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Enabling the Metaverse in Sub-Saharan Africa

Final Report

May 2023

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Executive summary

The metaverse is envisioned to be the next significant iteration of the internet.

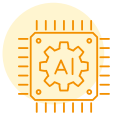
While still in its nascent stage, early metaverse experiences around 2D augmented reality (AR), artificial intelligence (AI), and immersive 3D virtual reality (VR) technologies are emerging through current connectivity infrastructure and user devices (e.g., smartphones, computers, headsets). Over time, as technologies and applications continue to evolve and connect, they have the potential to transform the way in which societies and economies interact, bringing together physical and virtual worlds through seamless and immersive experiences. This report explores the potential economic impact of the metaverse for Sub-Saharan Africa.

Web 2.0 made the internet more interactive, dynamic and social... enabling **open and inclusive opportunities** in Sub-Saharan Africa such as **mobile money** and **crowdsourcing**.

Sub-Saharan Africa has benefited greatly from **the internet**. Mobile connectivity and smartphone adoption have led to innovative solutions, such as mobile money services that emerged in 2007 through Kenya's 'M-Pesa' platform. Solutions like these **changed the development path** of regional economies by fostering inclusion and creating novel opportunities.

Hundreds of **advanced tech clusters** are proliferating across Sub-Saharan Africa, playing a key role in **accelerating and incubating metaverse entrepreneurship**.

Adoption of the possibilities and requirements of Web 2.0 began slowly at first, but then accelerated in large part due to the leading efforts of localised technology hubs or 'tech clusters' including iHub, CCHub, Silicon Cape and Silicon Savannah. These **tech clusters became a driving force for innovation in the era of Web 2.0**, playing a key role in bringing together entrepreneurs, investors, governments and industries to achieve rapid digital growth.



From **AI language translation to visually immersive crop monitoring** and **virtual education building key skills in industry**, the metaverse could assist with some of **Sub-Saharan Africa's most significant development challenges**.

A similar trajectory could be expected for the metaverse. While adoption may be slow initially in Sub-Saharan Africa with early experiences accessed through smartphones and AR, the longer-term development could offer considerable potential if opportunities are fostered and embraced. Adaptation of advanced software capabilities and novel data visualisation approaches can enable **a wave of new use cases** that cater to the needs of **young Sub-Saharan African populations** and unlock opportunities in a **range of industries**, from education to arts and tourism.

The stage is gradually being set for metaverse technologies in Sub-Saharan Africa as wider **digitalisation** continues, **digital trade and investment** are encouraged, and **innovations emerge**. **Tech clusters can be expected to continue their key role** in guiding innovation and progress as the metaverse begins to develop.

Figure 1. Estimated GDP impact of metaverse technologies for selected countries in Sub-Saharan Africa

Nigeria	South Africa	Kenya	Côte d'Ivoire	Ghana	Senegal
$9.2 – $17.3 bn	**$6.9 – $13.1 bn**	**$3.1 – $5.9 bn**	**$2.3 – $4.2 bn**	**$1.8 – $3.4 bn**	**$0.9 – $1.7 bn**

Source: Deloitte analysis

Some of the most **promising metaverse technological developments** already occurring across Sub-Saharan Africa have been led in partnership with tech start-ups. Examples include **VR tourist experiences like the Yemisi Shyllon Museum of Art** that enable immersive export opportunities and **advances in AI- and AR-driven agritech like the Nuru crop monitoring app** that could unlock agricultural productivity. In the longer term, Sub-Saharan African society could **access global platforms** that create inclusive opportunities for communities, commerce, employment and education.

The economic impact of the metaverse will be driven by the creation and expansion of **new markets**, enhanced **employment and training opportunities** and improved **access to information**. As metaverse technologies develop and adoption grows, it could facilitate **social inclusion** and increase access to **healthcare**.

The full scope of incremental GDP impacts could be significant, as shown in Figure 1, following the progress of metaverse adoption and innovation in use cases.

Metaverse offerings adapted for the domestic market can offer use cases with **lesser user hardware and connectivity** requirements... enabling more people to adopt the metaverse and impacts to be realised sooner.

Impact estimates rely on a set of enabling pillars being satisfied. Enabling the metaverse will require accelerated economic development and transformative innovations, much like those that made use of the internet in Web 2.0 possible. Innovation could make a promising set of use cases available with lesser requirements. Examples could include smartphone-enabled AR and VR hardware or software, cloud-enabled computing power accessible via mobile connections or delocalised open-access AI technologies. If championed, developing **metaverse technologies and applications adapted to the Sub-Saharan African market may benefit local populations in a more tangible and impactful way**.

Rapid digitalisation, openness to **digital trade and investment**, large and adaptable **youth populations**, and the disruptive role of **digital innovation** are **reasons for positivity**...

...though **affordability**, **connectivity** and **digital skills** are **key challenges** that remain **crucial to realise the full scope of the economic opportunity**.

For Sub-Saharan African economies, recent positive trends suggest access to metaverse technologies will continue to expand. However, **important challenges** remain. **Affordability and availability of connectivity and digital skills have continued to be principal constraints impacting broad internet adoption**. The potential for widespread adoption of current and emerging digital technology applications, and the full scope of impacts, would only be experienced when challenges on infrastructure, standards and human capital are overcome.

Tech clusters in Sub-Saharan Africa and global developers can create metaverse technologies that support common standards and drive inclusivity. Measures to ease some constraints are already under development, for instance through the reduction of language barriers using AI and the decentralisation of governance.

The path to the metaverse will take time, but with **targeted support** from governments, investors and unlocking the potential for innovation amongst the youth population, the opportunities of the metaverse could become a reality across Sub-Saharan Africa.

1. The potential of the metaverse in Sub-Saharan Africa

The metaverse is evisioned to be the next evolution in internet technology

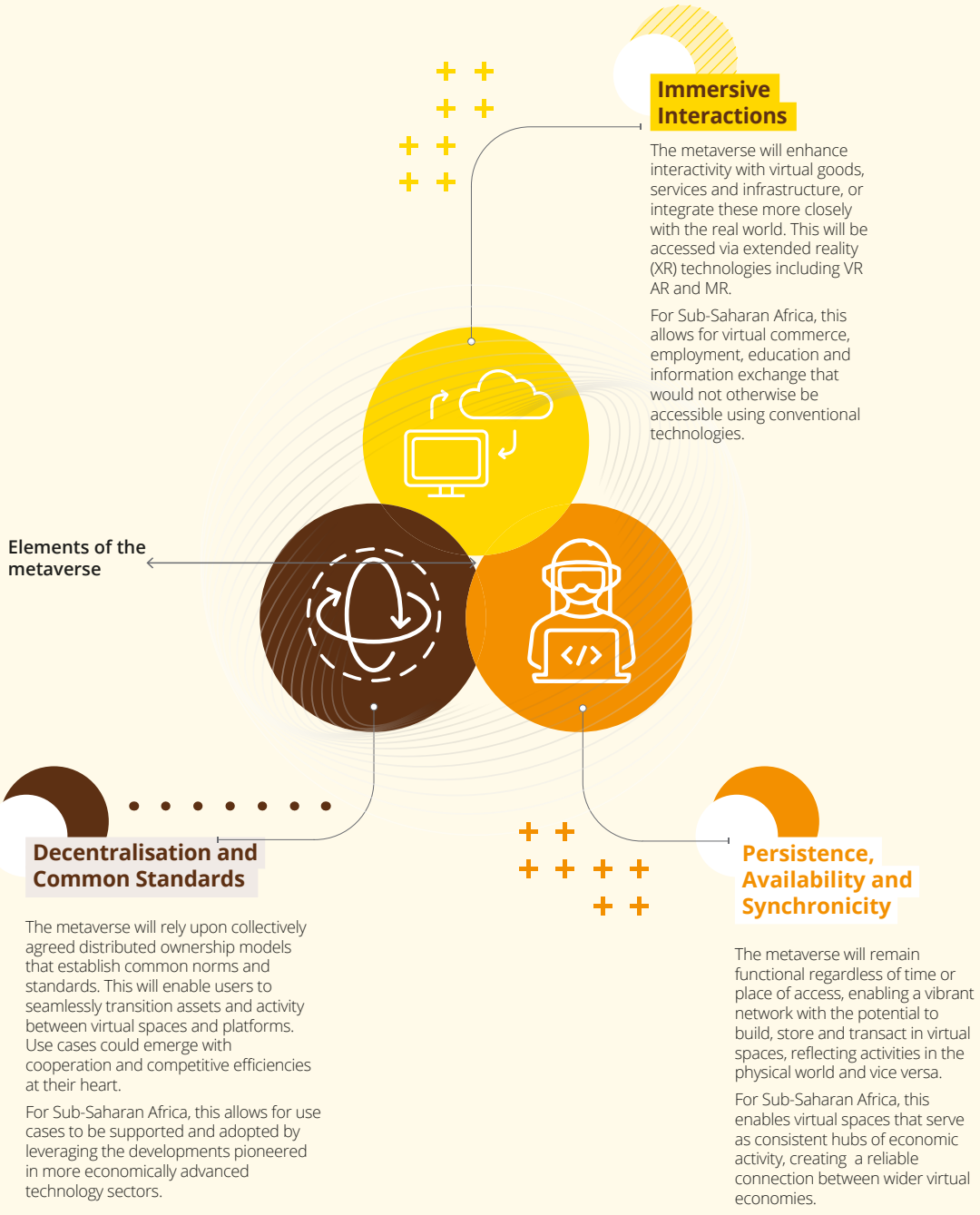
The internet as we know it today has evolved from early text-based beginnings to a fundamental technology of modern global exchange. 'Web 2.0' made the internet interactive and social, including features allowing users to create and share information and multimedia content.[1,2] The internet has become a tremendous source of impact in Sub-Saharan Africa, where the region to overcome economic challenges through technological adaptation.

Falling device prices and expanded mobile connectivity, made the internet more widely affordable and available in Sub-Saharan Africa.[3] Innovation took hold through tech entrepreneurship, which offered access to transformational use cases including mobile money, online learning and e-commerce. The internet continues to foster inclusion and economic participation by revolutionising modes of interaction between consumers, businesses and governments.

The metaverse is envisioned to be the next significant iteration of the internet. While still in its nascent stage, early metaverse experiences around 2D augmented reality (AR), artificial intelligence (AI), and immersive 3D virtual reality (VR) technologies are emerging through current connectivity infrastructure and user devices (e.g., smartphones, computers, headsets). Over time, as technologies and applications continue to evolve and connect, they have the potential to transform the way in which societies and economies interact, bringing together physical and virtual worlds through seamless and immersive experiences. It could offer potential impacts comparable to Web 2.0 if a similar trajectory is followed. This is encouraged by a range of trends including the rise of tech clusters, rapidly digitalising regional economies and the liberalisation of digital markets.

The metaverse will bring together technologies in novel and creative ways, many of which are yet to emerge. As such, no single definition captures its full potential. However, it is expected to encompass certain core characteristics, as illustrated in Figure 2 below.

Figure 2. Characteristics of the metaverse

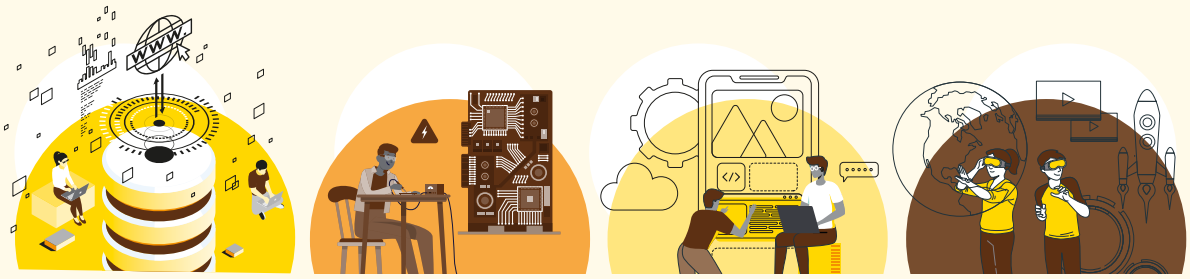


Source: Deloitte analysis

A complex ecosystem will support the metaverse

The metaverse's core characteristics and new forms of communication will rely upon a diverse ecosystem of technologies, standards and stakeholders as shown below in Figure 3. This 'metaverse ecosystem' is complex. Affordability, continuation of current infrastructure improvement and digital skills will be important in enabling widespread adoption of an evolved internet. See Section 4 for discussion.

Figure 3. The metaverse ecosystem



Digital Infrastructure

More innovative and immersive content will require continuing to maintain dependable and secure digital infrastructure to process and transmit increasing volumes of data. This could include:

- Cloud, data centers and edge computing
- Computing power
- Blockchain technology
- Connectivity infrastructure

Hardware, Protocols and Standards

Higher levels of immersion will require device sophistication (e.g., AR/VR headsets) at affordable prices. This includes:

- Smartphones and other user devices
- Device manufacturers
- Sensors
- Common technical standards

Content and Experiences

For the metaverse to commercially succeed, there also needs to be access to, and demand for innovative content and experiences. This includes:

- Users (consumers and businesses)
- Content creators
- Product developers
- App developers

Platforms

More sophisticated and affordable devices will increase the demand for supporting technology, such as fit-for-purpose platforms and system integration. This will involve:

- AR/VR platform builders and creators
- Software and IP development
- Technology firms
- Software engineers
- AI/ML

Public policy and governance frameworks

Public policy and regulation will also be crucial in fostering trust in metaverse applications for both consumers and businesses. This could include digital and innovation policy, data protection, online safety, competition, taxation, and cybersecurity.

Source: Deloitte analysis

Existing technologies may provide an entry point into the metaverse across societal groups

Advanced metaverse technologies and experiences will take time to be developed and adopted in Sub-Saharan Africa. In the meantime, near-term uptake across the region could be supported by **metaverse experiences that make use of technologies that are already available** in Sub Saharan Africa.

Example 1: Smartphone AR in e-commerce

The e-commerce shopping experience is being enhanced in Sub-Saharan Africa through smartphone AR technology.

On South Africa's Reka e-commerce app, **AR projections are accessible via smartphones, enabling consumers to project interactive virtual versions of physical products into their homes or onto their bodies**, making the online shopping experience more immersive and incentivising online purchases.[i]

Source: Digital Times (2021), Link.

For instance, before advanced VR or AR hardware are made available, metaverse applications can be adapted to use smartphone displays and cameras in the near term. This has been accomplished in **South Africa's Reka e-commerce app, where smartphone-enabled AR technology projects virtual retail products into consumers' homes** (see Example 1)**.** Similarly, before advanced localised computational power is developed in Sub-Saharan Africa, delocalised compute capability can be transmitted via mobile internet.

The metaverse may transform industry and consumer experiences

If supported and adapted to the region's requirements, metaverse technologies can be applied in both physical and virtual worlds and across industrial sectors and consumer markets. This will give rise to a vibrant set of use cases in the short– and long-term.

Industrial and consumer use cases

Both individuals and businesses, across consumer markets and industry, are expected to be potential metaverse end-users, with emerging diverse use-cases and applications that go beyond what is available with current technologies.

Example 2: altMTN

MTN Group, a leading South African mobile network operator, has announced the launch of **altMTN, a new consumer metaverse platform offering events, gaming and shopping**. In November 2022, MTN hosted a music concert on the platform.

Source: MTN (2022), Link.

In industry, metaverse technologies could enhance production processes. For instance, **Manobi and SpaceBel's NADiRA initiative uses sensors, Internet of Things (IoT)[4] and AR to enhance and add new visual dimensions to agricultural crop monitoring.[5]** In consumer markets, use cases could bring new forms of immersion and interactivity to commercial and leisure activities, for instance with **MTN Group's altMTN multipurpose metaverse platform** (see Example 2).[6]

Some metaverse use cases may impact both industrial and consumer segments, for instance through diverse marketplaces using metaverse technologies. For example**, the well-known South African artist Norman Catherine brought his work into Ubuntuland's marketplace with a 52-piece art collection comprising NFT paintings, sculptures, prints and mixed media.[7] The art collection sold out in two weeks for a total of $53,000 or R765,400, purchased in digital currencies** (see Example 3)**.**

In consumer markets, use cases can bring new forms of immersion and interactivity to commercial and leisure activities.

Example 3: Ubuntuland

Ubuntuland, the digital world hosted on Africarare (a 3D VR experience), offers **an immersive multifunctional space accessible via VR or smartphone**.

Ubuntuland offers a marketplace through which **users can buy, sell and share physical or virtual media, products, and services**. Additionally, persistent social spaces allow for interaction and events.

Source: Ubuntuland (2022), Link.

Physical and virtual worlds

Metaverse technologies could be used to create new forms of economic activity in the physical world, virtual worlds or a blend of the two. At one end of the spectrum, the metaverse could generate additional engagement with the physical economy, for instance through **metaverse-hosted immersive advertisement for physical goods or services.** At the other end of the spectrum, in virtual worlds (i.e. no physical presence), use case could generate new markets activities, for instance VR gaming.

Hybrid use cases could promote activity in both the physical and virtual worlds. For instance, this could include hybrid apparel retail where consumers transact for both virtual and physical versions of clothing items, such as in **Thrill Digital's Astra gamified fashion marketplace**[8] or in **virtual markets like the Ubuntuland digital world** (see Example 3).

Hybrid use cases can create activity in both the physical and virtual worlds.

Additional metaverse use cases may emerge in the longer term

As component technologies develop, a wide range of metaverse use cases could emerge. These could include **enhancing the interactivity and cohesion of remote working**[9] or **testing and improving manufacturing processes through the use of simulated 'digital twins'.**[10]

Enabling these use cases will be challenging but could become widely impactful. An indication of the breadth of metaverse use cases is shown in Figure 4. This includes examples set out in boxes found in Sections 1-3.

Figure 4. Short-term and long-term metaverse use cases

Source: Deloitte analysis

This report assesses how the metaverse could emerge in Sub-Saharan Africa

The metaverse could be a source of large potential impacts in Sub-Saharan Africa. At the same time, the metaverse is a complex proposition in an economic region that is facing specific challenges. The remainder of the report assesses the economic opportunity of the metaverse as follows:

— **Section 2** explains the drivers of metaverse technologies development that could generate a viable economic opportunity in Sub-Saharan Africa.

— **Section 3** estimates the magnitude of the potential economic impact of the metaverse on regional economies' GDP and discusses the impact drivers that can benefit key sectors.

— **Section 4** discusses the challenges and enablers that will shape the adoption of the metaverse and the realisation of economic impacts.

— **Section 5** concludes with a brief discussion of the immediate steps that would best support the economic opportunity.

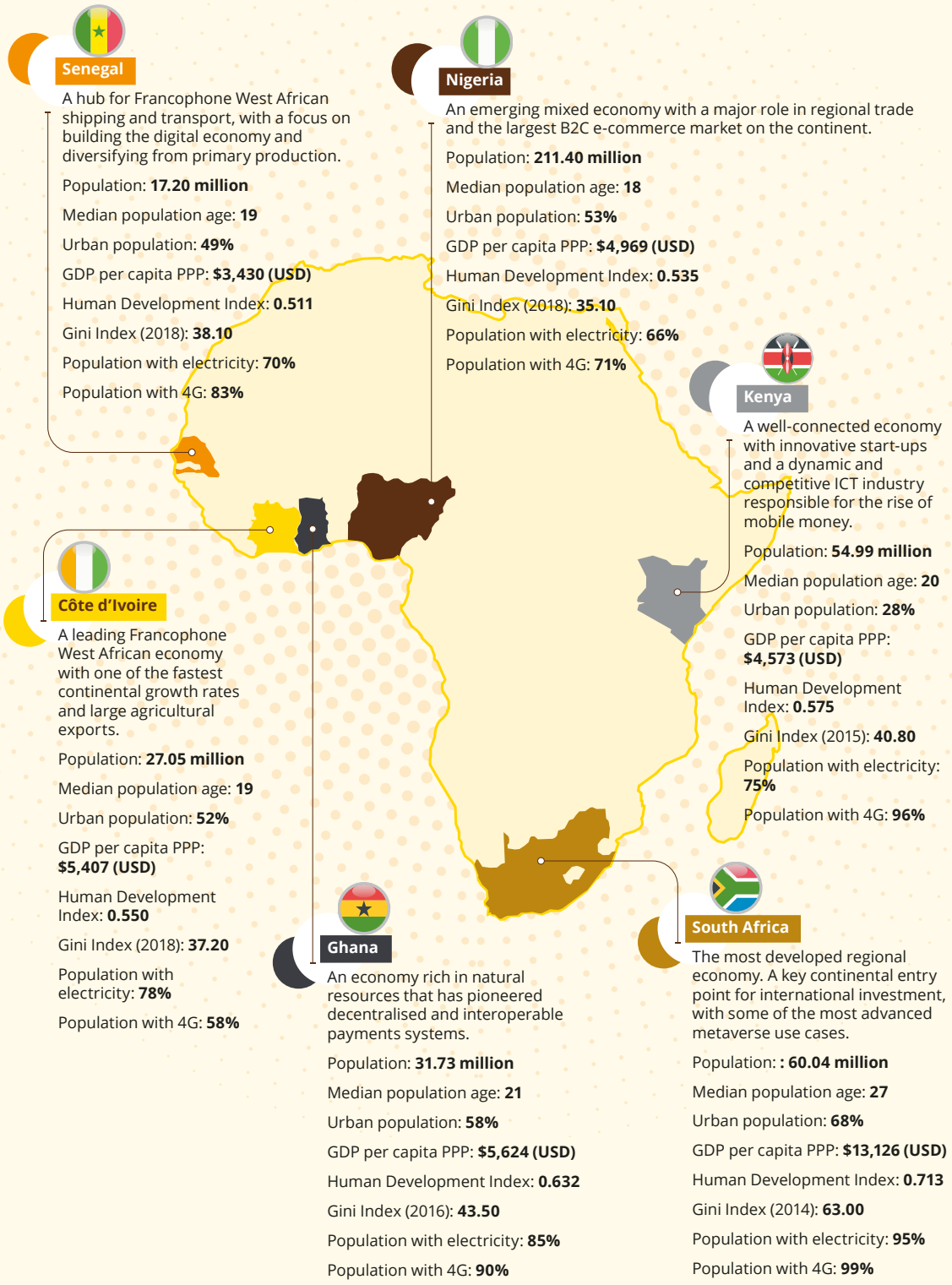
The metaverse could be a source of large potential impacts in Sub-Saharan Africa. At the same time, the metaverse is a complex proposition in an economic region that is facing challenges of its own.

2. Metaverse development drivers in Sub-Saharan Africa

Sub-Saharan Africa faces unique opportunities and challenges to unlock the potential of the metaverse

This report focuses on a selection of six countries in Sub-Saharan Africa[11] that illustrate the region's progress towards the metaverse – through growing technology ecosystems, ambitious digitalisation strategies or early metaverse applications. They capture the diverse strengths, propensity for change and shared challenges that characterise Sub-Saharan Africa's potential (see Country Profiles in the Appendix).

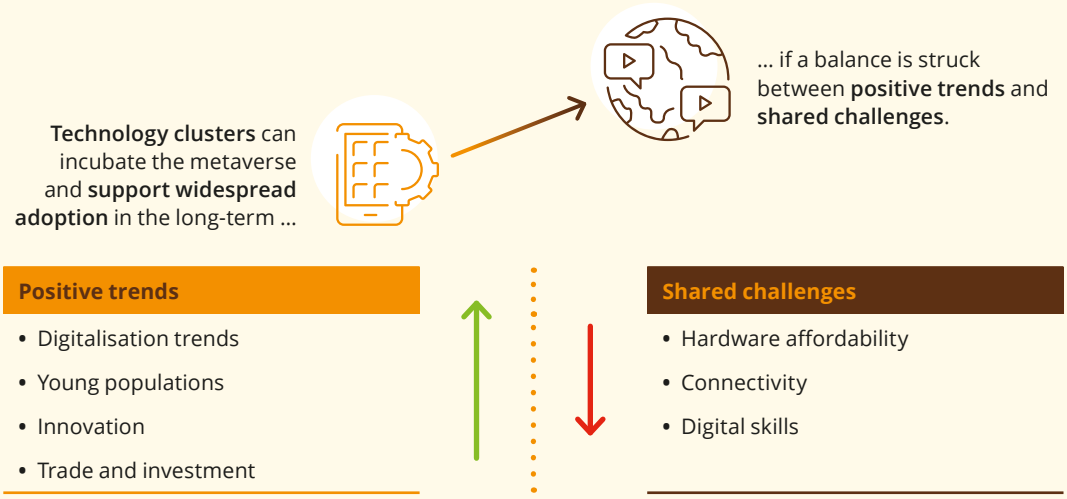
Figure 5. Sub-Saharan African countries of focus



Source: Population, urban population, GDP per capita and Gini Index data are available via World Bank (2022).[12] HDI data are available via UN (2022).[13] Population with access to electricity data are available via IEA (2019).[14] Population with 4G data are available at GSMA Mobile Connectivity Index (2021).[15] All figures above use latest available (2021) data unless stated otherwise.

Sub-Saharan Africa is a developing region with low average incomes, large rural populations and substantial informal economies. At the same time, economies are becoming more open and digitalised, whilst large youth populations are creating a climate supporting the adoption of technology. Web 2.0 technologies, including mobile connectivity and smartphone internet access, are innovating through tech entrepreneurship and are having a transformative effect across the region.[16]

Figure 6. Opportunities and challenges



Source: Deloitte analysis

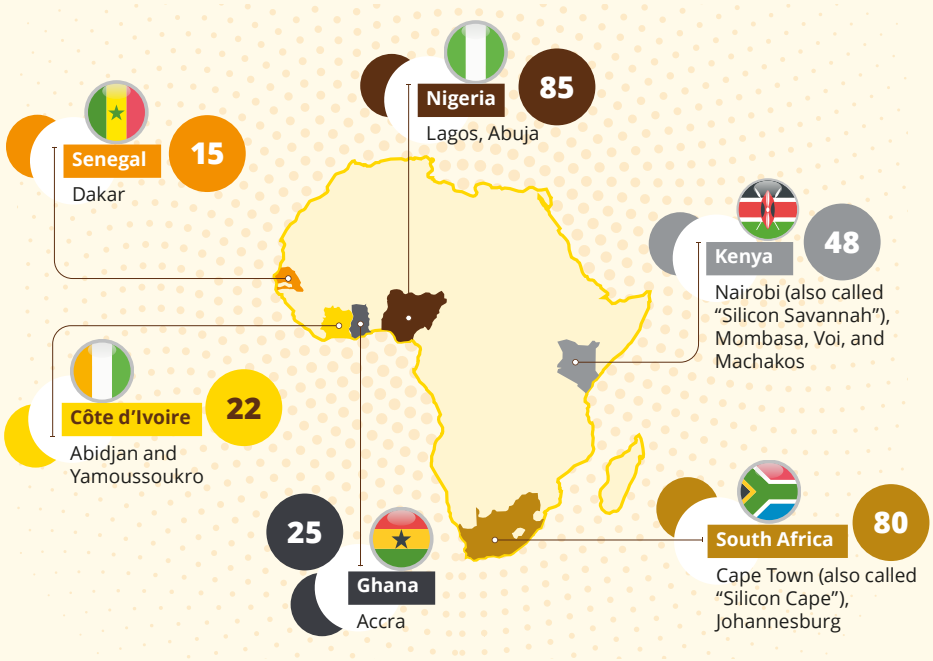
This creates a unique setting where the adoption and development of metaverse technologies could benefit from positive trends in digital economies whilst addressing key challenges that will shape its adoption, as summarised in Figure 6.

Technology clusters will be key in leading regional metaverse development

Localised tech clusters are pioneering digital innovation

Technology entrepreneurship is a growing force for digital innovation in Sub-Saharan Africa. As tech industries develop, a vibrant and fast-moving ecosystem is emerging as start-ups enter the market, consolidate and bring expertise to wider industries.

Figure 7. Number of tech clusters among reported countries



Source: GSMA – Mobile for development (2019). Link

To make the most of available infrastructure, talent and opportunities, the technology entrepreneurship environment has formed into discrete clusters of intense economic activity. **These 'tech clusters', such as South Africa's Silicon Cape, are geographically localised networks of technology start-ups, larger enterprises and investors** that are more digitally ready than the wider business environment (see Example 4).[17]

'Tech clusters', such as South Africa's Silicon Cape, are geographically localised networks of technology start-ups, larger enterprises and investors.

Example 4: Silicon Cape

Silicon Cape is a community of tech entrepreneurs, developers, creatives, angel investors and venture capitalists founded in 2009. Operating on a non-profit basis, this initiative fosters a sustainable tech and entrepreneurial ecosystem in South Africa. It is recognised as the most established entrepreneurial network on the African continent.

Acting as an **ecosystem facilitator for tech-enabled start-ups operating in various industries in the broader South African Cape Region**, Silicon Cape connects stakeholders, curates ecosystem data, amplifies the stories coming out of the ecosystem and advocates for stakeholders through its membership programme.

Source: Silicon Cape Initiative (2022), Link.

Tech clusters are proliferating rapidly across the African continent[18, 19], creating the foundations for a continental entrepreneurship network.[20] Figure 7 gives estimates of the number of clusters in each reported country. Though still modest in scale and output[21], comparisons can be made with the success of more mature tech hubs in Asian markets.[22]

These clusters are often situated in urban environments with relatively higher connectivity and higher income which can foster successful research and innovation outcomes.[23] They provide an environment that funnels investment and technical knowledge towards local start-ups through incubator and accelerator models.[24]

These partnership models foster links that can support the digitalisation of industrial value chains across Sub-Saharan African economies, from agriculture and e-commerce to fashion and healthcare.[25] CCHub, one of the largest of at least 85 Nigerian tech clusters, is reported to have provided investment to start-ups in public health, education, digital security, governance, research, product development and finance.[26, 27]

Tech clusters have already demonstrated their potential in the region

Tech entrepreneurship was at the heart of many of the most influential developments of Web 2.0 in Sub-Saharan Africa. **In 2007, Kenyan telecoms operator Safaricom partnered with Vodafone to launch the M-Pesa mobile money application (see below), where formal financial services were made available via basic mobile devices** (see Example 5)**.** This drew attention to the promise of continental digital entrepreneurship on the continent and triggered a cascade of innovation. For instance, **the iHub tech cluster, founded in Nairobi in 2008, has since produced over 450 start-ups.[28, 29]** Tech clusters continue to grow in number and in influence.

In 2007, Kenyan telecoms operator Safaricom partnered with Vodafone to launch the M-Pesa mobile money application, where formal financial services were made available via basic mobile devices.

Tech clusters are already supporting the adaptation of advanced technology for the development of use cases, for instance in VR tourism and e-Agriculture. In the longer term, if tech clusters continue to follow the same patterns of innovation that were observed with Web 2.0, they can make significant contributions to development of the metaverse technologies in the region.

Example 5: Mobile money

Mobile money services emerged in Sub-Saharan Africa as a means of enabling financial inclusion. It allowed local populations in rural or less connected geographies to **store, send and receive money through simple mobile phone applications without formal bank accounts or debit cards**.[i] Since their launch in Kenya in 2007 with Safaricom's 'M-Pesa' mobile money application, the uptake quickly grew and scaled to a global level.[ii]

Between 2009 and 2022, an estimated 47-54 per cent of global mobile money operations were registered in the Sub-Saharan African region. By 2021, Sub Saharan Africa represented 53 per cent of active customers, of which 89 per cent are found in the East and West of the region.[iii] **The region accounts for 67 per cent of global holdings, showing the major importance these services play in Sub-Saharan African societies**.[iv]

Mobile money now has a **significant global influence, with 1.35 billion registered accounts processing over $1 trillion in transactions annually as of 2022**. Use cases continue to rapidly diversify into 'ecosystem transactions', boosted by increasing interoperability. Impacts now span from improved business resilience to accelerated economic development and the reduction of the gender gap.[v]

Sources: i) Small World (2021), Link. ii) UNCDF (2022), Link. iii) GSMA (2022), Link. iv) IBID. v) IBID.

Positive trends support the rise of metaverse technologies

Digitalisation is continuing at rapid pace

The pronounced advances in digitalisation in Sub-Saharan Africa have resulted from clear prioritisation in public policy and investment, regional strategies and international initiatives.[30, 31] In the last decade, total inbound international internet bandwidth capacity increased over 50-fold, operational fibre-optic networks quadrupled, mobile cellular subscriptions doubled, and 58 percent of the total African population now have access to 4G networks.[32] **The World Bank's Digital Economy for Africa (DE4A) initiative has targeted universal digital enablement for individuals and businesses by 2030**.[33]

Example 6: Payments

Digital payments are on the rise in Sub-Saharan Africa, both in the numbers of users and proportions of the population transacting via digital platforms. Access **to payments platforms still remains constrained by financial infrastructure requirements** including the need for formal bank accounts.[i]

Accessibility is being enabled through payments innovations, for instance with **the Ghana Interbank Payments and Settlement System (GhIPSS)** offering a decentralised solution allowing for **common standards between mobile money wallets, bank accounts and the innovative e-Zwitch biometric card**.[ii]

Sources: i) Trade.gov (2022), Link*. ii) IFC (2018),* Link*.*

Continuation of current investment trends is essential for widening accessibility to current as well as future technologies. New initiatives are continuing to emerge, for instance in the payments ecosystem where **Ghana has established a decentralised solution enabling compatibility between a range of accounts and payment systems** (see Example 6).

Innovation can have wide-reaching impacts

Innovation will play a crucial role in the development of metaverse use cases, just as it did with Web 2.0. It may comprise the integration of new technologies or novel applications of existing technologies. This could drive costs and prices down and create new opportunities.[34]

With Web 2.0, innovation overcame connectivity limitations by bringing internet use cases into the mobile landscape. There are strong indicators of scope for further innovation via metaverse technologies.[35]

Example 7: Undersea cable fibre

The 2Africa consortium, including eight telecommunications and media major companies, is working on **the largest subsea cable project in the world**. It will connect **33 countries**, delivering fast and reliable internet service across Africa, Europe and Asia, **serving all coastal countries in the African continent** starting in 2024.[i,ii]

Source: i) Vodafone (2022), Link*. ii) The Africa Report (2022),* Link*.*

Continuing investments could improve people's access to both current and future technologies even in the fixed infrastructure landscape. **For instance, undersea fibre initiatives are at advanced stages, promising to connect all coastal cities in Sub-Saharan Africa to high-speed internet** (see Example 7).[36, 37]

Large young populations could be a source of economic growth

Sub-Saharan African populations are among the youngest in the world, with 20 percent of the total population between the ages of 15 and 25.[38] The average age is just 19.[39] People in Sub-Saharan Africa aged 18-29 are also the demographic most engaged with internet technologies.[40] Growing labour markets can swell to generate a 'demographic dividend', where investment, demand and production increase.[41] This will be contingent on the creation of government policy supporting effective economic participation and managing future birth rates.

Research suggests that the estimated potential for additional economic growth, once one-third or more of their unmet need for modern contraception are met, could range from 8% to 65% in GDP per capita between 2013 and 2030.[42] Alternatively, this could contribute $500bn per year to Africa over a 30-year timeframe.[43] As this young and adaptable user base emerges, it could become an impactful setting for the metaverse when adopted.

Proposals for undersea fibre are at advanced stages, promising to connect all coastal cities in Sub-Saharan Africa to high-speed internet.

Sub-Saharan African economies are opening to digital trade and investment

There are promising signs that Sub-Saharan African economies are opening up to digital trade and international e-commerce, which have been restricted in the past by overall digitalisation and particular challenges with internet security in policy[44] and practice.[45]

Example 8: Konga digital trade platform

Konga.com was launched in 2012 and is today the largest online commerce platform in Nigeria. It **aims to become a continental cross-border platform for commerce and trade**.

With a wide variety of products ranging from electronics to clothing and books, as well as a lowest price guarantee and a dedicated customer service support, **Konga offers an affordable and expansive platform for digital trade**.

The platform also **spans wider commercial sectors**, offering travel deals and on-demand food delivery.

Source: Konga (2022), Link.

The African Union established the African Continental Free Trade Area (AfCFTA) in 2018, the objectives of which include to coordinate digitalisation on a regional basis through the **AU Digital Transformation Strategy (2020-2030)**. Digital trade ties are being built via the **Draft AU Africa E-commerce Strategy (2021),** which emphasises common standards across platforms borders, a reduction in rural-urban divides and development of digital literacy to drive socioeconomic benefits from digital trade.[46]

These policy interventions are set to improve upon a continental e-commerce landscape that is already firmly established. For instance, **Nigeria's Konga.com offers one of the largest e-commerce platforms across Sub-Saharan Africa and has ambitions to expand trade across the continent** (see Example 8).

If these trends continue, the wider continental digital environment can become more generally supportive of new investment. Such investments could include investments across various forms of ICT capital such as hardware specific for metaverse technologies, computing networks and supporting infrastructure, and in less tangible assets such as software, databases, human capital, and content creation. However, some issues will need to be prioritised. These include achieving wider regional common standards, harmonising data protection and cybercrime policy provisions, and reducing exposures and vulnerabilities to cyber-attacks.

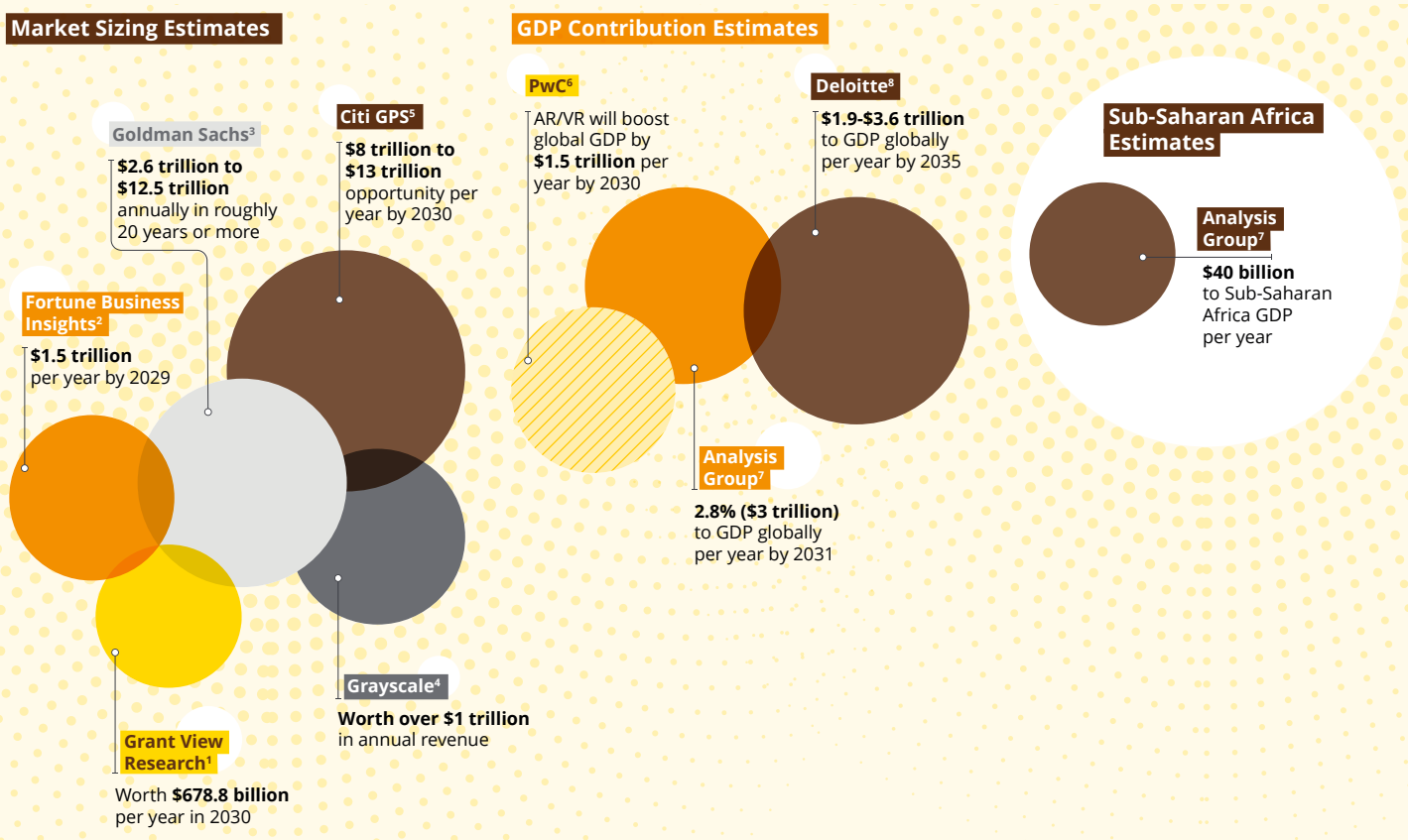
Nigeria's Konga.com offers one of the largest e-commerce platforms across Sub-Saharan Africa and has ambitions to expand trade across the continent.

3. Potential economic impacts of the metaverse

The economic potential of the metaverse in Sub-Saharan Africa is significant but estimates vary

As the metaverse is still developing, the scale of the economic impact is difficult to estimate with precision. As such, there are variations among published estimates. Nevertheless, most reports find evidence that potential impacts could be substantial, as illustrated in Figure 8.

Figure 8. Estimates of the metaverse market sizing and GDP contribution



Notes: [1]Value in 2021 $US. [2]Value in 2021 $US. [6]Value in 2019 $US.[7]Value in 2015 $US. [8]Value in 2021 $US.

Source: Grand View Research (2022), Market Analysis Report; Fortune Business Insights (2022), Metaverse Market Size, Share & Covid-19 Impact Analysis; Goldman Sachs (2021), Framing the Future of Web 3.0; Grayscale (2021), The metaverse; Citi GPS (2022), Metaverse and Money; PwC (2019), Seeing is believing; Analysis Group (2022), The Potential Global Economic Impact of the Metaverse; Deloitte (2022), The Metaverse and its Potential for Türkiye.

This report presents new country-level estimates for selected economies in Sub-Saharan Africa, summarised below in Figure 9. The methodology was developed at a global level, which estimated impacts between 1.3 and 2.4 percent of global GDP per year by 2035. The total global impact was then apportioned to each reported country according to their contribution to global GDP based on forecasted growth rates. Further details on the methodology can be found in the methodology overview box (Box 1).

Figure 9. Estimated GDP impact of the metaverse for selected countries in Sub-Saharan Africa

Nigeria	South Africa	Kenya	Côte d'Ivoire	Ghana	Senegal
$9.2 – $17.3 bn	**$6.9 – $13.1 bn**	**$3.1 – $5.9 bn**	**$2.3 – $4.2 bn**	**$1.8 – $3.4 bn**	**$0.9 – $1.7 bn**

Source: Deloitte analysis

These estimates depend on several modelling assumptions including global GDP forecasts, investment scenarios, and the additionality of investments in metaverse technologies. The magnitude of potential economic impacts and the distribution of benefits within Sub-Saharan African countries will depend closely on the challenges the region faces and the actions taken to tackle them.

The methodology was developed at a global level, which estimated impacts between 1.3 and 2.4 per cent of global GDP per year by 2035.

The impacts of greatest magnitude are expected in Nigeria and South Africa, which are among the largest economies of the six focused on in this report. In Nigeria, the large population size of 211 million is a key GDP impact driver, whereas South Africa is a relatively advanced regional economy with a higher GDP per capita of $13,126 (PPP) in 2021.[47]

METHODOLOGY OVERVIEW:

To estimate the impact of the metaverse in the six selected Sub-Saharan African countries, the methodology estimates the potential global economic impact of the metaverse, based on global metaverse investment scenarios. It then apportions this global total to obtain country level estimates. For the analysis, two scenarios for global investment in the metaverse, based on the literature, are considered:

Baseline scenario where global metaverse investment is US$140bn per year from 2022 to 2029,

Upside scenario where global metaverse investment is US$270bn per year over the same time period.

Using estimates from the economic literature on the relationship between investment in ICT capital and economic growth, the analysis suggests that metaverse investments could add **US$1.9-US$3.6** trillion to global annual GDP by the end of 2035 (in 2021 US dollars); this would be approximately **1.3**% – **2.4**% of global GDP in 2035. To apportion this global total, a proportion is attributed to the US based on its forecast contribution to global GDP. Following this, the two scenarios for metaverse investment are estimated to generate economic impacts per year by 2035 reported in Figure 9 for the six Sub-Saharan African countries. For a detailed description of the methodology, please see Deloitte's report 'The Metaverse and its Potential for Türkiye'. Please note that following the release of the Türkiye report, the IMF subsequently (in April 2023) published updated GDP forecasts, which have been used in this paper.

These impact estimates are dependent on several assumptions and external forecasts, including:

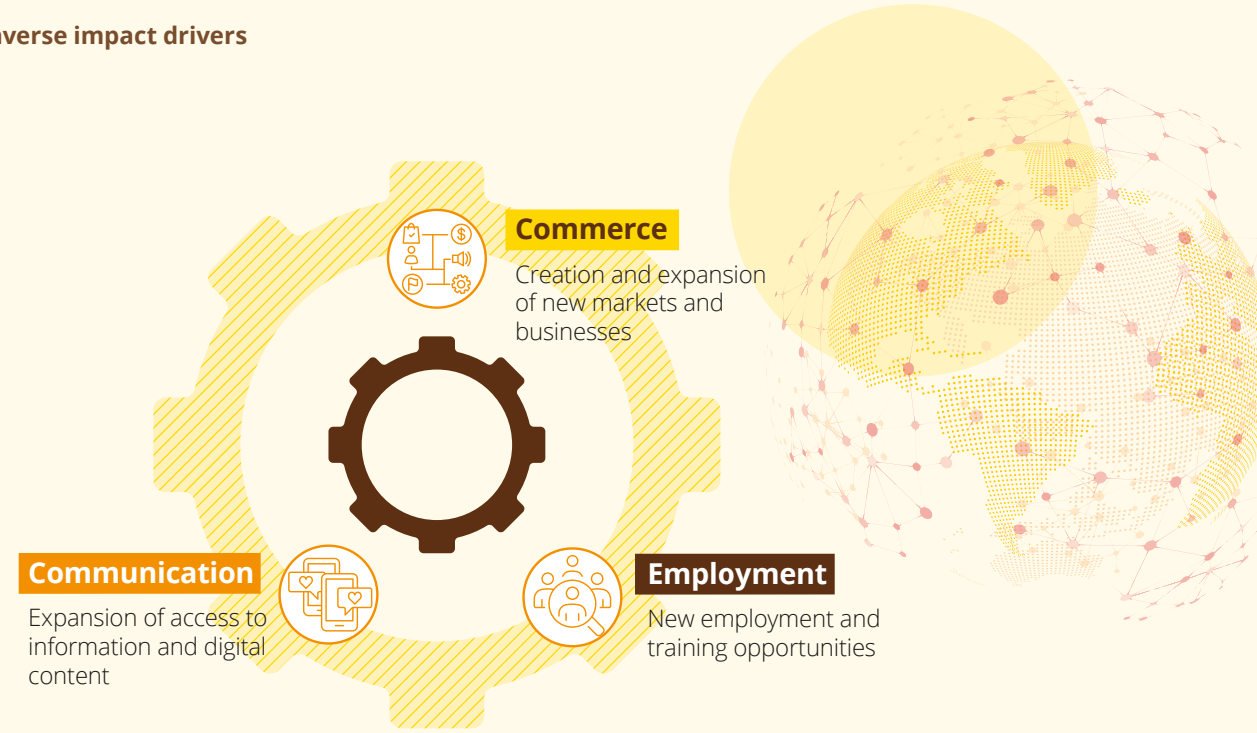
- Country level and global real GDP forecasts from the IMF for 2022-2028, and a CAGR for 2029-2035 based on World Bank figures for GDP over the period 2009-2019.
- The investment scenarios considered look at spending that is likely to arise from large technology firms in the development of metaverse platforms and technologies. Therefore, they do not necessarily consider wider, longer term, investment that may take place across a number of wider domains such as in communications, connectivity and underlying infrastructure.
- Global ICT investments in the metaverse being incremental to other ICT investments, rather than substitutes for ICT investments that will no longer take place.
- The development of an enabling environment to support adoption of the metaverse, e.g., sustaining current rates of investment into network infrastructure.
- Exclusion of metaverse-related investments by firms outside the ICT sector or by public authorities, which may indicate that the estimates are conservative.

Therefore, caution should be maintained over the exactness of the estimates as a result of assumptions and forecasts differing over time. Consequently, the impact of the metaverse both globally and in the six selected Sub-Saharan African countries may be larger or smaller.

Source: Deloitte analyss

Metaverse technologies could drive short-term impacts in Sub-Saharan Africa through three core channels

Figure 10. Metaverse impact drivers



Source: Deloitte analysis

Creation and expansion of new markets and businesses

Metaverse technologies have the potential to create innovative marketplaces and business models. They could also provide platforms for these to expand. For Sub-Saharan Africa, domestic industries could benefit from enabling commerce in virtual markets.

The tech entrepreneurship environment will play a crucial role in enabling new markets and business to emerge. In the short-term, start-ups will be early adopters of metaverse technologies. Tech clusters could accelerate participation by lending hardware or guidance to would-be producers.

In discrete economic segments, signs of these short-term impacts are already observed. These apply mainly to tourism and creative industries with a global consumer base.

Tourism

Tourism is a major domestic industry for several Sub-Saharan African countries including Kenya and South Africa. The metaverse could support the development of virtual tourism industries, where local producers prepare audio-visual content accessible via VR technology and circulate it via the metaverse. Content is targeted at users in regions where adoption of the metaverse is more advanced.

Examples are already emerging. **Nigeria's Yemesi Shyllon Museum of Art is offering interactive tours accessible through home computers or smartphone devices** (see Example 9). Elsewhere, more advanced 360° images and XR simulations are enabling would-be travellers to visit potential destinations remotely, showcasing the leading culture and heritage attractions in the region.[48] For instance, **Kenyan travel agency Asilia Africa have promoted tourism through immersive VR safari experiences set across East Africa** (see Example 9).

While physical tourism will remain important, potential visitors may face barriers to travelling – financial, geographical or physical (e.g., disabilities). Metaverse experiences could therefore be complementary to physical tourism, by expanding awareness of destinations and experiences to new customers, as well as providing inclusive access to those whose travel may be more restricted.[49]

Example 9: VR tourism

Virtual Reality tourism applications are already developing, showcasing the rapid development of this new market.

Foundational applications are becoming increasing commonplace, for instance in Nigeria's award-winning **Yemisi Shyllon Museum of Art where collaboration with virtual education start-up Experis Immersive offers interactive virtual tours** that display diverse art collections that cut across cultures, movements and media.[i]

Meanwhile, immersive virtual tourism is being taken to the next level. Kenyan travel agency **Asilia Africa has developed fully immersive VR walking and boating safaris in Tanzania**,[ii] whilst its Safari at Home initative provides **promotional 360º imagery available via basic devices or fully immersive 3D VR**.[iii]

Sources: i) Google Arts and Culture (2022), Link. ii) Africa Decisions (2022), Link. iii) Asilia Africa, Link.

Nigeria's Yemesi Shyllon Museum of Art is offering interactive tours accessible through home computers or smartphone devices.

Creative products and exports

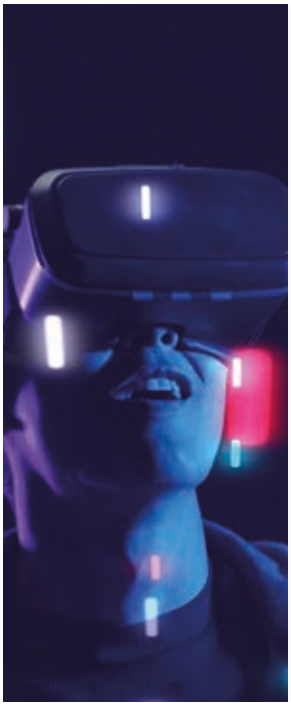
Sub-Saharan Africa's vibrant creative industries may also benefit in the short-term by producing virtual content and distributing it via metaverse technologies to global consumer markets. This could leverage the region's strengths in the arts and provide local producers with an interface to a much larger potential customer base than in domestic physical markets.

An early example of such a market is **Africarare, a 3D VR experience that hosts Ubuntuland – a virtual space and associated marketplace for African creativity and innovation**.[50] This platform has sold a digital collection of works by leading South African artist Norman Catherine and plans are in place for further VR galleries.[51] New markets are also emerging in the entertainment industry, where musical and performance arts could be internationally marketed. **South Africa's Soda Studio has entered the market by hosting live, interactive VR music events on its 'SodaWorld' metaverse venue.**[52]

New employment and training opportunities

The additional economic activity and new forms of interaction generated by metaverse technologies could offer opportunities for new forms of employment, enhance existing opportunities and facilitate the development of skills necessary for labour markets to accommodate them. The creation and expansion of businesses is expected to increase the demand for digitally skilled individuals. Metaverse technologies could be used to offer training opportunities to develop these skills. A number of start-ups are already showing that XR technologies could become highly impactful in education.[53] Large young populations could contribute towards future innovation if provided this training.[54] Metaverse-enabled education could be **applied across different skill sets and industries through adaptable XR experiences** (see Example 10)**.**

The impacts of training using metaverse technologies could be additional to those offered by conventional digital platforms by providing active and hands-on learning opportunities that are superior to passive digital learning. For instance, **the Naledi 3D start-up has partnered with the United Nations Industrial Development Organization (UNIDO) and the Government of Finland to provide forestry training using virtual reality technologies and flexible language translation tools.** These simulate the operation of machinery, providing a safer learning environment that distils best practice.[55]



Example 10: Virtual reality education

Virtual Reality South Africa is an XR start-up that offers a range of software solutions to businesses across Africa as well as Europe and the USA.

Among its services, the company offers **highly customised VR and AR learning experiences**. This aims to **bridge the gap between learning resources and opportunities**, enabling practical teaching environments that can be **adapted to any skillset, industry or individual**.

The learning experiences can be accessed via a range of devices including VR headsets and smartphones.

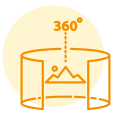
Source: Virtual Reality Education South Africa (2022), Link.

Expansion of access to information and digital content

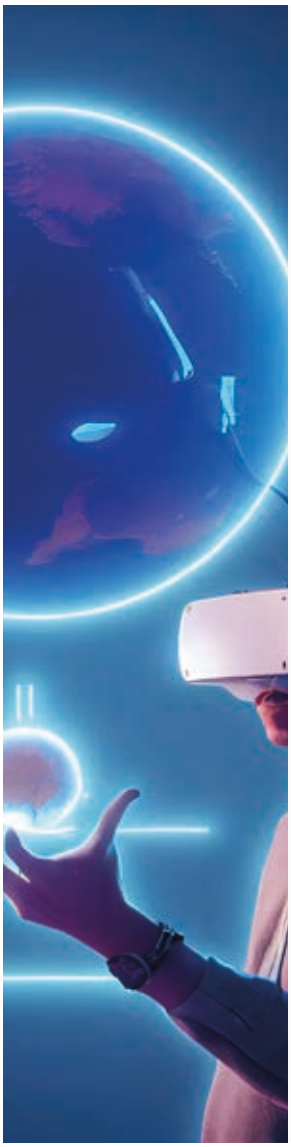
Metaverse technologies could offer new platforms for open data and enhanced data management in Sub-Saharan Africa. This could improve decision-making, developmental support and transparency. For instance, a range of open data repositories are being created across the region. These span from the **Ushahidi crowdsourcing app, which delivers a centralised bank of social and geographical 'empowerment' information**[56], to **the interactive Healthsites.io database where users have mapped the location of over 57,000 healthcare centres across the continent to date**.[57, 58]

Among governments, efficiency of public service delivery can be improved, for instance in **Kenya's Huduma initiative where a network of integrated platforms is being used to coordinate and automate services and transactions**.[59]

Information constraints can be a key barrier to productivity and the adoption of technology in informal or subsistence industries such as rural agriculture. These constraints can be resistant to intervention that uses conventional ICT technologies, but novel technologies like VR and AR could have a more transformational effect.[60] Metaverse technologies could offer a further degree of immersion and could distribute information more accessibly. The **Nuru agritech phone app shows that AR and AI usage can disseminate ready to use information to subsistence farmers** (see Example 11). Elsewhere, the **Senai Global initiative is partnering with XR Global to provide VR-based agricultural information to African farming communities**.[61]



The Nuru agritech phone app shows that AR and AI usage can disseminate information accessibly to subsistence farmers.



Example 11: First steps towards metaverse agricultural technology

While the metaverse itself is yet to tap into rural and subsistence agricultural industries in Sub-Saharan Africa, many of its component technological elements are already beginning to transform the sector.

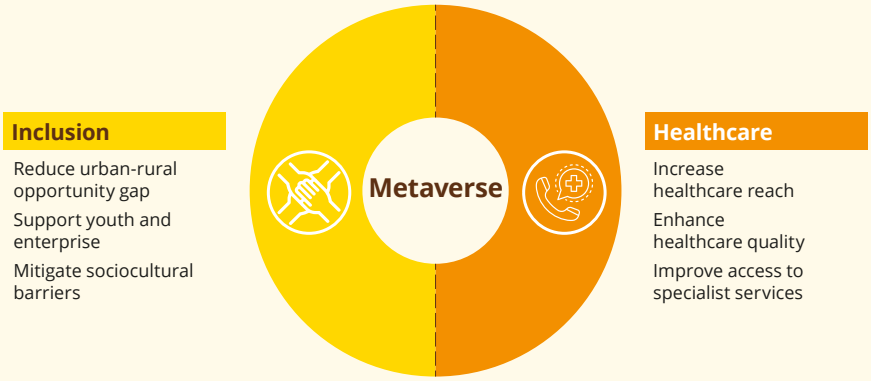
Nuru, a mobile phone app developed by Penn State University, IITA and RTB, **uses AI and Google's TensorFlow technology to analyse information from farmers' phone cameras to recognise signs of disease in cassava leaves produced in Kenya and other Sub-Saharan countries**, providing relevant advice on how to respond. The app uses advanced AI, leveraging computer vision, machine learning and satellite and mobile spectrophometry data to forecast crop health and detect anomalies.

Nuru adapts advanced technology by making it readily accessible available via smartphones and in offline settings, including a downloadable knowledge repository. Nuru is a stepping stone to metaverse applications, showing the utility of component technologies

Source: MEL CGIAR (2020). Link

The metaverse could achieve additional inclusion and healthcare outcomes

Figure 11. Metaverse social impacts



Source: Deloitte analysis

Inclusion

Metaverse technologies offer the opportunity for Sub-Saharan Africa to become more connected to the global digital economy. This could include access to markets, financial services, educational resources and healthcare (see below). Inclusion can be bolstered by providing access to applications and services that would not otherwise be available.

The internet already serves as a powerful tool for inclusively delivering such services and opportunities.[62] **Mobile connectivity has been shown to lead to increased labour force participation, reduce poverty and increase welfare, particularly among rural populations**.[63,64] Internet applications can also target specific barriers to inclusion. For instance, **mobile money contributes towards reducing digital gender divides[65]** by mitigating barriers to participation in the financial system[66] and driving investment in women-led businesses.[67] Similarly, digitalisation of the payments ecosystem has been shown to increase account ownership among the unbanked.[68]

Metaverse technologies offer capabilities that could help to close the opportunity gap even more. For instance, **Cloud technology could enable small businesses in Sub-Saharan Africa to remotely access Software as a Service (SaaS).** This may support entrepreneurship by allowing operations to scale flexibly, whilst reducing up-front ICT infrastructure costs, increasing security and decreasing digital skills requirements.[69]

Metaverse technologies may also further reduce barriers to inclusion. For instance, in response to persistent sociocultural barriers to financial accessibility, **MTN Ghana is currently working with GSMA Inclusive Tech Lab to reduce the digital gender divide through a novel peer-to-peer encrypted tokenisation technology that shields women's identities when depositing, withdrawing or transacting using mobile money accounts**.[70]

However, improvements in inclusion will require ongoing support for access to basic internet technologies. An inclusive metaverse will require careful planning. Attention will need to be paid to challenges that will become more significant as advanced technologies become standard. These include availability, affordability and skills requirements.

Health and Healthcare

Metaverse technologies could facilitate improvements in healthcare by increasing the reach of existing services, for instance via virtual consultation services. They could improve health outcomes by enabling access to higher-quality or more specialist healthcare services across great distances.

For example, **Medical simulation training centers are using AR to train physician assistants to perform lifesaving measures, such as stabilizing injuries, when a surgeon is not available immediately.**[71] By connecting geographically distant experienced surgeons to less experienced local healthcare providers, this technology could increase the availability of healthcare knowledge and personnel.[72]

Example 12: Eden Wellness Station

Eden Wellness Station, by the South African start-up Eden, improves youth wellbeing in hospitals through a VR series where animated characters explain difficult topics such as 'What is an MRI' and 'What is Cancer'. This content aims to prepare children for medical treatments and provides them with coping strategies and support.

Source: Africa XR Report (2022), Link.

VR technology has also been adopted in healthcare settings to provide immersive care to patients. For example, **South Africa's Eden Wellness Station has developed animated VR content used to provide wellbeing services to children in hospitals** (see Example 12).

More generally, telemedicine has long been an area of interest for many governments in Sub-Saharan Africa. In 1980, Ethiopia, Nigeria, Ghana and Gambia founded the **HealthNet telemedicine project**, while Uganda and Kenya established the **Project SHARE** telemedicine initiative in cooperation with Canada's St. John medical facility.[73] Since then, initiatives aiming to enhance the quality and reach of telemedicine in the region have occurred across numerous medical fields. Success stories include **drone delivery of COVID-19 test samples in rural Ghana in 2020** and the **establishment of a telemedicine technology centre for the detection of the COVID-19 virus in Kenya.**[74]

Such innovations could provide significant benefits in rural populations, where healthcare services are not universally available. The impact could be enhanced through efficiencies generated by concentrating healthcare resources in localised geographic areas.

South Africa's Eden Wellness Station has developed animated VR content used to provide wellbeing services to children in hospitals.

Long-term economic and social impacts could be transformative

The impacts discussed above are local in scope and scale given the early stages of metaverse development in Sub-Saharan Africa. In the longer term, benefits may become more widespread, especially as innovation takes hold. Long-term impacts are those that can take the GDP impact opportunity to the new frontiers suggested in empirical estimates.

Impacts could develop in breadth as a wider range of potential use cases are enabled, more industries adopt the metaverse and it becomes accessible to a wider population of consumers.

Impacts could grow in scale and magnitude as technology becomes more widely accepted in standard industry practice, or as such technologies develop to become more advanced and immersive.

Impacts could synergise with innovative ICT developments that enhance the applicability of metaverse use cases, magnify value drivers and benefit from tech entrepreneurship.

The complex dynamics facing Sub-Saharan Africa will define the path towards the long-term metaverse opportunity. This path will be long but could lead to substantial benefits. It is expected that the short-term impacts described above will develop slowly at first but may accelerate in future into a significant opportunity.

The complex dynamics facing Sub-Saharan Africa will define the path towards the long-term metaverse opportunity.

4. Enablers influencing metaverse growth

The economic opportunities of the metaverse are contingent on a series of enabling factors that support its adoption. These 'enabling pillars' are shown in Figure 12 below. They are common across all countries and determine the long-term success of the metaverse, though some key challenges are particularly crucial for Sub-Saharan Africa.

Figure 12. Metaverse enabling pillars

Source: Deloitte analysis

Metaverse technology fundamentals include factors necessary for the metaverse to exist, such as network connectivity and computing power. Meanwhile, the wider ecosystem consists of enablers that facilitate widespread adoption and efficient operation, such as user behaviours and common standards.[75]

Realisation of the economic opportunity requires key challenges to be unlocked

The economic context of Sub-Saharan Africa discussed in Section 2 referred to the interplay between positive trends that support the long-term opportunity and shared challenges that could slow its emergence (see Figure 6). These challenges:

Affordability — **Connectivity** — **Digital skills**

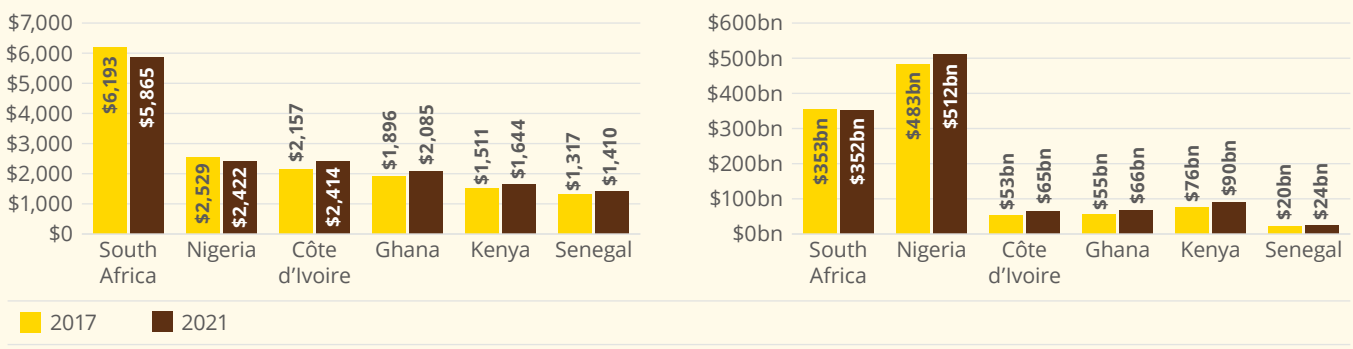
... correspond to technology fundamentals and the key human capital element of the wider ecosystem.

User devices are limited in affordability and availability

Affordability of user devices is critical to the growth of metaverse technologies. Sub-Saharan Africa is a low income region; GDP per capita across the six reported countries is significantly lower than the global average ($1,410-$5,865 vs $18,195 in 2021). This limits the demand for advanced user devices including VR/AR headsets and personal computers.

Metaverse opportunities will have to adapt to less advanced user devices. The rapid adoption of smartphones in Sub-Saharan Africa is an ongoing success story, where falling prices continue to increase user uptake.[76] As of 2021, smartphone devices comprised 49 percent of total mobile connections across Sub-Saharan Africa.[77] While more limited in their potential for immersive experiences, smartphones are expected to be an initial entry point to the metaverse. A number of smartphone-enabled use cases have been developed, such as in **AI-driven agritech**, **smartphone AR e-commerce** or in accessing **educational resources**. To realise the full potential benefits of the metaverse, advanced hardware will need to become more affordable and available. This could happen over time, but it remains to be seen.[78] Smartphone adoption may itself reach a limit in future as a result of ongoing income limitations in spite of falling prices. In particular, income inequalities will make adoption more infeasible towards the lower end of the distribution.

Figure 13. GDP per capita (Panel 1) and GDP (Panel 2), in constant 2015 USD



Source: World Bank – World Development Indicators

Mobile connectivity has been prioritised over fixed networks

For the foreseeable future, immersive metaverse adoption will continue to be driven predominantly through VR. Almost all VR content is currently consumed over fixed networks through Wi-Fi. With respect to AR, existing services today are largely 2D and already supported by today's networks. As a result, existing fixed network capacity and mobile coverage, in combination with future network investments for 5G, particularly fixed wireless access, fiber-optic cables, along with continued development of edge computing, is likely sufficient to support the ongoing use of the Internet and foreseeable metaverse use cases. Further use cases are expected to develop gradually over the coming years.

Sub-Saharan Africa faces spending constraints restricting the expansion of fixed connectivity networks. Limited budgets are dedicated towards reducing physical infrastructure gaps and establishing mobile connectivity.

Public spending on physical infrastructure, such as energy, transport and water networks, is of high priority across Sub-Saharan Africa as a whole. For instance, in 2014 only 43 percent of rural communities in Africa had access to roads linking to economic centres,[79] whilst in 2022 43 percent of Sub-Saharan African population had no access to electricity.[80]

Given these spending priorities, Sub-Saharan African governments, national and multinational corporations have prioritised ongoing investment in mobile connectivity, with fixed networks receiving relatively less funding.[81] In Ghana, Kenya and South Africa, over 90 percent of the population now has 4G coverage. Mobile connections support smartphone use cases and provide the opportunity of initial metaverse experiences to those that can afford it.[82] This could be a viable development path for the Sub-Saharan African metaverse until fixed connectivity becomes more widely accessible, for instance through fixed access network deployment and Wifi 6GHz spectrum initiatives discussed in Section 2.

The costs of connectivity can still be considerable for consumers, with typical mobile broadband access priced at 4.4 percent of GNI (i.e., GDP plus net exports) on average across the region. This is significantly less constrained than the cost of fixed connectivity (at 18.6 percent of GNI), but it is still above the 2 percent affordability target identified by the ITU Broadband Commission.[83]

Improvements in digital skills are needed

Basic digital skills will be required for users to engage meaningfully with available metaverse use cases, whilst advanced digital skills are required to generate a supply of metaverse technologies developers and expand the technology entrepreneurship environment.

Development of digital skills in Sub-Saharan Africa is a challenge that is crucial to the viability of most use cases. Whilst there are advances in education, skills and employment among high-income groups, basic education and skills are still lacking elsewhere. In 2020, only 66 percent of the Sub-Saharan African population aged 15 and above possessed basic literacy.[84] The digital skills required to use and develop frontier technologies are not yet widespread across the six reported countries.[85] A skills gap is emerging as a result, for instance with 50-55 percent of all jobs in Kenya (roughly 16.5 million jobs) requiring digital skills. This compares to 35-45 percent of all jobs in Nigeria and Côte d'Ivoire (roughly 28.4 million and 5.0 million jobs, respectively).[86] Until basic education and digital skills are more widespread, the user base for the metaverse will be limited and will impose constraints on the magnitude of the economic opportunity.

However, there are reasons for optimism. Basic education and digital skills are both growing over time.[87, 88] Meanwhile, advanced AI is showing potential to mitigate some of the most significant barriers to skills development. For instance, the **Masakhane open-source AI project aims to build a neural network that can translate between the 2,140 languages spoken across the continent.**[89]

In addition, **Microsoft's Azure Neural Speech software can address literacy barriers by converting text from 140 languages into AI-generated voice audio and vice versa.**[90] **Language barriers are also being rapidly addressed, with 91 languages available for translation to US English to date.**[91] Examples like these could unlock the potential for young and ambitious populations to access the rich stock of educational resources available online and via metaverse applications.

Wider ecosystem enablers require coordinated support

The challenges discussed above represent the most pressing issues that limit the metaverse opportunity currently in Sub-Saharan Africa. Wider ecosystem enablers are no less important, influencing the rate of adoption among those that have access to the hardware, connectivity and skills to participate.

Wider Ecosystem
Support the development of the metaverse

Technological Readiness of Businesses

The EIU Business environment rankings includes South Africa as 51st out of 82 countries. Kenya and Nigeria rank 75th and 76th respectively *(Economist Group)*

Social Acceptance, Security and Privacy

In the six reported countries:

- The ITU's global cybersecurity index ranges from 36 (Senegal) to 87 (Ghana) *(ITU)*
- Social media penetration in Sub-Saharan African regions range from 45% in Southern Africa to 8% in Central Africa *(Statista)*
- Trust in online privacy varies across the six reported countries, ranging between only 25% (Nigeria) to 48% (South Africa) *(Economist Group)*

Competition and Common Standards

Digital competitiveness differs across the six reported countries, with Cote d'Ivoire ranking 7th among the 36 African countries considered, and South Africa and Kenya ranking 33rd and 34th respectively *(Statista)*

Technological Readiness of Businesses

The ability of businesses to employ new technologies will be crucial for generating long-term economic impacts. In Sub-Saharan Africa, the general technological readiness of businesses is low. Côte d'Ivoire, for instance, scores only 44/100 for 'Business environment' in the ICT Readiness Index.[92] This index evaluates the extent to which market policy and regulation are supportive in enabling businesses to drive growth through internet technologies.[93] South Africa, the highest-ranking reported country, scores 67/100. The remaining reported countries' scores range between 53 (Senegal) and 58 (Ghana).[94] Therefore, there is scope to build upon digital strategies to position the business environment for the adoption of metaverse technologies.

Social Acceptance, Security and Privacy

Data protection and prevention of online harms will be important for social acceptance as societies' use of digital technologies, including metaverse applications, continues to grow. These goals, amongst other factors, help to promote social acceptance across society, and incentivises commercial investment into innovative technologies, like the metaverse. In the region, this is complicated by the fact that cybersecurity levels vary substantially across the six reported countries. To help further these goals, new data protection policies, prompted by GDPR in the EU, were introduced in Kenya and Nigeria in 2019 and a year later in South Africa.[95] These constitute solid foundations that may contribute, together with other factors, to building a secure user base and can contribute towards commercial scalability and investment in the ICT sector.

Competition and Common Standards

Some of the key functionalities of metaverse technologies rely upon seamless transition of assets and activity between virtual spaces and platforms. Common standards can enable the creation of a large network of users and use cases that encourages market entry and competitive efficiencies. Unless there is collective agreement on standards and norms, barriers to entry could fragment the metaverse ecosystem, leading to smaller platforms with less widespread adoption.

Common standards are also crucial for encouraging user adoption. This extends to device accessibility, where widespread adoption would be best supported through collective agreement supporting the use of less expensive technology (e.g., accessibility through more basic hardware, lower speed, or higher latency internet connections).

For Sub-Saharan African countries, participating actively in the development of global standards, so as to ensure that regional needs are taken into proper account, could support local innovations in digital technologies, including the metaverse, whilst remaining competitive both across the continent, and globally. Tech clusters aside, businesses in Sub-Saharan African countries may face challenges when competing on digital technologies, as implied by national economies generally having low scores in digital competitiveness indices. For instance, in Statista's digital competitive index,[96] Cote D'Ivoire is ranked 7th among 36 African countries – the highest in the sample. Meanwhile, Kenya and South Africa are ranked among the bottom five countries.[97]

Wider ecosystem enablers are no less important, influencing the rate of adoption among those that have access to the hardware, connectivity and skills to participate.

5. Conclusion: Principles of metaverse support

In a region facing significant economic challenges, the opportunity of the metaverse is currently one for the future. With the right support, this future could emerge more quickly and create wider opportunities.

Metaverse technologies are already emerging in Sub-Saharan Africa

Even today, small-scale and localised opportunities of the early metaverse technologies are emerging across the region. New markets allow countries' diverse strengths in culture and heritage to be expressed on the global stage through tourism and the arts. Better access to information promises transformative use cases in agriculture for example in the near future. Novel advancements and widely accessible use cases are giving rise to inclusion and health impacts. Continual increases in the breadth, sophistication and adoption of emerging use cases could convert these early signs into longer-term outcomes.

Collaboration is needed for the metaverse to become transformational

A structured approach is needed to make best use of ongoing trends in Sub-Saharan African digital economies. This can include **constructive national policy, regional coordination**, continued prioritisation of **inter-regional trade or agreements on common standards** and the encouragement of **foreign investment** and **private partnerships**.

With multilateral support in place, the development of the necessary enabling pillars can then be accelerated. Certain actions can make strides in supporting future potential:

01. **Continued efforts towards increasing availability, affordability, and quality of fixed and mobile connectivity infrastructure would improve accessibility to both current and emerging digital technology applications.** Continuing the rollout of fixed and mobile networks into unconnected geographies would benefit the broader internet ecosystem allowing more inclusive access to early metaverse use cases , as well as current digital technology use cases. This is contingent on connectivity being made affordable to end-users. Simultaneously, supporting innovative connectivity initiatives could bolster access to more advanced use cases and the development of tech entrepreneurship.

02. **A secure digital economic environment would improve incentives for international support.** Prioritising the progress of harmonised data protection and intellectual property standards and frameworks could allow the metaverse ecosystem to become more interoperable as it develops. This can in turn provide a basis for investment to take hold in secure digital economies.

03. **Reducing the skills gap would support adoption.** Policy action to build digital literacy and employability can encourage adoption by potential users and support the future developer ecosystem, which could allow Sub-Saharan Africa to drive its own metaverse future. With the appropriate skills in place, the metaverse can become a nexus for impact generation in the longer-term.

04. **Scaling the tech entrepreneurship environment would increase the likelihood of transformative innovations.** Championing digital innovation and entrepreneurship through continued provision of funding and expertise via tech clusters can make the development of novel solutions much more likely. This can help the metaverse circumvent challenges and follow the trajectory of Web 2.0 as it emerges.

Appendix: Country profiles

Indices definitions

e-Government Index[1]

The e-Government Index is calculated as a weighted average of composite measures assessing three dimensions of e-government: the scope and quality of online public services, the development of telecommunications infrastructure and levels of human capital. Scores are obtained from the United Nation E-Government Survey, which is produced every two years by the Department of Economic and Social Affairs.

GSMA's Mobile Connectivity Index[2]

The Mobile Connectivity Index measures the performance of 170 countries against key enablers of mobile internet adoption. Countries are scored within a range of 0 to 100 across 42 indicators including, among others, coverage of 2G, 3G, 4G, and 5G networks, mobile download and upload speed, and mobile latency. A higher score represents stronger performance in delivering mobile internet connectivity.

Global Innovation Index[3]

The overall Global Innovation Index score is the simple average of the Innovation Input and Output Sub-Index scores. The Innovation Input Sub-Index rank is computed based on a simple average of the scores in the first five pillars (Institutions, Human capital and research, Infrastructure, Market sophistication, and Business Sophistication), which capture elements of the economy that enable and facilitate innovative activities. On the other hand the Innovation Output Sub-Index rank is computed based on a simple average of the scores in two pillars (Knowledge and technology outputs and Creative outputs), which are the result of innovative activities within the economy. Scores are normalized values that fall within the 0–100 range.

UNCTAD Frontier Technology Readiness Index[4]

The UNCTAD Frontier Technology Readiness Index metric assesses a country's readiness for using, adopting and adapting 11 technologies including Artificial Intelligence (AI), Internet of Things (IoT), Big data, 5G, 3D printing, Robotics, Drone, Gene editing, Nanotechnology, and Solar photovoltaic. Based on the index, a ranking of the 158 considered countries has been published. Five components are used to construct the underlying index: ICT deployment, skills, R&D activity, industry activity and access to finance.

01. **ICT deployment**: This is the level of ICT infrastructure. This considers the prevalence and the quality of the relevant infrastructures to allow for advanced and efficient use of internet-based technologies like AI, IoT, big data and blockchain.
02. **Skills**: Using, adopting and adapting frontier technologies needs people equipped with relevant skills. These may be advanced but are generally lower than those required to originate the technologies. Two types of skills need to be considered: skills acquired through education, and skills acquired in the workplace through practical training or learning-by-doing.
03. **R&D activity**: R&D activity is needed not just for the production of frontier technologies, but also for adoption and adaption. R&D activities are measured using the number of publications and patents filed on the 11 frontier technologies in a country.
04. **Industry activity**: This aims to capture ongoing activities in an industry related to the use, adoption and adaption of frontier technologies. It considers three sectors that are early adopters: manufacturing, with high-tech manufacturing as the frontrunner; finance; and ICT, which tends to interact with other technologies. It uses export data, on high-technology manufactures, as well as on digitally deliverable services which cover both finance and ICT.
05. **Access to finance**: This assesses the availability of finance to the private sector. Better access to finance could accelerate the use, adoption and adaption of frontier technologies. For this purpose, domestic credit to the private sector as a percentage of GDP was selected as part of the index. This indicator measures resources provided by financial corporations. It also includes various financial instruments including loans, purchases of non-equity securities, and trade credits and other accounts receivable.

1 United Nations E-Government Survey (Link)

2 GSMA's Mobile Connectivity Index (Link)

3 Global Innovation Index (2022) (Link)

4 UNCTAD (2021), *via Statista's publication repository* (Link)

Background information (for all countries, unless otherwise specified)

Data Point	Source
GDP (Current US$ billion, 2021)	World Bank (2022). GDP (current US$) – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
Population (2021)	World Bank (2022). Population, total – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
GDP per Capita (Current US$, 2021)	World Bank (2022). GDP per capita (current US$) – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
Median Age	Hannah Ritchie and Max Roser (2019). Age Structure
Urban Population (% of total population, 2021)	World Bank (2022). Urban population (% of total population) – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
Gini Index	World Bank (2022). Gini Index – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
Poverty levels (2017 PPP) (% of population)	World Bank (2022). Poverty headcount ratio at $2.15 a day (2017 PPP) (% of population) – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa
Active mobile-broadband subscriptions (per 100 inhabitants, 2020)	ITU(2020). Digital Development Dashboard
Secure Internet Servers (per 1m inhabitants)	World Bank (2022). Secure Internet servers (per 1 million people) – Cote d'Ivoire, Ghana, Kenya, Senegal, South Africa

Côte d'Ivoire

$2.3-$4.2bn

Estimates suggest that the potential economic impact of the metaverse could reach $2.3-$4.2bn per year in Côte d'Ivoire by 2035.

Following COVID-19, key public measures boosted Côte d'Ivoire's resilience through the digital economy, leading to a strong impetus for further regulatory development in 2022.[1] Côte d'Ivoire reported a mobile phone penetration rate of 162% in 2021, which is continuing to grow, suggesting that multiple SIMs tend to be used by single users.[2] However, Côte d'Ivoire's digital foundations and ecosystem support will require further development for the full potential of the metaverse to be realised. Côte d'Ivoire is still developing its digital foundations but has been targeting these proactively in public policy.

Resilience was shown during the COVID-19 pandemic as a result of digital public interventions. The government distributed social grants using mobile payment systems and accelerated the digitalisation of key public services. For example, it launched **Citizen's House**, a one-stop online platform for virtual public services. In 2022, **remote work was officially recognised and protected by the Labour Code** and a digital tax reporting system was launched.[3]

These developments are the latest in a long-term positive trend. Its e-Government Index grew from 0/100 in 2003 to 45/100 in 2020, moving from the 174th position to the 139th in the world ranking.[4] **Digital connectivity is now available to over half of individuals, though there is room for further expansion of mobile networks.** Penetration of online purchases is ranked fifth among the six reported countries.

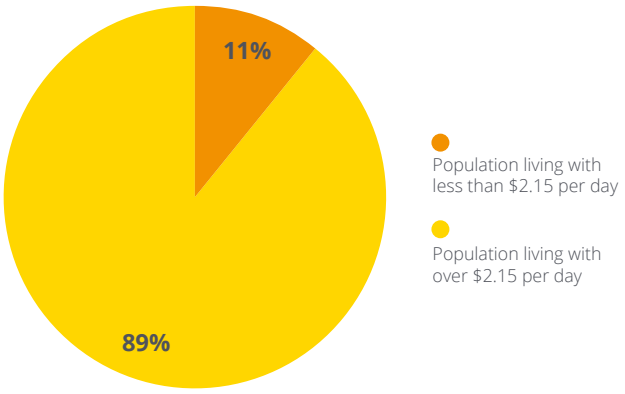
Côte d'Ivoire's technological readiness has the lowest overall ranking among the six considered countries (131th/158).[5] The positive impetus seen in the digitalisation of government is reflected in access to finance and industry activity. The country performs less strongly in other sub-categories of ecosystem support. Frontier technologies are still to become widely adopted, whilst digital skills and levels of R&D are lowest among the six Sub-Saharan African countries profiled in this report.

Background

Côte d'Ivoire	
GDP ($, m)	$65,319
Population	27,053,629
GDP per Capita (PPP, $)	$5,407
Median Age (2020)	18.7
Urban Population	52.2%
Gini Index (2018)	37.2
Global Innovation Index	21
ICT Sector (% of GDP) (2020)*	11%

**Estimate by Oxford Business Group (2020) (Link)*
Note that all data reported refer to 2021 unless otherwise specified.

Poverty levels (PPP, 2018)



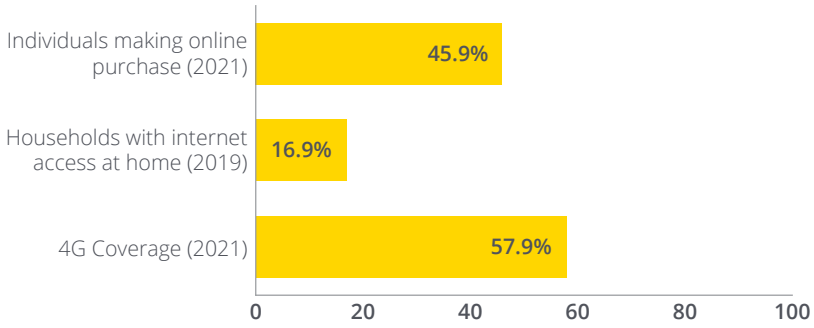
75 **Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)

45 **E-Government Index** (2020)

57 **Secure Internet Servers** (per 1m inhabitants – 2020)

1 Oxford Business Group (2022) (Link)
2 Oxford Business Group (2022) (Link)
3 United Nations E-Government Survey (Link)
4 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)
5 UNCTAD (2021) via Statista's publication repository (Link)

Digital Foundations[1]

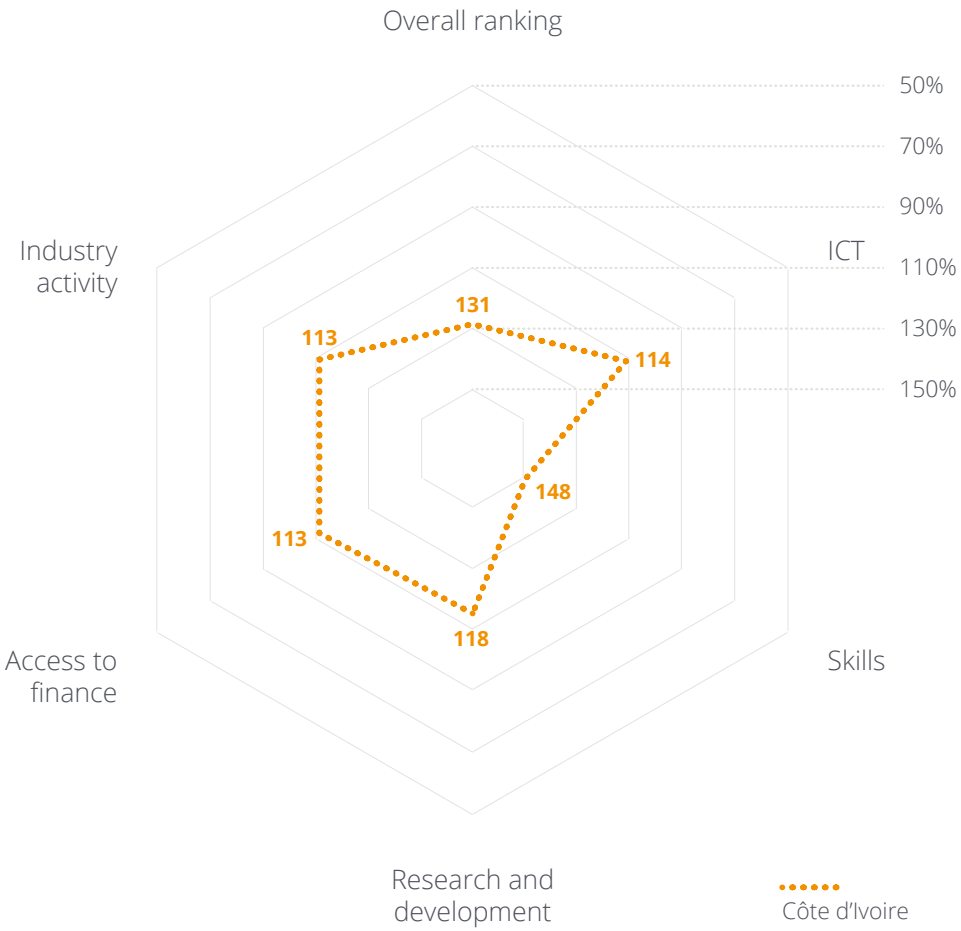


37.9 Mbit/s
International internet bandwidth per internet user (2021)

46.9/100
Mobile Connectivity Index (2021)

Ecosystem Support

UNCTAD Frontier Technology Readiness Index (2019)



1 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)

Ghana

$1.8-$3.4bn

Estimates suggest that the potential economic impact of the metaverse could reach $1.8-$3.4bn per year in Ghana by 2035.

Ghana has experienced rapid digital development since 2018, when mobile technology innovations generated widespread impacts in sectors such as health, finance, and agriculture.[1] These steps could pave the way for the metaverse opportunity if trends continue.[2] Public initiatives including the Ghana Digitalisation Impact Project aim to support the recent trajectory.[3] However, Ghana will require further development of its digital foundations and ecosystem support to generate enablers of the metaverse.

Ghana is benefitting from a range of public digitalisation initiatives focused on enabling digital finance and commerce. These include the **Mobile Money Interoperability Project (MMI),**[4] **the National Payment Systems Strategic Plan (2019-2024)**[5] **and the National Digital Property Addressing System.**[2] Digital training and support is also provided by the government, aiming to boost e-commerce participation through **'Ghana Online Mall', 'Digital Marketing' and 'Made in Ghana Mall'** initatives.[2]

Ghana's digitalisation has progressed significantly in recent years. The country's **e-Government Index scores grew the most** among the six reported Sub-Saharan African countries between 2003-2020 (+148%, from 24 to 60/100).[6] The **majority of individuals now have access to mobile connectivity** and online purchases are increasing.

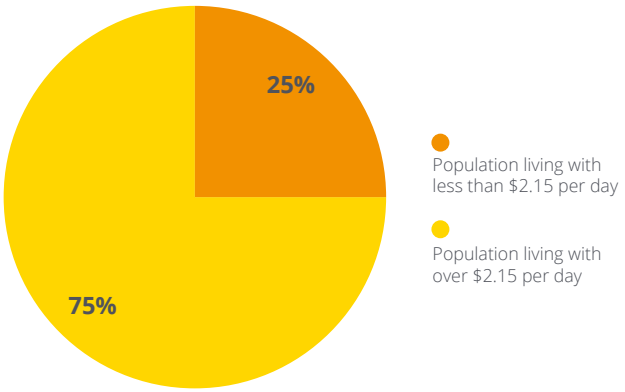
While Ghana's support for the ecosystem is still developing, the country ranks second among the six reported Sub-Saharan African countries in the overall UNCTAD Frontier Technology Readiness Index.[8]

Background

Ghana	
GDP ($, m)	$66,150
Population	31,732,128
GDP per Capita (PPP, $)	$5,624
Median Age (2020)	21.1
Urban Population	58.0%
Gini Index (2016)	43.5
Global Innovation Index	22
ICT Sector Value ($) (2022)*	$1 billion

** International Trade Administration (2022) (Link)*
Note that all data reported refer to 2021 unless otherwise specified.

Poverty levels (PPP, 2016)



85 **Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)

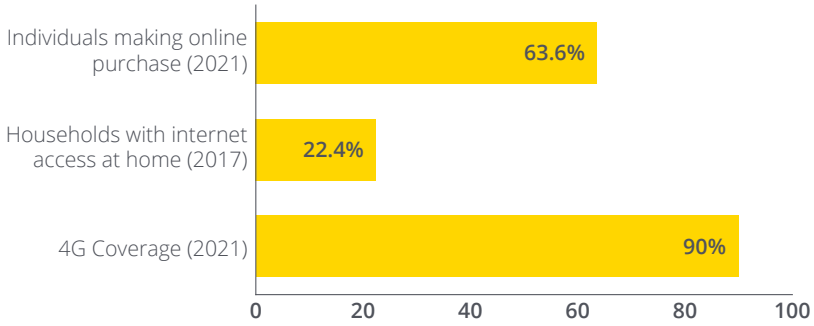
60 **E-Government Index** (2020)

59 **Secure Internet Servers** (per 1m inhabitants – 2020)

Ghana has a **relative strength in industry adoption of frontier technologies and in R&D in the field.** While ranking 106th out of 158 countries included in the UNCTAD index, the country ranks second among the six considered here, only behind South Africa, for the **availability of ICT infrastructure**. Ghana ranks only 148th in access to finance, indicating that innovation could be constrained. Accordingly, room for improvement is indicated by the Global Innovation Index, where the country ranks 95th among the 132 countries considered, and third among the six reported Sub-Saharan African countries.[9]

1 Face 2 face Africa (2021) (Link)
2 ODI (2022) (Link)
3 Ghana Digitalisation Impact Edition (Link)
4 Bank of Ghana (2019) (Link)
5 Bank of Ghana (2019) (Link)
6 United Nations E-Government Survey (Link)
7 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)
8 UNCTAD (2021) (via Statista's publication repository)
9 Global Innovation Index (Link)

Digital Foundations[1]

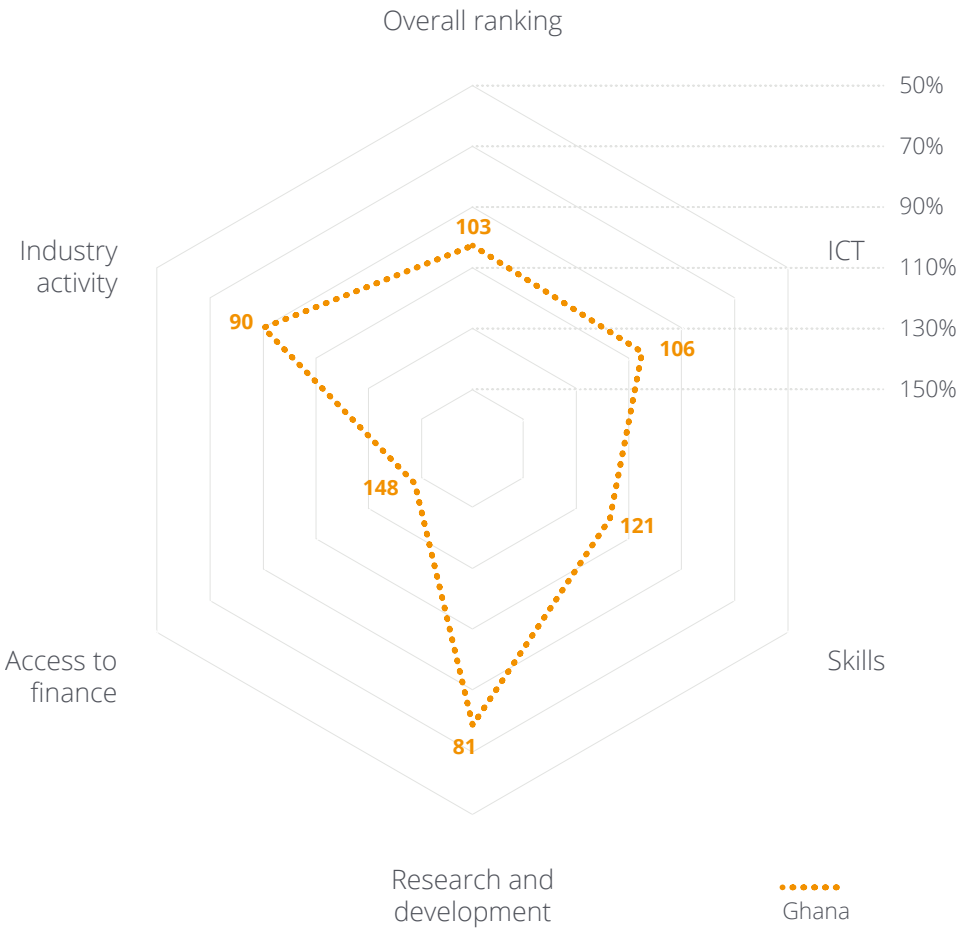


51.4 Mbit/s
International internet bandwidth per internet user (2021)

56/100
Mobile Connectivity Index (2021)

Ecosystem Support

UNCTAD Frontier Technology Readiness Index (2019)



1 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)

Kenya

$3.1-$5.9bn

Estimates suggest that the potential economic impact of the metaverse could reach $3.1-$5.9bn per year in Kenya by 2035.

Kenya is one of the fastest growing economies in Sub Saharan Africa, and its government has undertaken many digital initiatives aimed to further transform the country into an upper middle-income country by 2030.[1] The country's biggest tech hub, Silicon Savannah, is at the forefront of the continent's emerging tech industry, with the potential to attract international interest and accelerate the development of localised metaverse use cases in the shorter term.[2]

Kenya has advanced its levels of digitalisation across government, industries and households in recent years. While the country saw its e-Government Index grow from 30 to 53/100 between 2003-2020 (+78%), it only gained two positions in the global ranking (from 118th to 116th).[3] **4G is now near-universal, whilst penetration of online transactions is the highest among reported countries**.

A range of frameworks are in place that support digital commerce. The **2013 Information and Communications Act** established governance over electronic transactions and e-authentication. The **Consumer Protection Act** provides the country with a resolution mechanism for digital trade disputes. **In 2019, the Data Protection Act was introduced, modelled on EU GDPR regulations**. In 2020, Kenya introduced a Digital Services Tax on income from services provided through the digital marketplace in its Finance Bill.[4]

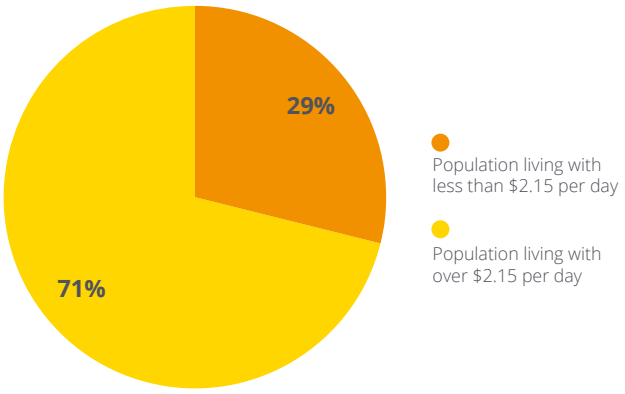
Kenya's support for the ecosystem is strong among reported countries, with no particular areas of weakness.[5] **Relatively high rates of R&D on frontier technologies and of businesses adopting them are reported in the country.** Funding availability and ICT infrastructure are ranked similarly to their overall rank, while the skills available in the country to adopt frontier technologies are only ranked 123rd among the 158 countries considered in the ranking.

Background

Kenya	
GDP ($, m)	$90,373
Population	54,985,702
GDP per Capita (PPP, $)	$4,573
Median Age (2020)	20.0
Urban Population	28.5%
Gini Index (2015)	40.8
Global Innovation Index	28
ICT Sector (% of GDP)*	5%

** KNBS – Economic Survey 2021 (2021) (Link) and World Bank (Link). Note that all data reported refer to 2021 unless otherwise specified.*

Poverty levels (PPP, 2015)



47 **Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)

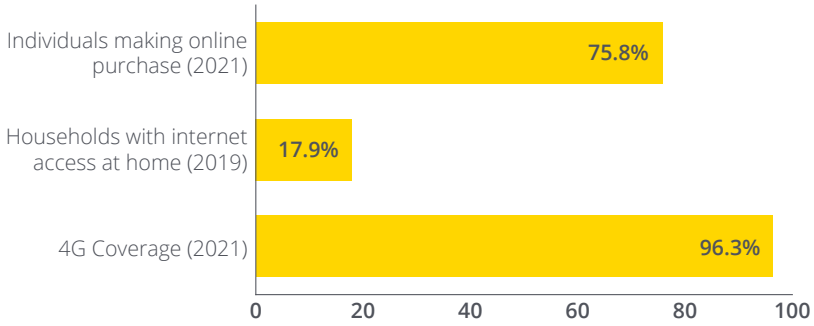
53 **E-Government Index** (2020)

239 **Secure Internet Servers** (per 1m inhabitants – 2020)

The business environment is relatively innovative in Kenya, ranking second among the six reported Sub Saharan African countries in the Global Innovation Index, and 88th among all 132 countries considered.[6] **Kenya incubated the mobile money industry**, where the M-Pesa app rose in 2007 to become a catalyst for global digital finance.

1 Global Switzerland Enterprise (2021) (Link)
2 AppsAfrica (2022) (Link)
3 United Nations E-Government Survey (Link)
4 ODI (2022) (Link)
5 UNCTAD (2021), *Technology and Innovation Report 2021* (Link)
6 Global Innovation Index (Link)

Digital Foundations[1]

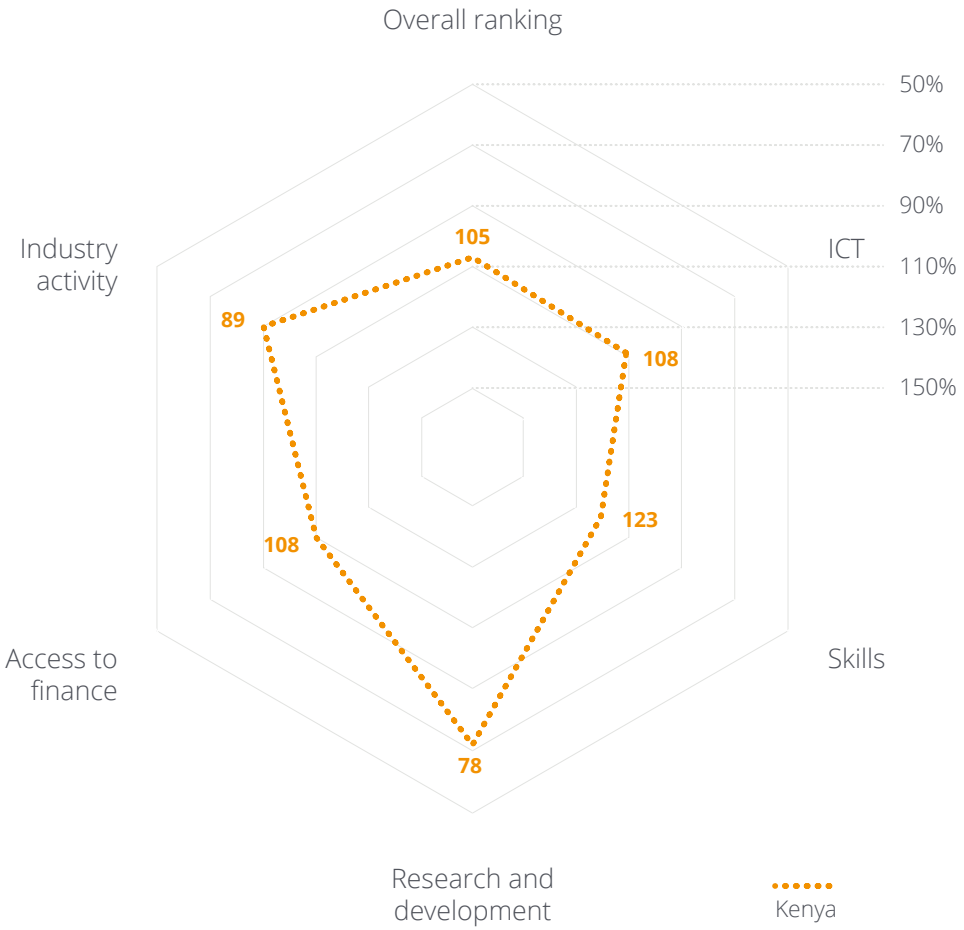


79 Mbit/s
International internet bandwidth per internet user (2021)

53.2/100
Mobile Connectivity Index (2021)

Ecosystem Support

UNCTAD Frontier Technology Readiness Index (2019)



1 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)

Nigeria

$9.2-$17.3bn

Estimates suggest that the potential economic impact of the metaverse could reach $9.2-$17.3bn per year in Nigeria by 2035.

The Nigerian government has set the digital economy among its key priorities, as shown by the country's Economic Recovery and Growth Plan 2017-2020 (ERGP).[1] The biggest tech cluster in Nigeria, the Yaba ICT Hub, aims to foster tech innovation through sponsorship by the Lagos State Government and private investors.[2] This is a key foundation for localised metaverse use cases in the shorter term. However, Nigeria will need to universalise mobile connectivity and improve upon user affordability to secure a widespread metaverse opportunity.

As the largest and most populous economy in Africa, digitalising Nigeria continues to be a challenge. Its **digital foundations are relatively strong especially given its size**, with the majority of individuals having access to 4G. **Despite having the largest e-commerce market on the continent, fewer than a third of individuals make online purchases**.

To encourage participation and investment in the digital economy, the Nigerian government have established a **Data Localisation Act** and **Cybercrime Law** that bolster the security of e-commerce and digital transactions.[3] In 2020, Nigeria formalised foreign investment via its **Companies Income Tax (Significant Economic Presence) Order** that set out regulations for non-resident digital companies. Nigeria's scores in the e-Government Index grew by 96% between 2003-2020 (from 23 to 44/100), in line with global trends.[4]

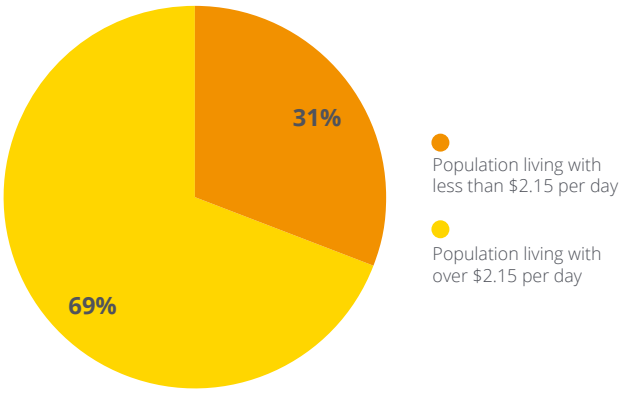
Nigeria's ecosystem support shows room for improvement, as could be expected given the size of the economy. Its **digital skills are well-developed especially given the size of the population**. Industries are not yet widely adopting frontier technologies, whereas ICT infrastructure and funding are less available than the sample average. Industries are not yet widely adopting frontier technologies, and funding is less available than in most of the 158 countries considered in the ranking.

Background

Nigeria	
GDP ($, m)	$551,932
Population	211,400,704
GDP per Capita (PPP, $)	$4,969
Median Age (2020)	18.1
Urban Population	52.7%
Gini Index (2018)	35.1
Global Innovation Index	20
ICT Sector (% of GDP) (2022)*	18.4%

** NBS – Nigerian GDP Report (Q2 2022) (2022) (Link)*
Note that all data reported refer to 2021 unless otherwise specified.

Poverty levels (PPP, 2018)

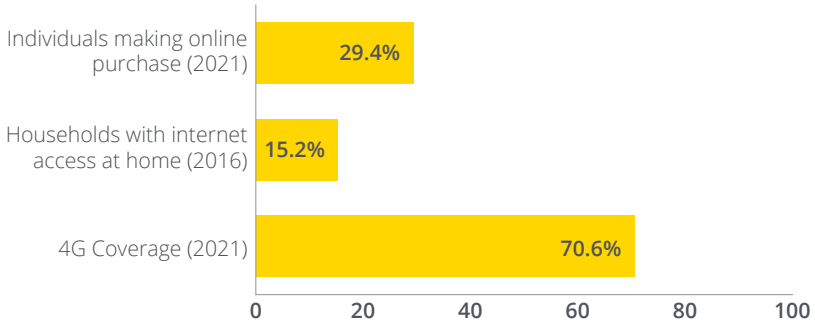


42	**Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)
44	**E-Government Index** (2020)
74	**Secure Internet Servers** (per 1m inhabitants – 2020)

Nigeria's **Economic Recovery and Growth Plan 2017-2020** made provisions that support the ecosystem, including fixed and mobile digital infrastructure, digital skills and entrepreneurship.[5] Continuing the prioritisation of these areas will allow a potentially large ecosystem to develop.

1 Nigeria's ERGP (Link)
2 Yaba ICT Hub (Link)
3 ODI (2022) (Link)
4 United Nations E-Government Survey (Link)
5 Federal Republic of Nigeria (2017) (Link)

Digital Foundations[1]

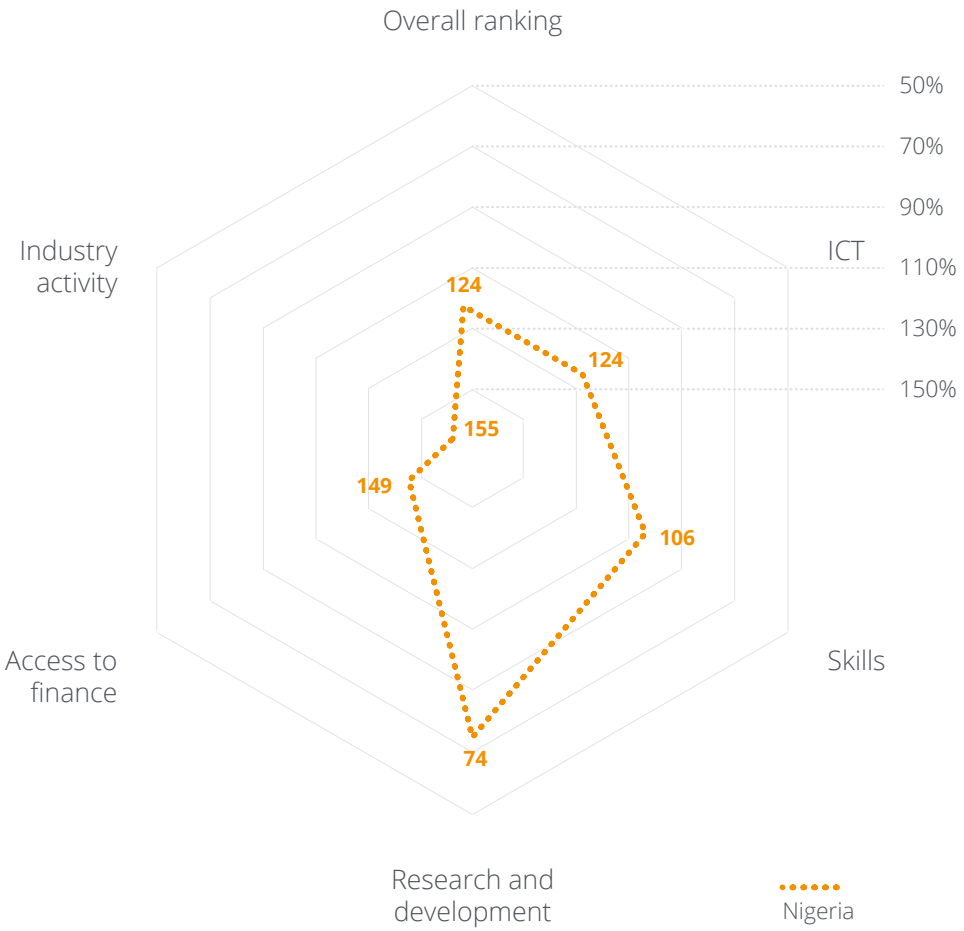


37.1 Mbit/s
International internet bandwidth per internet user (2021)

54.4/100
Mobile Connectivity Index (2021)

Ecosystem Support[2]

UNCTAD Frontier Technology Readiness Index (2019)



1 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)

2 UNCTAD (2021), *via Statista's publication repository* (Link)

Senegal

$0.9-$1.7bn

Estimates suggest that the potential economic impact of the metaverse could reach $0.9-$1.7bn per year in Senegal by 2035.

The Senegalese government's Digital Senegal Strategy 2025 aims to make Senegal a hub for digital transformation in the region, bringing the digital contribution to the country's GDP to 10% by 2025.[1] While being ranked fifth in the continent in the Network Readiness Index (2022) and outperforming the African average in all four pillars of the index,[2] connectivity and digital skills remain among the most pressing challenges for the country to expand the metaverse opportunity.[3]

Digitalisation is prominent in Senegal's economic strategy, with its **Digital Strategy 2025** aiming to raise digital GDP substantially. Its **Programme de Réforme de l'Environnement des Affaires et de la Compétitivité (PREAC3)**, aims to digitalise government transfers to businesses, though progress in the business environment is still needed.[3] Senegal's e-Government Index rose 110% between 2003-2020 (from 20 to 42/100), though it lost three positions in global rankings, reaching 150th place in 2020.[4]

Senegal is becoming increasingly digitalised, with **over 80% of individuals having access to 4G connectivity due to prioritisation of mobile infrastructure over fixed connections**. Cost of connectivity is still high at approximately 12% of monthly income per capita.[1] Where affordable, the network is substantial, ranking **fifth on the African continent in the 2022 Network Readiness Index**.[2] Online transactions are still only made by around half of individuals.[5] Further progress will be required for this to become truly widespread.

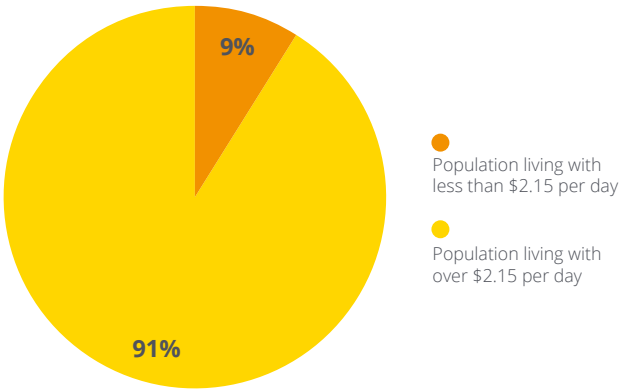
There is room for growth in Senegal's support for the ecosystem.[6] Digital skills are Senegal's only area of significant weakness relative to other reported countries. The country also ranks 107th among of the 158 considered countries in access to funding and to ICT infrastructure, but these are still ranked second and third among the six reported Sub-Saharan African economies.

Background

Senegal	
GDP ($, m)	$24,246
Population	17,196,308
GDP per Capita (PPP, $)	$3,430
Median Age (2020)	18.7
Urban Population	48.6%
Gini Index (2018)	38.1
Global Innovation Index	23
ICT Sector (% of GDP) (2018)*	3.5%

** ARTP (2018) (Link)*
Note that all data reported refer to 2021 unless otherwise specified

Poverty levels (PPP, 2018)



67 **Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)

42 **E-Government Index** (2020)

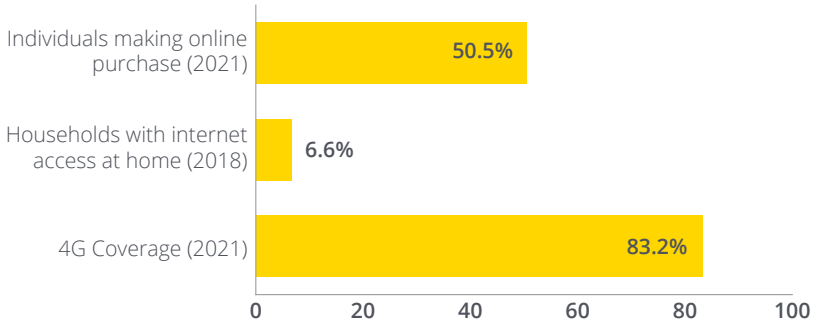
26 **Secure Internet Servers** (per 1m inhabitants – 2020)

The **Digital Senegal Strategy 2025** makes direct provisions addressing areas of weakness.[1] Its targets are ambitious. By enhancing the environment for digital entrepreneurship and reducing barriers to entry, **it aims to directly create over 50,000 digital jobs by 2025**.

Senegal is ranked 99th of 132 countries in the Global Innovation Index and fourth among the six reported regional economies.[7]

1 World Bank (2018) (Link)
2 Network Readiness Index 2022 (Link)
3 World Bank (2021) (Link)
4 United Nations E-Government Survey (Link)
5 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)
6 UNCTAD (2021), *via Statista's publication repository* (Link)
7 Global Innovation Index (Link)

Digital Foundations[1]

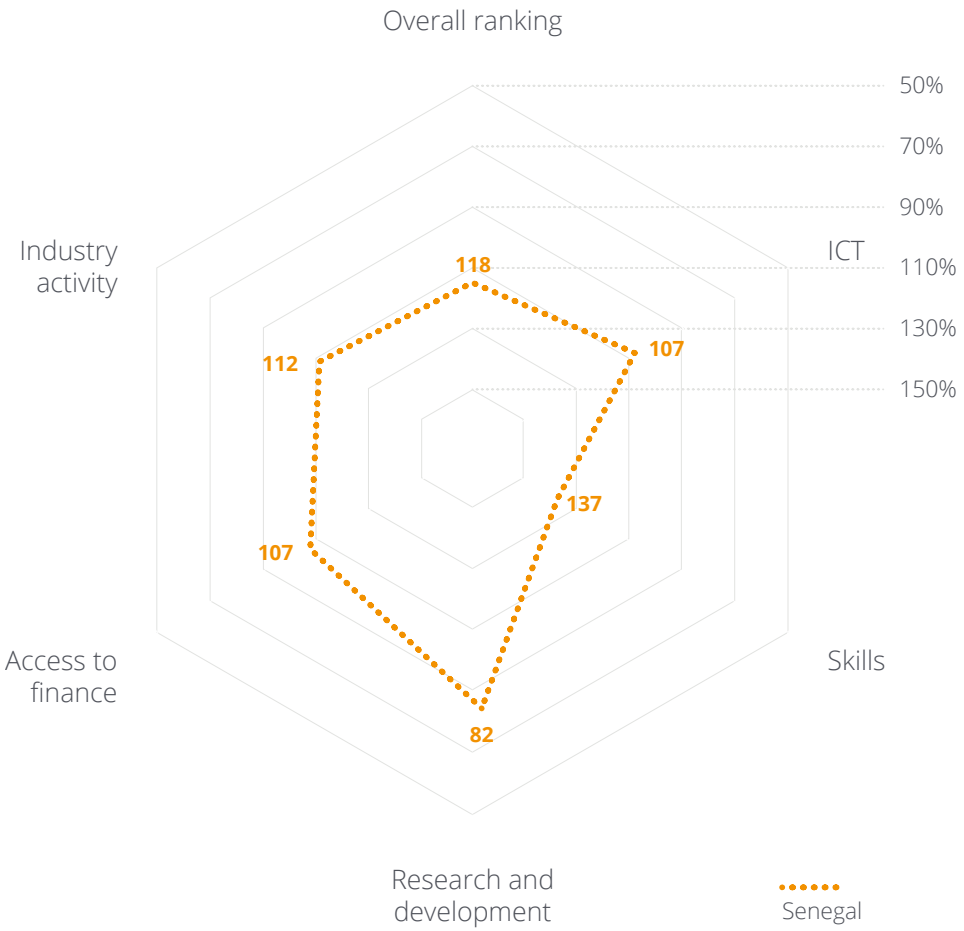


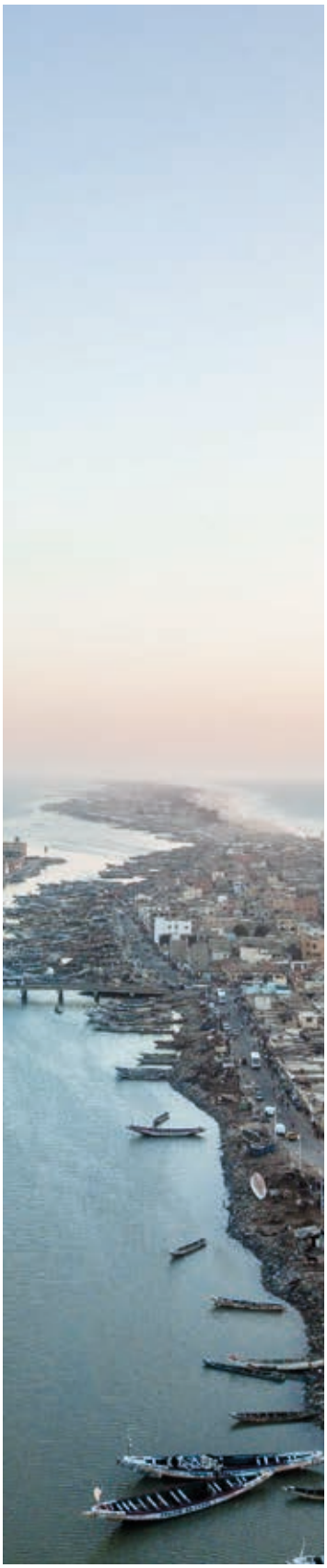
34.9 Mbit/s
International internet bandwidth per internet user (2021)

44.4/100
Mobile Connectivity Index (2021)

Ecosystem Support

UNCTAD Frontier Technology Readiness Index (2019)





1 GSMA's Mobile Connectivity Index (Link) and ITU's Digital Development Dashboard (Link)

South Africa

$6.9-$13.1bn

Estimates suggest that the potential economic impact of the meta-verse could reach $6.9-$13.1bn per year in South Africa by 2035.

South Africa's digital foundations and ecosystem support are among the strongest on the continent, with the most advanced telecommunications networks in the Sub-Saharan African region.[1] The continent's largest tech cluster, Silicon Cape, has created a community of developers, investors and venture capitalists operating on a non-profit basis to foster a sustainable tech and entrepreneurial ecosystem.[2] This could accelerate the development of localised metaverse use cases in the shorter term in South Africa and beyond.

South Africa's **digital connectivity has remained the most developed in the region in recent years**. It has led in the e-Government Index among the reported Sub-Saharan African countries since 2003 (52/100), with a score of 69/100 by 2020. In global terms, it fell 33 positions in the ranking (from 45th to 78th).[3]

South Africa has **near-universal 4G population coverage (99%)** and fairly advanced rollout of household internet access (63.3%). **It is one of the only Sub-Saharan African countries to have begun 5G rollout**. It ranks top among reported countries in the GSMA's Mobile Connectivity Index (64.5/100). The country is also **the strongest performer on the Global Innovation Index**, where it ranks 66th of 132 countries globally.[4]

South Africa's support for the ecosystem is the highest scoring across the six reported Sub-Saharan African countries.[5] The 2013 **"South Africa Connect"** national broadband policy has been lauded by the World Bank as a policy that has effectively targeted both the demand – and supply-sides of the telecoms infrastructure segment.[5]

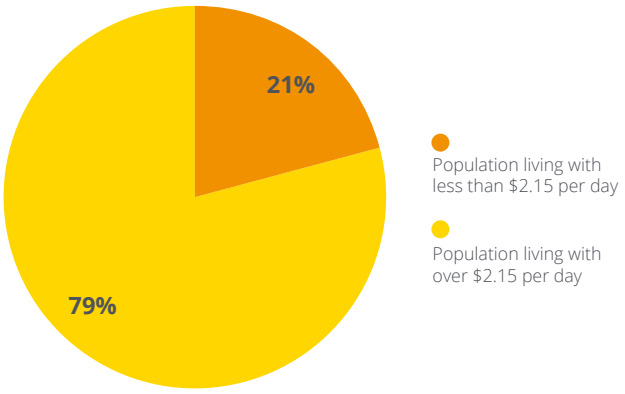
South Africa ranks first in all aspects of ecosystem support among the six reported countries.[6] Private funding is available to support investments, and R&D is consistently undertaken in the country.

Background

South Africa	
GDP ($, m)	$352,136
Population	60,041,996
GDP per Capita (PPP, $)	$13, 126
Median Age (2020)	27.3
Urban Population	67.8%
Gini Index (2014)	63.0
Global Innovation Index	33
ICT Sector (% of GDP) (2020)*	8%

** Business Wire (2021) (Link)*
Note that all data reported refer to 2021 unless otherwise specified.

Poverty levels (PPP, 2014)



111	**Active mobile-broadband subscriptions** (per 100 inhabitants – 2020)
69	**E-Government Index** (2020)
14.4k	**Secure Internet Servers** (per 1m inhabitants – 2020)

These outcomes suggest that the ecosystem could develop well in the short-term.

Widespread adoption of the metaverse, particularly in rural populations, will still rely on further advances in ecosystem support. **Digital skills are being targeted by the South African Government through its 2020 National Digital and Future Skills Strategy.**[7]

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3 United Nations E-Government Survey (Link)
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5 The Conversation (2020) (Link)
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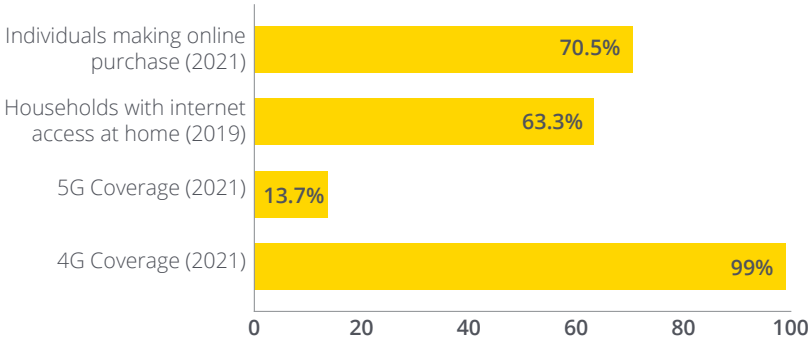
Digital Foundations[1]

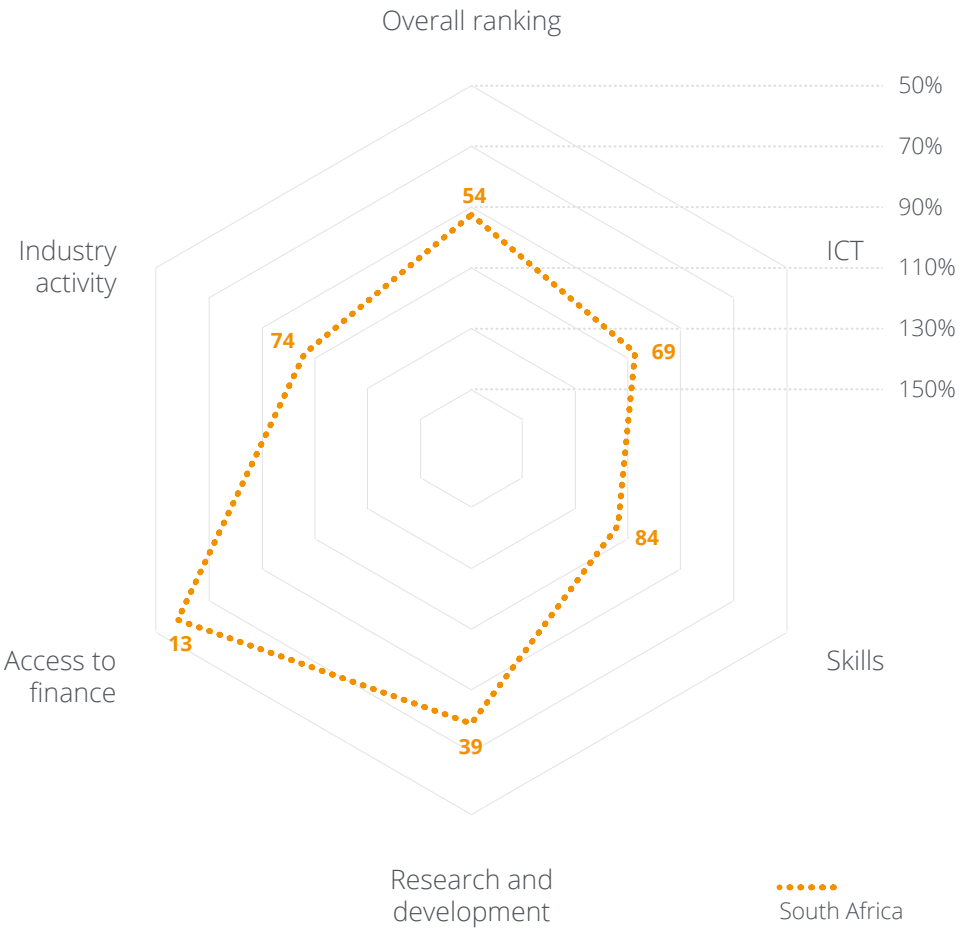


47.5 Mbit/s
International internet bandwidth per internet user (2021)

64.5/100
Mobile Connectivity Index (2021)

Ecosystem Support

UNCTAD Frontier Technology Readiness Index (2019)



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