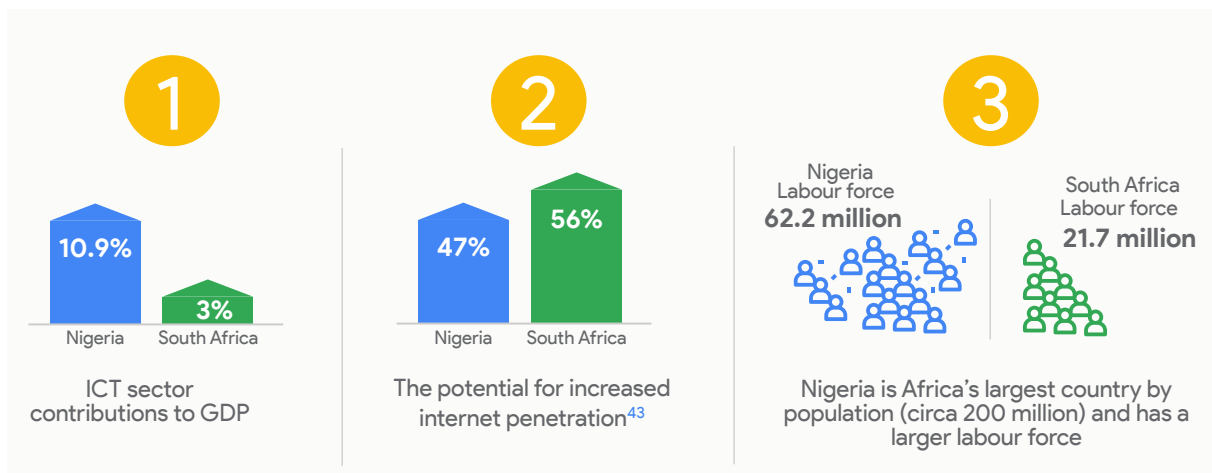
2022 - 2025



Source: Genesis Analytics, 2021

41. Hounghonon, G.V., Mensah J.T., Traore N., 2020, High-Speed Internet, Innovation and Entrepreneurship: Evidence from Africa.

The number of jobs expected to be created indirectly due to Equiano is significantly larger in Nigeria than in South Africa due to three key factors:⁴²



Source: Genesis Analytics, 2021

AFRICA'S DIGITAL DIVIDE AND EDUCATION

Across the continent, the closure of educational establishments due to COVID-19 widened existing education, socio-economic and gender inequalities. While schools and universities in more developed countries were quickly able to pivot to remote learning, many of those in Africa were not prepared to move teaching online. According to the International Association of Universities' Global Impact Survey on COVID-19,⁴⁴ only 29% of African higher education institutions had shifted to distance learning online, compared to 85% in Europe. A 2021 survey by SHARE in 21 African countries revealed that 22% of students in schools that had discontinued in-person classes had not been offered remote learning options.⁴⁵ SHARE also found that while 96% of surveyed students had access to a computer and intermittent access to the internet through a computer, 85% reported that the lack of access or quality of internet connection was a significant obstacle in completing remote work.

Reliable connectivity - along with adequate hardware - is an important tool for learning, particularly so over the last year when many educational establishments have been closed. In 2019, UNICEF and the ITU partnered to launch the Giga Initiative, which aims to connect every school to the internet, and every young person to information, opportunity and choice. Investments such as Equiano, amplified or complemented by the right government initiatives, can help solve the connectivity challenge, broaden access and contribute to improving educational outcomes.

42. Namibia has a population of 2.5 million. Accordingly, Equiano's impact on job creation is significantly smaller than in Nigeria or South Africa.

43. Figures are for 2019.

44. International Association of Universities, 2020, Global Impact Survey on COVID-19.

45. SHARE, 2021, COVID-19's Impact on Higher Education in Africa.

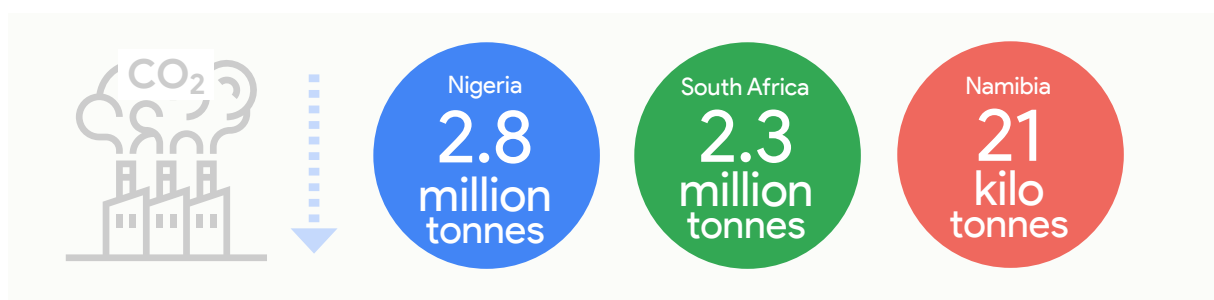
Sustainability impact of Equiano

Savings in CO₂ emissions and contribution to the SDGs

The expected increase in broadband penetration and adoption by consumers, businesses, government institutions and educational establishments is expected to lead to savings of CO₂ emissions, as a result of three main impact pathways:



FIGURE 19 : Expected savings of CO₂ emissions due to Equiano 2022 - 2025



Source: Genesis Analytics, 2021

More broadly, investments in connectivity can significantly accelerate progress towards achieving the UN's SDGs by 2030. The SDGs are a blueprint for a better and more sustainable future for all. SDG 17 – Partnerships for the Goals – emphasises that technology is a cross-cutting theme that underpins the attainment of all other SDGs, including economic development, health and education.

5 : Policy recommendations

By establishing policy environments that attract investments in telecommunications infrastructure and the broader ICT sphere, governments will be able to fully capitalise on the internet's potential. In doing so, they will unlock significant opportunities for their young, urban and increasingly educated populations. The digital economy can unlock new pathways for inclusive growth and has the transformative potential to spur innovation, create jobs, improve service delivery and reduce poverty across the continent.

Adequate legislative, policy and regulatory frameworks are central to attracting such investments. This is particularly important for countries in sub-Saharan Africa, which are affected by domestic digital divides, as well as digital gaps with more developed economies around the world.

Establishing enabling environments and securing domestic and international investments in connectivity can help address existing challenges, while driving long-term growth, job creation and sustainability. Failure to implement the necessary reforms and mobilise sufficient financing for internet-related projects risks further exacerbating existing inequalities, leading to suboptimal growth. This has important implications for African countries' socio-economic development and poverty alleviation.

To achieve this, we recommend policy streamlining and intervention in three main areas with regard to submarine cables and the broader telecommunications ecosystem:

Attracting investments in submarine cables⁴⁶

- Implement transparent and clear procedures to obtain licences and permits to deploy submarine cables and build cable landing stations. Outlining the steps in the licensing process, relevant stakeholders, and the associated fees and deadlines can bring clarity to potential investors.
- Establish a central point of contact that oversees the licensing process for submarine cables. Currently, a wide range of government stakeholders and regulatory institutions are involved in licensing, potentially leading to coordination challenges and delays. A lead agency can facilitate and streamline these processes, reducing complexity for investors and shortening the time it takes to deploy new cables.
- Promote an environment that is conducive to international investment. Specifically, governments should adopt flexible investment policies, allowing majority ownership of submarine cables by international investors.
- Promote a competitive commercial landscape. Governments should ensure a level playing field that encourages new market entrants and avoids potential monopoly situations for landing stations.
- Promote a diversity of landing stations to ensure network redundancy in case of outages.

46. Copenhagen Economics, 2021, The Economic Impact of the Forthcoming Equiano Subsea Cables in Portugal.

Protecting and maintaining submarine infrastructure⁴⁷

- Fast-track permit applications for the inspection and repair of cables to allow timely response in the case of damage.
- Exempt the maintenance and inspection of cables from cabotage laws, which impose restrictions such as the need to fly the national flag of a country or to have a local crew.
- Fully implement and effectively enforce cable protection laws.

Encouraging terrestrial infrastructure development

- Boost competition within the telecommunications sector to reduce prices for consumers and increase internet penetration and adoption. Governments should ensure that competition legislation is enforced and that players in the ICT sector compete on an equal footing.
- Incentivise the growth of terrestrial fibre optic networks. High right of way fees in many countries continue to hinder the roll-out of fibre infrastructure and could be reduced. In parallel, establishing “dig once” policies and building ready-made, buried conduits can significantly reduce the cost of expanding fibre networks. Third-party, independent infrastructure operators also have an important role to play and their presence should be welcomed by regulators.
- Encourage infrastructure sharing agreements among telecom operators and other infrastructure owners.
- Leverage existing fibre infrastructure owned by government agencies, national grids and railway companies. Dark fibre should be commercialised and made available to wholesale fibre providers and telecom operators.

47. Ibid.

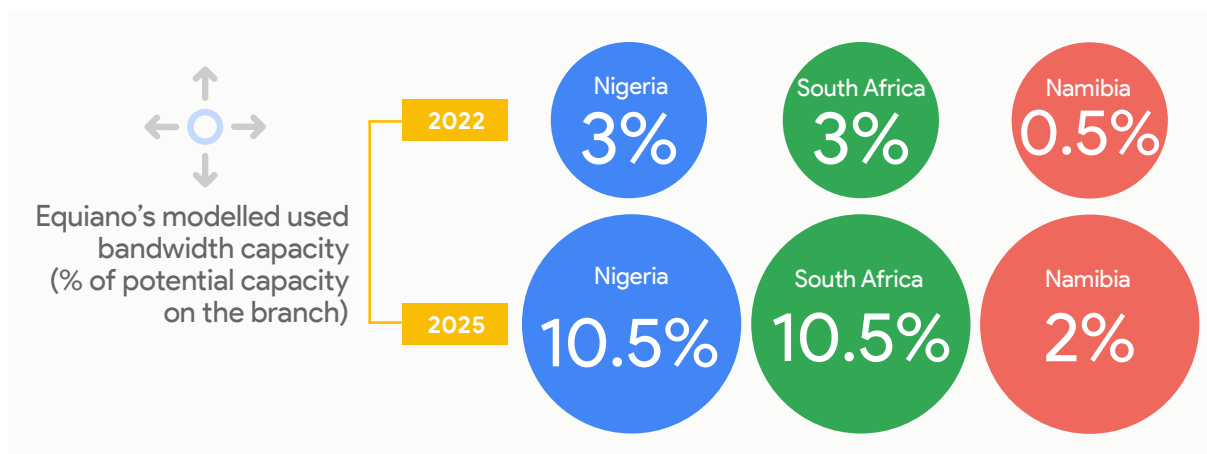
6 : Methodological annex

Below we outline the key studies used by Genesis Analytics in its modelling of Equiano’s impact in Nigeria and South Africa.

Modelled variable	Studies used
Internet speed	<ul style="list-style-type: none"> Hjort, J. and Poulsen, J., 2019, The Arrival of Fast Internet and Employment in Africa, American Economic Review
Retail internet prices	<ul style="list-style-type: none"> Analysys Mason, 2020, Economic Impact of Google’s APAC Network Infrastructure
GDP growth	<ul style="list-style-type: none"> RTI International, 2020, Economic Impacts of Submarine Fiber Optic Cables and Broadband Connectivity in South Africa RTI International, Economic Impacts of Submarine Fiber Optic Cables and Broadband Connectivity in Nigeria, 2020 Scott C., 2012, Does Broadband Internet Access Actually Spur Economic Growth? Qiang C. et al., 2009, Economic Impacts of Broadband. Information and Communications for Development
Job creation	<ul style="list-style-type: none"> Hjort, J. and Poulsen, J., 2019, The Arrival of Fast Internet and Employment in Africa, American Economic Review
CO ₂ emissions	<ul style="list-style-type: none"> SQW, 2013, UK Broadband Impact Study, Impact Report

Equiano’s used bandwidth capacity is likely to start off low to match the lower demand. Below we outline the initial used bandwidth capacity in the impact models for Nigeria, South Africa and Namibia:

FIGURE 20 : Equiano’s modelled used bandwidth capacity



Source: Genesis Analytics, 2021

