State of Africa’s Infrastructure Report 2024

The Infrastructure Imperative: Igniting Africa’s Industrial Renaissance
Contents

Foreword 05
Taking the Pulse 07
Transport & Logistics 13
Energy 33
Digital Infrastructure 53
Industry & Manufacturing 71
References 91
The Infrastructure Imperative: Igniting Africa’s industrial Renaissance

State of Africa’s Infrastructure Report 2024

A Blueprint for Strategic Development and Economic Sovereignty
In line with our mandate to develop, de-risk and finance the infrastructure that will enable Africa’s industrialisation, the Africa Finance Corporation has initiated an annual study on the State of Africa’s Infrastructure. This deep-dive examination strengthens our appreciation of the continent’s infrastructure landscape, spotlighting critical gaps and offering new insights into the core sectors of power, transport, logistics, digital communications, and commodity-based value chains. Our findings not only quantify the magnitude of Africa’s infrastructure opportunities but also serve as a strategic guide for prioritising investments. These investments are crucial for driving the structural transformation of African economies, promoting sustainable growth, empowering our people across the continent, and finally putting Africa on a path to overcome the vicious cycle of boom-bust economies affected by volatility in global commodity prices.

Our report elucidates a stark reality: despite decades of achievement, the pace of Africa’s infrastructure development has not kept up with the growing needs of our population. Too much of our core infrastructure is centred around legacy redundant pit-to-port models. Such conclusions must spur us to reassess our approach and build infrastructure that will instead catalyse economic and structural transformation.

The urgency to act cannot be overstated and presents us with unparalleled opportunities. International economic shifts, including the restructuring of supply chains and transition to green energy, offer Africa a unique opportunity to redefine its role on the world stage. We possess the raw materials essential for renewable energy technologies and electrification, both critical to the global shift towards a less carbon-intensive future, as well as a resourceful youth ready to drive this change. For Africa to fully capitalise on this pivotal moment, we must act decisively and urgently to develop the infrastructure and value chains that will enable industrialisation. We have an unprecedented chance to develop resilient, climate-adaptive infrastructure from the ground up, while embracing greener development models, by matching Africa’s abundant mineral and renewable energy resources with resolving the continent’s current lack of serving infrastructure.

Foremost among multiple areas requiring priority attention is the vast disparity in energy access, which impedes Africa’s potential in industrial and manufacturing growth. Structural transformation will not happen unless we provide reliable and affordable energy to meet our industrial needs. For this reason, progress in this crucial area must no longer be measured simply by our ability to reduce the high levels of household energy poverty but also by our capacity to provide sustainable energy solutions that support industrial and economic development. Instead, the quantum potential from bridging Africa’s energy deficit in full is illustrated in this report by considering new metrics such as the Modern Energy Minimum, and by analysing the processing needs for commodities like bauxite and copper.

Taking Guinea as a case study, we observe that despite possessing the world’s largest bauxite reserves and being a top producer like Australia, Guinea struggles to fully capitalise on its resources. This is largely due to inadequate energy systems and a lack of processing facilities. In contrast, Australia, with similar bauxite volumes, extracts more than double the economic value thanks to its advanced refining and smelting capacities, supported by a robust natural gas-powered energy infrastructure. This disparity highlights the urgent need for West Africa to develop robust energy systems and processing infrastructure. By investing in cross-border electricity and gas networks and leveraging existing ECOWAS treaties, West Africa can build new industrial supply chains, accelerate industrialisation, and move beyond mere extraction of raw materials.

Africa’s transformation also requires better integration of its transport and logistics networks. Advancement in some key infrastructure areas reinforces our belief that, through deliberate and coordinated efforts, we can rapidly scale these successes. Considerable investments in port infrastructure, for instance, have not been adequately matched by enhancements in the connecting road and rail networks, suggesting a significant opportunity to expand and optimise marine transit logistics. Our research points to several opportunities to support trade corridors with new cross-border rail and road networks, and to expand cargo handling at airports. Substantial expansion and integration of our transport infrastructure would in turn reduce the disproportionately high transportation costs that currently inflate the price of goods by as much as 40%.
The potential for transformation extends beyond physical infrastructure. Africa’s true strength lies in its people—particularly our young population, the youngest of any continent. Our demographic dividend provides a formidable resource that, if harnessed through education, skills development, and health care investment, can propel our continent towards rapid industrialisation and economic self-sufficiency.

This is why, at the AFC, we are committed to a holistic and strategic development approach. We focus not just on bridging the physical infrastructure gaps but also on building ecosystems to support sustainable and inclusive growth. This means investing in projects that connect markets, boost regional trade, unlock private sector growth, and harness natural resources. These ecosystems are key to retaining and generating value on the continent, thus driving the structural transformation required to enhance Africa’s global standing.

To invoke this change, it is imperative that we adopt a new investment ethos—one that is smarter, more targeted, and impactful, using innovative financing mechanisms to attract investment. This involves adopting public-private partnerships and utilising developmental skills and experience to de-risk projects. At AFC, our mission is to leverage our expertise and resources to catalyse such partnerships, creating structures that deliver maximum impact. Our experience has shown that these collaborations can accelerate project delivery and spur the innovation needed to tackle complex challenges.

Notable examples of our approach’s effectiveness include the Henri-Konan-Bedie Toll Bridge in Côte d’Ivoire, the Red Sea Power Wind Farm in Djibouti, and our investment in Infinity Power and Lekela, which position us as the largest renewable energy investor in Africa. Furthermore, our development of the Gabon Special Economic Zone has given rise to ARISE Integrated Industrial Platforms (ARISE IIP). This entity now has operational assets in Gabon, Benin, and Togo, encompassing multiple value chains. Additionally, ARISE IIP is developing assets in seven countries: Chad, Republic of Congo, Côte D’Ivoire, Democratic Republic of Congo, Nigeria, Rwanda and Sierra Leone. Furthermore, we are significant investors in four operational ports located in Gabon, Côte d’Ivoire and Mauritania with an active pipeline under development.

As we present this report, we go beyond outlining challenges. Our determined objective is to inspire a unified, vigorous response to the monumental tasks ahead. Let us be driven not by the challenging nature of the infrastructure gaps but by the promising opportunities that our collective resolve can unlock for Instrumental Africa. Together, we can write a prosperous, innovative, and impactful new chapter in Africa’s story.

Samaila Zubairu
President, Africa Finance Corporation
Taking the Pulse
Four years after the Covid-19 pandemic, which marked Africa’s first recession in 25 years, the continent stands at a pivotal moment. The recovery remains sluggish and uneven, largely due to successive domestic and external shocks, hindering a return to Africa’s potential growth path. Over a longer period, the continent’s economic prospects, as measured by growth performance, have been on the decline, with most countries increasingly unable to surpass population growth rates in terms of economic expansion. In more than half of Africa’s economies, per capita incomes have either stagnated or declined over the past two decades, resulting in a deterioration of living standards for most of the continent’s population. While around 60% of African economies experienced a compound annual growth rate (CAGR) exceeding 5% from 2000 to 2011, the proportion dropped to 40% in the subsequent decade and plummeted to less than 10% in the post-Covid era.

Given this backdrop, Africa is in urgent need of new and innovative approaches to steer its economies back to potential growth. What can African countries learn from historical examples where countries achieved growth “takeoffs” or accelerations i.e., sustained periods of rapid economic expansion? These growth accelerations are crucial because they mark a transition from low growth to sustained high rates of economic expansion, leading to significant improvements in living standards, infrastructure quality and quantity, and overall economic development.

Targeted industrial policies, together with significantly scaling up of investments in infrastructure and education, while fostering a conducive business environment for the private sector, played pivotal roles in catalyzing the growth takeoffs of the “Asian Tigers”—Japan, South Korea, Taiwan, and Singapore—during the mid-20th century. These efforts propelled them from low-income to high-income status in a relatively short span of time. More recently, China’s economic rise since the late 20th century has leveraged the country’s labor force, whilst also investing in infrastructure and technology to pursue export-led growth. This strategy has lifted hundreds of millions of people out of poverty and put China on track to become the world’s largest economy.

Pre-Covid decline in Africa’s growth trajectory...

Africa: real GDP growth (%)

... and increasingly elusive high growth rates

Share of African countries (%)

The recovery remains sluggish and uneven, largely due to successive domestic and external shocks.
**Africa’s infrastructure stocks are barely growing**

Infrastructure development is crucial for Africa’s economic growth, but the public and private investments required to support it have largely been absent. Public and private investment flows are key inputs in developing a network of physical infrastructure assets over time, including economic infrastructure (ports, railways, roads, airports, etc.) and social infrastructure (schools, hospitals, etc.). Unfortunately, while a country’s capital stock\(^1\) has been shown to contribute towards higher productivity growth and living standards, Africa’s total capital stock\(^2\) has experienced a near stagnation over the past three decades. Its annual growth rate averaged between 1-2% in the 1990s and 2-4% since the start of the millennium, compared with a constant 10% in China over the same periods (see chart).

The real value of Africa’s accumulated capital stock did rise on a steady basis but remains severely low at only $10.5bn compared with almost $64bn in China in 2019. China’s total capital stock, which stood at 0.47 times below Africa’s in 1960, steadily climbed to surpass Africa’s by 1996-1997. Subsequently, it experienced a rapid surge in line with the country’s growth takeoff from the early 2000s. By 2018, China’s total capital stock had escalated to approximately 6.1 times the level in Africa.

**Africa’s capital stock accumulation has been stagnant over the past three decades...**

Average growth rates in the capital stock annual change, (%)

![Graph showing capital stock accumulation over time]

**Africa’s former lead in capital stock accumulation outpaced by China**

Total capital stock billions of constant 2017 international dollars

![Graph comparing China and Africa’s capital stock]

**...resulting in Africa falling behind other regions**

Total capital stock as a share of Africa’s capital stock

![Graph comparing capital stock share by region]

Source: IMF Investment and Capital Stock Dataset, 2021

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\(^1\) A country’s capital stock is its initial capital stock plus the annual increase in public and private investments less depreciation of the existing capital stock.

\(^2\) Total capital stock is defined as the total of public, private and PPP capital stocks as estimated by the IMF’s Investment and Capital Stock Dataset, 2021.
Public sector constraints

The surge in debt accumulation has raised debt-to-GDP ratios in Africa...

African governments are grappling with formidable challenges stemming from over-leveraged balance sheets and soaring debt repayment obligations. In recent years, many countries across the continent have significantly increased borrowing to fund infrastructure projects and fulfill budgetary needs stemming from successive crises.

This surge in debt accumulation has raised debt-to-GDP ratios, in some countries surpassing internationally recognised thresholds for sustainable debt levels. For instance, according to data from the IMF, the average debt-to-GDP ratio in sub-Saharan Africa surged from 23.2% in 2008 to 57.1% in 2022, and is expected to remain at that level until 2029. This is in turn raising the risks of debt distress, and making it harder and harder to finance much-needed infrastructure spending.

According to the World Bank’s Debt Sustainability Analysis, there were eight African countries in ‘debt distress’, or unable to fulfill their repayment requirements in 2023. A further 15 African countries were already at high risk of debt distress, with another 14 at moderate risk.

Compounding the fiscal challenges, compared to other regions of the world, Africa struggles with relatively low revenue mobilisation, exemplified by its lower tax-to-GDP ratio. While the average tax-to-GDP ratio in 2020 stood at 36.1% in advanced economies, 34.3% in European emerging markets, and 28.6% in Latin America, Africa lagged with an average tax-to-GDP ratio of only 15.6%.

This combination of rising debt levels and insufficient revenue mobilisation severely limits the fiscal space available to African governments for investment spending, particularly on critical infrastructure projects, thus impeding the continent’s economic growth and development prospects. This is why continental initiatives to support infrastructure development through the African Union and other multilaterals have become ever more critical.

Source: World Economic Outlook 2023, IMF

*2021 data used (2022 data not available).
Yet existing continental financing mechanisms remain underfunded. From 2012 to 2020, African Union (AU) Member States allocated c.$34bn to the Programme for Infrastructure Development in Africa (PIDA) Priority Action Plan 1 (PAP1), equivalent to just 0.2% of the region’s nominal GDP over the same period. PIDA, a continental framework rooted in African ownership principles, plays a pivotal role in coordinating infrastructure development efforts across Africa.

Despite AU Member States contributing 51% of the estimated financing requirement, PIDA relies on funding from International Cooperation Agencies (ICAs) and the private sector. However, private sector financing constituted only 3% of total investment, indicating PIDA’s untapped potential in attracting private investment. To address this, PIDA’s PAP2 Financing Strategy aims to enhance private sector participation by reducing risks, adjusting regulations, and building capacity for institutional investors.

Initiatives like the 5% Agenda, led by the African Union Development Agency (AUDA-NEPAD), seek to increase Sovereign Wealth Fund and Pension fund participation in African infrastructure financing. By unlocking African institutional savings and attracting international financiers, PIDA initiatives are crucial for accelerating Africa’s infrastructure development and fostering sustainable economic growth across the continent.

Africa’s growing private consumption drives infrastructure demand

On the back of a growing middle class and increasing household consumption expenditure, private consumption in Africa presents significant opportunities for infrastructure development. Over the past decade, private consumption expenditure in Africa has been steadily increasing, driven by factors such as population growth, urbanisation, and a burgeoning middle class. According to data from the African Development Bank, private consumption expenditure in Africa grew from $470 billion in 2010 to over $1.4 trillion in 2020, representing a substantial expansion. This surge in private consumption has created a growing demand for improved infrastructure, including transportation networks, energy systems, telecommunications, and water and sanitation facilities. Meeting this demand requires substantial investments in infrastructure projects, providing opportunities for both domestic and foreign investors.

Moreover, enhancing infrastructure can further stimulate economic growth by reducing transaction costs, improving connectivity, and facilitating trade and investment. Therefore, leveraging the rising private consumption in Africa presents a compelling opportunity to address the continent’s infrastructure deficit and foster sustainable development.

"By the end of 2020, private sector financing constituted only 3% of total investment under the Programme for Infrastructure Development in Africa (PIDA)."
The African ‘ports race’ that started in the mid-2000s has resulted in significant capacity additions at African ports. However, this expansion has not translated into more efficient and integrated logistics supply-chains across the continent.

While ports are monopolising private sector interest, the rest of the value-chain, notably roads and railways, remains under-funded, under-developed and fragmented. Poor road networks, inefficient railways, and limited airports capacity contribute to high logistics costs, hindering industrialisation and economic diversification efforts.

Despite increasing integration in certain regions, such as East and Southern Africa, cross-border connectivity remains constrained due to inadequate infrastructure and regional integration. DFI intervention can play a pivotal role in supporting the development of new cross-border transport systems that deviate from traditional Pit-to-Port models. This includes bolstering regional railway and road networks to unlock multi-industry growth and foster private sector-led development.

Given the constraints on public funding available, attracting private sector capital has become critical for expanding logistics infrastructure and improving cross-border connectivity. Private capital investment is crucial for enhancing regional corridors development, thereby facilitating efficient movement of goods, and promoting economic growth across Africa.
Africa’s trade and logistics sector faces a series of pressing challenges across roads, railways, airports, and seaports. While the ports sector has witnessed a formidable ‘ports race’ with cargo and containers handling capacity additions across African seaboards, the rest of the value-chain remains fragmented and under-developed. Road networks are limited with an uneven distribution and poor quality, especially in sub-Saharan Africa.

Railways struggle with underinvestment, low usage, and technological disparities, limiting their efficiency and connectivity. The aviation sector shows growth potential but grapples with high costs and safety concerns.

These segments also lack integration given little attention to multimodality and the development of logistics corridors. Upon arrival at African ports, logistics bottlenecks make the onward transportation of goods an inefficient, time-consuming, and expensive business.

As initiatives like the African Continental Free Trade Area (AfCFTA) and the Programme for Infrastructure Development in Africa (PIDA) seek to enhance cross-border trade, improved connectivity will be critical for Africa’s logistics sector to enable it to become a key driver of the continent’s trade, competitiveness, and economic growth.
1. Investment in ports projects with private sector participation was the highest in the world between 2010 and 2022, leading to significant cargo and containers handling capacity additions and the emergence of regional hubs.

1.1. Since the mid-2000s, Africa has witnessed a significant surge in what can be termed as a ‘Ports Race’, with foreign investors pouring billions of dollars into the modernisation and expansion of the continent’s ports.

Over the past decade, Africa’s maritime industry has experienced rapid growth. Between 2010 and 2022, investment in port projects with private sector participation was the highest in the world, totaling some $13 billion. This amount nearly doubled compared to the previous decade and stood approximately 1.8 times higher than the global average for the same period.

Investments have led to the emergence of new regional ports and mega-hubs such as Tanger Med in Morocco, which overtook South Africa’s Richards Bay in cargo volumes in 2021. These investments have also facilitated substantial growth in handled traffic, with total container throughput in Africa rising from 24.5 million TEUs to 35.8 million TEUs between 2011 and 2021. Remarkably, this growth closely aligns with the 10-year projections outlined by PIDA. Much of the expansion in ports has leveraged Africa’s demographic and economic growth, as well as the increasing consumption from a growing middle class to justify investments and expansion plans. In many cases, ports’ success stories in the segment are attributed to their strategic positioning as transshipment hubs within their sub-regions or as pivotal export/import hubs for the surrounding hinterland. In Gabon for instance, the construction of a general cargo port for exports was critical to the success of Arise IIP’s Gabon Special Economic Zone (GSEZ).

Consequently, these investments have led to the emergence of new hub ports equipped with extensive regional container and break-bulk facilities, serving either as vital supply bases for areas further afield (Mombasa, Abidjan, Durban) or as crucial transshipment hubs (Tanger-Med, Lomé, Tema) for transferring goods to smaller feeder ports.

<table>
<thead>
<tr>
<th>Investments in port projects continue to increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment in port projects, $mn</td>
</tr>
<tr>
<td>2002 - 2012</td>
</tr>
<tr>
<td>2012 - 2022</td>
</tr>
</tbody>
</table>

| Source: Private Participation in Infrastructure (PPI) Project Database, World Bank |

<table>
<thead>
<tr>
<th>Biggest ports investments over the past decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Dem. Rep. Congo</td>
</tr>
<tr>
<td>Nigeria</td>
</tr>
<tr>
<td>Senegal</td>
</tr>
<tr>
<td>Ghana</td>
</tr>
<tr>
<td>Nigeria</td>
</tr>
</tbody>
</table>

3 Tanger Med was ranked 4th best port globally (out of 345) in the 2022 World Bank Container Port Performance Index, with only two more African ports out of 64 making it to the global top 50, Port Said in Egypt, and Djibouti.

4 World Bank, UNCTAD, AFC Research.
Transshipment has provided a solution to a fragmented onshore continental trade network in need of logistics capacity. Limited logistics infrastructure such as roads or railways make moving goods from ports to ports a more attractive solution and has supported a rising demand for transshipment.

Logically, transshipment has risen the most in places where regional and cross-border terrestrial networks are limited, particularly in West Africa. Lomé, for example, witnessed rapid growth in traffic, from less than 8 million tonnes in 2012 to over 29 million tonnes in 2021, with container traffic nearly quintupling during the same period. Togo has now solidified its position as the leading transshipment hub for Africa’s Atlantic coast, with transshipment operations constituting 70% of its total traffic. Additionally, ports such as Abidjan, Tema, Dakar, Mombasa, and Djibouti have experienced growth driven by robust domestic economic performances and their connections to landlocked countries, of which Africa has the highest number globally.

The upward trend is expected to persist, with several new terminals already confirmed for development between 2022 and 2026. In 2022, both Abidjan TC2 in Côte d’Ivoire and Lekki LCT/Phase 1 in Nigeria were commissioned, followed by Tema T3 in Ghana in 2023. Looking ahead, the sector anticipates further expansion with the introduction of new terminals such as Cotonou BT/15 in Benin, Onne AMP1 in Nigeria, Kribi Container Terminal (KCT) Phase 2 in the Democratic Republic of Congo (Congo, DRC), Banana Phase 1 also in the DRC, and Luanda LMT in Angola. Once again, the bulk of these capacity additions appear concentrated along the Atlantic Coast, particularly in West Africa.

“Transshipment has provided a solution to a fragmented onshore continental trade network in need of logistics capacity.”
1.2. Ports investments present a lucrative opportunity to capitalise on Africa’s economic and demographic growth while minimising country risks.

Since colonial times, ports have held a distinct status among physical assets due to their role as strategic posts for controlling access to Africa’s vital natural resources, including minerals and oil. This historical trend persists today, with several terminals and port facilities developed to handle increased volumes of mining products and critical minerals exported to processing facilities overseas.

However, ports have evolved beyond their historical role; they now represent a profitable opportunity to gain access to Africa’s growing domestic markets while minimising exposure to individual country risks. With Africa’s population expected to grow from 1.4 billion to 2.4 billion by 2050 and boasting some of the world’s fastest-growing economies, particularly in West and East Africa, the combined forces of economic and demographic growth are fueling increased consumption and driving imports. As a result, African ports emerge as a highly attractive asset class poised for sustained growth in the foreseeable future.

Volume projections further bolster the case for African ports, given that their capacity still falls significantly below global benchmarks. In 2021, Africa’s maritime transport accounted for less than 7% of total goods loaded and 5% of total goods discharged globally. Regional comparisons underscore a substantial increase in investments in the foreseeable future.

In Southeast Asia for instance, where a growing middle class has fueled domestic consumption for decades, container ports represent some 168 TEUs per thousand capita. This stands in stark contrast to Africa, where estimates from the Africa Finance Corporation indicate only 25 TEUs per thousand capita. To achieve a similar level of container throughput capacity as the ASEAN community, African ports would need to increase their capacity over sixfold today, without even considering the future needs of its projected 2.4 billion people.

PIDA has set a more realistic target, expecting African ports to achieve a throughput of 2 billion tonnes of cargo and 176 million TEUs by 2040. However, even to handle that volume of containers, Africa would need to construct the equivalent of one Tanger-Med port every year for the next two decades.

Africa’s imports of cereals have soared to some 100m tonnes a year

<table>
<thead>
<tr>
<th>Year</th>
<th>Intra-African Imports</th>
<th>Overseas Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2011</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>2021</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: FAOSTAT

Africa’s imports of petroleum products have grown almost threefold in 20 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Petroleum Products</th>
<th>Crude Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>5,000</td>
<td>5,289</td>
</tr>
<tr>
<td>2011</td>
<td>5,350</td>
<td>5,859</td>
</tr>
<tr>
<td>2021</td>
<td>6,320</td>
<td>6,675</td>
</tr>
</tbody>
</table>

Source: OPEC

---

1.3. The segment shows no sign of losing momentum and appears to monopolise the appetite of a broad spectrum of international investors. Ports continue to attract a diverse array of investors from across the Americas, Europe, the Middle East, and Asia, including numerous regional and international development finance institutions (DFIs). In 2021, British Investment International (BII) and DP World launched an investment platform, committing an initial $1 billion to the ports of Dakar (Senegal), Sokhna (Egypt), and Berbera (Somaliland). Additionally, DP World is engaged in two of the largest greenfield port projects on the continent, Banana in the D.R. Congo and Ndayane in Senegal.

Many global logistics companies and shipping lines are equally seeking to expand their market share and presence on the continent through investments in upgrades and capacity expansion plans. Recent strategic concession agreements affirm this trend, including:

1. The signing of a Memorandum of Understanding (MoU) inked between Ibistek and Yilport Holdings of Turkey for the operation of Ghana’s Takoradi Port. Yilport Holdings also acquired a 35% stake from the AFC to the port’s concessionaire, Atlantic Terminal Services Limited (ATSL).

2. The selection of International Container Terminal Services, Inc. (ICTSI) of the Philippines by Transnet SOC Ltd of South Africa as the preferred bidder for a 25-year joint-venture to develop and operate the Durban Container Terminal Pier 2.

3. The issuance of qualification tenders by the Kenya Ports Authority for the development and operation of the Lamu Container Terminal (Berths 1-3), Lamu SEZ, and Mombasa Ports (Berths 11-14) and Mombasa Port Container Terminal 1.

4. Approval by Nigeria’s Federal Executive Council for the renovation and expansion of the Burutu Port in Delta state, the development of the Ondo Multi-Purpose Deep Seaport, and the creation of the Snake Island Terminal in Lagos, all structured as Public-Private Partnerships (PPPs).

5. The signing of a 30-year concession between DP World of Dubai and the Tanzania Ports Authority to operate the multi-purpose Dar es Salaam port.
2. Africa’s logistics infrastructure, including railways, roads, and airports, has not seen a corresponding level of development, resulting in a fragmented and under-developed network.

In contrast to the bustling activity witnessed in the ports sector, other segments of logistics such as railways, roads, and airports have struggled to attract investments and meaningfully interest the private sector. Consequently, project activity in these areas has remained relatively subdued, contributing to significant logistics bottlenecks throughout the continent.

**African ports are attracting the largest private sector participation globally but the rest of the logistics and transport value-chain fails to generate private sector investment.**

Investment in projects by sectors and by region, $m (2010-2022)

<table>
<thead>
<tr>
<th>Ports</th>
<th>Railways</th>
<th>Roads</th>
<th>Airports</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Asia &amp; Pacific</td>
<td>3.056</td>
<td>50,000</td>
<td>12,480</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>5,470</td>
<td>4,387</td>
<td>56,634</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>32,212</td>
<td>26,835</td>
<td>31,477</td>
</tr>
<tr>
<td>Middle East</td>
<td>1,185</td>
<td>0</td>
<td>10,067</td>
</tr>
<tr>
<td>South Asia</td>
<td>6,645</td>
<td>6,781</td>
<td>94</td>
</tr>
<tr>
<td>Africa</td>
<td>13,146</td>
<td>5,645*</td>
<td>1,242</td>
</tr>
</tbody>
</table>

Source: Private Participation in Infrastructure (PPI) Project Database, World Bank

* The Cairo Monorail Transit System in Egypt represents over 85% of the investment in railways

2.1. Despite its critical role in facilitating trade, Africa’s road network remains largely undeveloped, poorly maintained, and inadequate.

Roads play a critical role in Africa’s infrastructure landscape, facilitating 80% of the continent’s goods traffic and 90% of passenger traffic. Improving access to high-quality roads is imperative for driving economic and social development across urban and rural areas alike. Despite its vital importance to Africa’s economy and growth potential, the continent’s road network faces significant challenges, primarily uneven distribution across countries and communities, as well as poor quality.

According to research conducted by the African Development Bank (2023), Cross-Border Road Corridors: Expanding Market Access in Africa and Nurturing Continental Integration. Infrastructure and Urban Development Department, October 2023.

AFC, Africa’s total paved road network spans approximately 680,000 kilometres, which is six times smaller than that of India, a country with a similar population but only one-tenth the land area. Notably, the continent’s most developed economies, particularly South Africa and Algeria, account for a disproportionate share of the paved road network, comprising 40% of the entire network. This disparity in road infrastructure extends to Africa’s global standing, where despite occupying 20% of the world’s land mass, Africa’s paved road network accounts for just 1.5% of the global total.


7 Better road networks enable people and businesses to access social and economic services, and the UN 2030 Sustainable Development Goals (SDGs) include the percentage of the population with access to an all-weather road as a key proxy for equitable infrastructure development.
Although the picture changes slightly when considering road density, with island nations in eastern Africa emerging as leaders, sub-Saharan Africa’s road density still significantly lags behind other regions. With an average of almost 2.3 kilometers per 100 square kilometers, sub-Saharan Africa falls far behind Asia, where India averages 138 kilometers per 100 square kilometers and ASEAN countries average 29.5 kilometers per 100 square kilometers. Both quantity and quality metrics underscore the urgent need for strategic investment in African road infrastructure. The low levels of road density translate to an unequal distribution of paved networks between rural and urban communities. Rural areas are particularly underserved, with many existing roads being unpaved, hindering vehicle travel and impeding goods flows, thus limiting economic opportunities – especially for farmers.

According to the Africa Transport Policy Programme, high transport costs account for 40% of the final price of goods in Africa. Addressing historically high levels of inflation requires fundamentally improving road infrastructure and connectivity within and between regions.

Furthermore, the quality of road networks poses a significant challenge due to inadequate investment and maintenance. Although not unique to Africa, the consequences can be more severe on this continent, as underinvestment in roads can triple long-term maintenance costs, which African economies may struggle to meet.

### African roads’ length and quality vary greatly between North and sub-Saharan Africa

<table>
<thead>
<tr>
<th>Paved roads density is low and averages 2.3 kilometres per 100 square kilomtres km/100km²</th>
<th>The Mean Speed Score shows that roads quality is the highest in Northern and Southern Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>45 - 55</td>
</tr>
<tr>
<td>2 - 5</td>
<td>55 - 70</td>
</tr>
<tr>
<td>5 - 15</td>
<td>70 - 80</td>
</tr>
<tr>
<td>15 - 30</td>
<td>80 - 100</td>
</tr>
<tr>
<td>200+</td>
<td>NO DATA</td>
</tr>
</tbody>
</table>

Source: AFC Research based on latest data available for each country


### Map of African Roads

The boundaries, colours, denominations and other information shown on any map in this work do not imply any judgment on the part of the African Finance Corporation concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

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8 Calculated based on surfaced roads data provided by the Ministry of Road Transport and Highways.
9 Calculated based on data from ASEANStatsDataPortal.
10 Africa Transport Policy Programme (SSATP), World Bank and UNECA.
To assess road quality, the IMF recently introduced a novel measure based on the travel mean speed between major cities, using data from Google Maps. This metric provides a new perspective on road infrastructure and exposes access disparities worldwide. It illustrates the expected regional disparities, showcasing the higher quality networks in northern and southern Africa, contrasted with the low-quality roads in the western, central, and eastern regions.

Establishing a benchmark to gauge the actual gap in Africa’s road density and regional road networks poses a considerable challenge due to the continent’s vast land area, the largest in the world. For instance, ASEAN — the most integrated regional community in the developing world — has a paved road network density of 29.5 kilometers per 100 square kilometers and 1.91 kilometers per 1,000 people. However, ASEAN is almost seven times smaller than Africa and mainly comprises large islands with only one landlocked country.

Comparisons with India and China, which have similar populations to Africa but smaller land areas, are more insightful. To match the same level of road density as a proportion of the population in these Asian countries, Africa would need a paved road network 60 times larger than it currently has. Currently, Africa’s ambitions are focused on connecting its major economic and urban centres. The Priority Action Plan (PAP) of PIDA aims at achieving this by targeting approximately 30,700 kilometers of modern highways by 2040, of which 16,066 kilometers have been completed since the early 2010s.

Much of the focus is on finalising the Trans-African Highway Network designed to enhance the continent’s connectivity. Nevertheless, constrained public funding poses a risk to the development of most proposed projects. African governments burdened by high public debt levels are becoming less inclined to provide the viability gap funding (VGF) and sovereign guarantees required to initiate road projects.

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12 IMF (2022) developed an objective method to measure road network quality, using Google Maps data to calculate travel mean speeds between large cities in a country.

13 The significant distance between countries coupled with topographical obstacles such as mountain ranges, deserts and equatorial forests make comparisons with other regions of the world difficult.

Moreover, establishing public-private partnerships (PPPs) for road development, including toll roads, has proven challenging in Africa. Factors such as low population density along key connecting routes, transit risks, exchange and currency risks, and public resistance to toll fees have diminished the appeal of these ventures to private investors. This is evident in projects like the Lekki-Epe concession toll road in Nigeria, where the state government had to buy back the rights to the 30-year concession.

To attract the necessary capital for expanding Africa’s road network, existing PPP frameworks need to be reformed and innovative approaches to road development are imperative. Some of the continent’s most ambitious road projects, such as the $15.6 billion Abidjan-Lagos Highway, are designated as PPP initiatives and their progress depends on securing private sector involvement.

Fortunately, despite historical reliance on public sector funding with limited private sector engagement, African roads are beginning to undergo transformation. Notable successes demonstrate the potential for PPPs in the sector, as evidenced by projects such as the Henri-Konan-Bedie Toll Bridge in Côte d’Ivoire and the Dakar-Diamniadio Toll Highway in Senegal. Recent developments signal a growing commitment by African governments to reassess their PPP frameworks and promote greater private sector participation in road projects.

Key developments include plans by Kenya, Tanzania, and Uganda to implement toll charges on select expressways, with Kenya’s Annuity Programme showing early promise. Kenya has attracted prominent players such as Mota-Engil, VINCI Group, and Meridiam into PPP concession agreements with the Kenya National Highways Authority (KeNHA). In Nigeria, significant progress is being made in the road infrastructure sector, evidenced by nine highway concessions reaching commercial close in May 2023 under the Highways Development and Management Initiative (HDMI).

Recent developments within major African economies reflect a growing commitment by African governments to reassess their PPP frameworks for road projects.

### Investment in road projects are increasing but remain low compared to other regions

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment in road projects, $mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-2012</td>
<td>760</td>
</tr>
<tr>
<td>2012-2022</td>
<td>1,472</td>
</tr>
</tbody>
</table>

(No data for North Africa)

Source: Private Participation in Infrastructure (PPI) Project Database, World Bank
2.2. While plans have been on the table for years to move goods and people from roads to railways, Africa’s railway network remains sparse and fragmented.

Historically, the development of Africa’s railroad infrastructure was closely intertwined with colonial industrial and logistical policies, following a traditional Pit-to-Port model. Initially, rail enjoyed almost no competition from other modes of transportation before roads became a more attractive and modern alternative. Today, roads dominate passenger and trade traffic while the railway sector grapples with a host of interconnected challenges: inadequate investment, low usage levels, and incompatible technology.

Research conducted by the AFC shows that Africa’s railway network remains relatively small, spanning approximately 87,000 kilometers across a continental surface area of over 29 million square kilometres. To put this into perspective, India covers only 11% of Africa’s surface area but boasts a rail network equivalent to about 75% of Africa’s. The existing rail capacity is predominantly concentrated in the northern and southern regions, mirroring the distribution of other infrastructure assets. Notably, thirteen sub-Saharan countries have no operational rail network, with half of them being landlocked.

Moreover, the quality of the network has deteriorated due to insufficient maintenance, with some lines exceeding a century in age, rendering them uncompetitive against modern highways developed to link key economic corridors. Several lines such as the Dakar-Bamako axis, are currently inactive, while other national networks such as those in Ghana, Uganda, and Togo, suffer from under-performance due to neglect and lack of rehabilitation.

Africa’s rail network density remains low

Density in km/’000km²

<table>
<thead>
<tr>
<th>Density in km/’000km²</th>
<th>0 - 5</th>
<th>5 - 10</th>
<th>10 - 15</th>
<th>15 - 20</th>
<th>NO RAILWAY</th>
</tr>
</thead>
</table>

Density in km/million population


15 Estimates based on data from India’s Ministry of Railways.
African railways face a myriad of challenges, including neglect, underfunding, and declining traffic, which perpetuates a negative cycle of underinvestment.

The dearth of passengers and freight depletes the network of cash, leading to further deterioration of services and diminishing attractiveness to businesses and passengers alike. For instance, in Ghana, the rail network transported approximately two million tons of cocoa, timber, bauxite, manganese and other minerals in the late 1960s. However, by 2018, only roughly 750,000 tons of manganese freight were transported by rail. Similarly, the Senegal-Mali railway, which once transported 1.5 million tons of freight at its peak, ceased operations entirely in 2018 following floods.

Among the busiest networks in Africa, alongside South Africa and eSwatini, are Mauritania, Gabon, and Mozambique. However, most of these networks average less than 500,000 traffic units per kilometer of route, a measure of network density. In contrast, European railway systems typically average 2 to 5 million traffic units, with densities below 1 million found only in countries like Albania and Montenegro.

Different systems across the continent utilise a variety of track gauges, with northern, eastern, and certain parts of West Africa predominantly utilising old meter gauge and new standard gauge railways (SGR), while southern Africa primarily relies on Cape gauge networks. This diversity in track gauges further complicates the movement of goods across different regional networks. Due to the variation in gauges, technical standards, axle loads and specifications of African railway networks, the development of interconnected and interoperable railway systems poses significant challenges. While regional integration efforts have commenced in southern and eastern Africa through the construction of new rail lines and the extension of existing tracks, rail integration in the west is largely absent. Achieving connectivity in this region would depend on initiatives such as the reopening of the Dakar-Bamako line and the extension of the Togo line and the Abidjan-Ouagadougou line to create a ring through Niger.

The railway sector’s ambitions are limited by a lack of funding

Plans for expanding and enhancing the rail network under PIDA PAP 1 have yielded limited success thus far. Out of the proposed 30,200 kilometers of new routes, only 4,000 kilometers have been constructed. This target includes 40% of new routes alongside a program to modernize existing networks. While notable successes such as the completion of the 768-kilometer Djibouti-Addis Ababa standard gauge railway (SGR) in 2018 and the 700-kilometer Mombasa-Naivasha SGR between 2017 and 2019 exist, these examples are exceptions. Insufficient funding has already hindered the extension of Kenya’s SGR to Uganda and slowed the progress of Tanzania’s planned SGR network, which aims to connect Lake Victoria, Rwanda, and Burundi.

This shortfall is concerning given the substantial investment requirements of the sector. To achieve the railway network density observed in countries like China or India, Africa would need to expand its network by at least four times. Based on the cost of recently constructed lines on the continent, this could amount to between $65 to $106 billion annually until 2050, solely to bridge the railway infrastructure gap. In comparison, private investment in railway infrastructure has remained relatively low, hovering around the $5-6 billion range during both the 2002-2012 and 2012-2022 periods, according to World Bank data. This level of investment is notably inadequate, particularly considering that two major projects have significantly influenced this investment landscape.

Securing private sector funding for railway developments across the African continent has proven to be a challenging endeavor. Recent projects that have progressed and attracted capital continue to rely on a traditional Pit-to-Port model, exemplified by initiatives such as the Transguinean Railways in Guinea or the Pepel-Tonkolili Railway and Pepel Port in Sierra Leone. While these projects contribute to the growth of African economies by boosting export revenues, they often direct private sector interest toward single-purpose lines rather than investments in cross-border ventures that could better foster inclusive domestic and regional growth.

One exception is the Lobito Corridor connecting the Congo DRC, Zambia, and Angola. Here, the Africa Finance Corporation, as the lead developer of the Zambia-Lobito component, aims to construct an economic corridor connecting three important countries, thereby facilitating the development of the critical mineral sector, while also enhancing trade, tourism, and economic ties. G7 and African partners are also investing catalytic public funds in various sectors along the corridor to transcend the traditional Pit-to-Port model, underscoring the significance of constructing a much-needed cross-border railway network with multiple positive economic benefits for the region.

In June 2023, the World Bank also approved the $300m Accelerated Economic Diversification and Job Creation Project to increase private investment and climate-resilient growth of MSMEs, particularly along the corridor. This highlights the crucial role that multilateral development finance institutions (DFIs) must play in enhancing connectivity across the continent. Given limited capacity within individual countries, regional transportation projects of this magnitude and scope can typically only be realised through multilateral efforts that can pool the capabilities and financing required to turn these cross-border ambitions into reality.

To achieve the railway network density observed in countries like China or India, Africa would need to expand its network by at least four times.

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19 Private Participation in Infrastructure (PPI) Project Database, World Bank.

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State of Africa’s Infrastructure Report 2024: Transport & Logistics

Investment in railway projects are low and dominated by large single transactions

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment in railway projects, $mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-2012</td>
<td>5,093</td>
</tr>
<tr>
<td>2012-2022</td>
<td>6,061</td>
</tr>
</tbody>
</table>

Source: Private Participation in Infrastructure (PPI) Project Database, World Bank
2.3. Africa’s airport infrastructure has witnessed continued expansion in recent years; however, it still falls short of global performance standards and handles only a modest volume of freight.

While Africa’s aviation sector has witnessed significant growth over the past two decades, it remains comparatively small on a global scale and faces notable challenges, most importantly a poor safety record and inadequate infrastructure. Between 2001 and 2015, the overall air transport capacity in sub-Saharan Africa saw a notable increase from an estimated 47 million seats to 105 million, boasting an average annual growth rate of nearly 6%\textsuperscript{20}. However, Africa’s share of global air transport measured by the number of kilometers travelled by paying passengers, remains the smallest in the world and is projected to continue this trend in the foreseeable future\textsuperscript{21}.

This disparity extends to commercial air freight, which serves as a crucial economic artery for landlocked countries within the continent’s interior and for transporting perishable goods. Despite witnessing robust growth over the past decade, from 2.2 million tons per kilometer in 2012 to 4.2 million tons per kilometer in 2021, Africa’s air freight levels still lag significantly behind those of the Middle East (34 million tons per kilometer) and Asia (65 million tons per kilometer)\textsuperscript{22}.

Moreover, the establishment of air cargo hubs has been limited to specific regions where economies exhibit greater diversification, such as Egypt, South Africa and Kenya. This underscores the pressing need for further investment in cargo handling and storage infrastructure to bolster economic diversification efforts and the ongoing shift towards greater value addition to raw materials.

Several factors hinder investments and growth in the African aviation sector. The relatively high cost of air travel, stemming from low passenger volumes, coupled with stringent air space regulations and elevated passenger and airport taxes, present significant challenges. However, the overriding concern for the industry is safety, exacerbated by subpar infrastructure quality and operational standards in air traffic control and ground communications\textsuperscript{23}.

Consequently, the aviation sector in Africa has witnessed limited private sector investment in recent years, with investment levels even declining from 2002-2012 to 2012-2022.

### Investment in airport projects have decreased and remain low compared to other regions

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment in airport projects, $mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 - 2012</td>
<td>2,209</td>
</tr>
<tr>
<td>2012 - 2022</td>
<td>1,176</td>
</tr>
</tbody>
</table>

Source: Private Participation in Infrastructure (PPI) Project Database, World Bank

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\textsuperscript{22} World Bank DataBank.

\textsuperscript{23} AfDB, Tracking Africa’s Progress in Figures (p.52).
Given sector projections, it is imperative to reverse this trend and promote airport concessions and privatisation to attract capital and expand facilities. Africa is projected to see significant growth in air traffic activity in the coming decade, placing strain on its airport infrastructure. The Asian example has demonstrated how free trade agreements coupled with the expansion of the middle class and liberalised visa requirements can lead to significant growth and demand for intra-regional air travel, particularly in regions where alternative modes of transport are not available.

The African context of today is very similar to that of Asia twenty years ago and points to growing demand for air travel over the coming decades, especially if the African Union’s project for a Single African Air Transport Market is put in place.

According to the International Civil Aviation Organisation, passenger and freight traffic in Africa is expected to increase annually by 4.3% and 3.9% respectively until 2045 – higher than the world average. But to cope with traffic growth, Africa has only two large airports that currently handle more than 10m passengers a year – Cairo and Johannesburg – and no mega airport, defined as airports that handle 33m passengers or more. In comparison, Asia has about 30 mega airports, including three in India alone – which has a similar population to Africa.

Higher volumes of cargo and numbers of passengers should improve the economics of the system, making it more attractive to potential investors and injecting revenue to finance much-needed improvements in telecommunication equipment, air cargo warehousing, and meteorology facilities among others.

In response, several African countries are actively investing in upgrading airports to enhance their capacity, facilities, and compliance with international standards. Notable projects include the construction of new airports in East Africa, such as Uganda’s Kabaale International Airport in Hoima and Rwanda’s Bugesera International Airport. The latter operates under a 25-year concession agreement involving Mota-Engil and Aviation Travel and Logistics Holdings Ltd. Additionally, Angola opened the new Dr. António Agostinho Neto International Airport (AIAAN) in Luanda at the end of 2023, a $3 billion project funded by the government but managed under concession to the private sector.

Several other countries are exploring airport privatisation efforts to modernise and expand existing facilities. Nigeria is actively pursuing airport privatisation for its major hubs in Lagos, Abuja, Kano, and Port Harcourt, while Kenya has expressed intentions to construct a state-of-the-art passenger terminal at Nairobi Jomo Kenyatta International Airport (JKIA) through a Public-Private Partnership (PPP) framework. VINCI Airports achieved financial close in 2023 on a 40-year concession with the government of Cabo Verde, covering the operation of seven airports. This significant development in Cabo Verde holds promise as a potential model for broader airport privatisation across Africa.

Africa’s projected annual growth of air traffic to 2045 overperforms the global average

<table>
<thead>
<tr>
<th></th>
<th>Passenger traffic growth, %</th>
<th>Freight traffic growth, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>4.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Africa</td>
<td>4.3</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Source: ICAO

24 “Airport infrastructure in Asia: Coping with the demand surge”, PwC, Edward Clayton.
3.

Multimodality and regionalisation can help make logistics cheaper, faster, and more efficient.

Insufficient investment in logistics infrastructure is causing bottlenecks throughout the continent, resulting in costly, time-consuming, and inefficient trade processes. In addition to expanding the capacity of ports, roads, railways, and airports, advancing the development of African infrastructure requires the implementation of enhanced multimodal and integrated solutions capable of facilitating cross-border trade and regional integration. The overarching strategy to accomplish this objective is outlined in the plan to develop the African Regional Transport Infrastructure Network (ARTIN), which is projected to deliver $172 billion in value by improving and unlocking trade routes. Its success will be pivotal to the roll out of the African Continental Free Trade Area (AfCFTA), uniting 55 African Union (AU) member states and eight Regional Economic Communities (RECs) under the common objective of establishing a unified continental market. Thus, well-integrated infrastructure is now indispensable to the success of this initiative.

3.1. Addressing Africa’s lagging Logistics Performance.

Africa suffers from the most challenging logistics environment globally, hindering efficient and cost-effective trade facilitation across the continent. According to the 2023 World Bank Logistics Performance Index, African economies ranked lower than their global peers, with only slightly over 10% of the 139 countries assessed placing in the top half of the index. Notably, South Africa, Botswana and Egypt were the only countries to perform above the global average.

In fact, sub-Saharan Africa exhibited the least progress of any region in the Logistics Performance Index between 2012 and 2022. Despite the substantial investments in ports highlighted earlier, the movement of goods within the continent has not notably improved. Africa’s poor logistics performance is primarily attributed to slow clearance times for cargo at ports, inadequate interconnectivity with other infrastructure networks such as rail and road, and insufficient levels of automation.

This fragmented value-chain and lack of integration with national and regional networks result in inefficiencies at all levels, ultimately affecting the process through which consumers pay for goods. According to a 2021 survey by the Shippers Council of East Africa (SCEA), transporters utilising the Northern Corridor, serving Kenya, Uganda, Rwanda, Burundi, Congo DRC, and South Sudan to and from Mombasa, incur an estimated cost of $1.8 per kilometer per container, nearly double the international norm of $1 per kilometer per container.

Seaports in Africa face congestion and higher handling costs, which require addressing through digitalisation and the acquisition of modern equipment. Processing times and handling costs are notably higher in African ports, averaging 50% higher than other regions. Moreover, many African ports are either at or nearing their capacity limits, with traffic growth projections expected to further strain turnaround efficiency.

AFDB, Tracking Africa’s Progress in Figures (p.53).
Costly congestion-related delays at major ports like Lagos, Mombasa, Dar es Salaam, Dakar, Cape Town, and Algiers underscore the lack of connectivity between current port infrastructure and national/regional hinterlands. Integrated investments in developing hinterland logistics via roads, railways, and airports are essential to unlock additional efficiency from ports and expand functioning trade corridors, ultimately reducing transportation costs and schedules.

For example, the new Djibouti/Addis Ababa railway significantly reduced travel time from the port of Djibouti to the Ethiopian capital, from three days to just 10-12 hours. Similarly, the new Mombasa/Nairobi railway has notably decreased travel time between both Kenyan cities, facilitating better logistics with the rest of the region, particularly Uganda.

The structure of African trade also contributes to inefficiencies, with trade flows heavily focused on either imports or exports, resulting in empty return journeys for railways or lorries. This situation compels operators to charge higher rates or wait for a sufficient amount of goods to justify the return journey, further exacerbating logistical challenges.

"Transporters utilising the Northern Corridor in East Africa incur an estimated cost of $1.8 per kilometre per container, nearly double the international norm."
3.2. Enhancing regional integration requires improvements in logistics quality and border facilitation.

If the example set by ASEAN countries is anything to go by, developing efficient intra-regional value-chains in Africa will require efforts to improve the quality of logistics from existing assets while enhancing border facilitation and providing institutional support to intra-African trade. This imperative is particularly significant in a continent that has the highest number of landlocked countries globally and relies on road transport for logistics.

Until now, efforts to improve logistics quality have largely been led by the private sector, especially by entities such as ports operators, shipping lines and logistics companies. Throughout Africa, the proliferation of dry ports and inland container depots (ICDs) has been notable, especially in regions where logistics infrastructure is fragmented and dispersed over long distances. Africa Global Logistics, for instance, operates over 30 dry ports in West Africa alone, marking its substantial presence on the continent. But while private investment in inland logistics infrastructure is crucial and advantageous, its scope remains limited without significant intervention from the public sector to support logistics corridors. Numerous studies on trade and logistics in Africa underscore that the existing processes and procedures, from ports to border checkpoints, are overly burdensome and hinder the development of efficient trade corridors.

In recent years, one-stop border posts (OSBPs) have emerged as a solution to address these challenges by integrating hard infrastructure assets with trade policies, thereby facilitating smoother cross-border logistics operations. The Chirundu OSBP between Zambia and Zimbabwe was the first one to be commissioned on the continent in 2009. Since then, 17 OSBPs have been opened in East Africa, eight in West Africa, and three in Southern Africa. In total, 120 are currently in planning or implementation stage. In almost all cases, OSBPs have led to significant reductions in transport costs and dwelling times. This is especially the case in East Africa, the region that has both the highest number of operational and planned OSBPs and the highest level of intra-African trade. There, transport costs reductions linked to OSBPs have ranged from 62% to 87%.

26 Single land border crossing facility that combines all procedures required for exit and entry formalities into a country.
28 “One-stop border posts in East Africa: impact on transport costs and issues for further analysis”, Research reports, Overseas Development Institute, July 2023.
As Africa embarks on implementing the world’s largest free trade area, its transport and logistics sector grapples with capacity constraints and a lack of regional coordination, particularly in North, West and Central Africa.

Amidst mounting debt obligations and limited fiscal space, African nations are urged to embrace public-private partnership (PPP) models to amplify their trade and logistics infrastructure, thereby fostering increased private sector participation in critical areas such as roads, railways, dry ports, and airports.

Addressing persistent challenges along the supply-chain is imperative, including congested and inefficient ports, fragmented and unprofitable railway systems, poor road networks (especially for last mile connectivity to farmers), and lack of cargo handling capacity at airports. In doing so, offering multimodality and connectivity between all modes of transport will ensure that logistics becomes faster, cheaper, and more efficient but increasingly calls for better regional planning and integration to attract capital into the development of value-creating and productive regional corridors.
• Africa’s energy mix is dominated by wood fuel and charcoal for domestic use, both of which are traditional and polluting sources of energy. Additionally, transportation predominantly relies on imported petroleum products. Except for North Africa, the continent’s electricity infrastructure remains underdeveloped and unreliable, hindering development and industrialisation efforts across much of sub-Saharan Africa. The consequences for Africa are dire: despite being home to 18.5% of the world’s population, it only contributes to less than 6% of global energy consumption.

• Despite an increase of over 66 GW in power generation capacity connected to the grid between 2012 and 2022, Africa still faces a significant shortfall in meeting its energy needs. Remarkably, even with this capacity addition, Africa’s current power generation capacity still stands at the same level as that of Germany, a country with a population of only 84.5 million.

• The level of investments into electricity generation has not matched Africa’s potential. Africa has tapped into only a fraction of its renewable energy resources, utilising just 1% of its solar energy potential, 5% of its gas-to-power potential, 6% of its geothermal energy potential, 7% of its wind energy potential, and 11% of its hydropower potential. Lower income African economies suffer the largest energy deficit, exacerbating their increased vulnerability to climate change. Limited funding and capacity further hinder these economies from competing for global capital, resulting in most energy investments being concentrated in the more developed economies of Morocco, Egypt, and South Africa. These three countries accounted for half of all renewable energy capacity additions between 2012 and 2022.

• The lack of public funding and limited private sector interest in transmission and distribution projects are exacerbating grid constraints in both efficiency and capacity. Existing grid networks suffer from losses that hinder the utilisation and evacuation of electricity from existing power plants. Additionally, the lack of grid capacity constrains investments in new electricity generation capacity. This dual challenge underscores the urgent need for collaborative efforts between public and private sectors to tackle grid infrastructure deficiencies, which are crucial for overcoming Africa’s energy deficit.

• The sector presents opportunities for Development Finance Institutions (DFIs) to intervene in the transmission and distribution sector, thereby making it more bankable and attractive to private sector capital. Additionally, there are opportunities for DFIs to invest in brownfield generation projects within existing plants. Relevant initiatives would include the modernisation of African dams to enhance climate-resilience, the conversion of the thermal fleet (coal, diesel, HFO) to gas to support decarbonisation, and the upgrading of outdated refineries to ensure a cleaner fuel supply.
Africa continues to grapple with the world’s most significant energy deficit, struggling to combat energy poverty with mixed success so far. Wide disparities in capital allocation, project execution and supply growth persist between countries and regions, with investments and capacity additions largely failing to address Africa’s growing energy needs. As a result, gains in energy access are barely able to keep up with demographic and economic growth. African homes are largely dependent on traditional and polluting sources of energy for cooking and heating while electricity supply for industry remains unreliable and costly.

Against that backdrop, investment flows are uneven and insufficient. International capital is focused on clean energy projects in more developed markets where baseload is already available and public funding has supported grid expansion to enable the integration of intermittent sources of energy. Conversely, energy provision in many African regions remains costly, environmentally harmful, and unreliable, with much of the generation infrastructure requiring modernisation, upgrades, or reconversion. Privatisation and decentralisation are becoming critical to attract much needed private sector investments into the sector, particularly in transmission and distribution to address persistent losses and build additional grid capacity.
1. Africa has the world’s largest energy deficit, and its economies largely rely on expensive, inefficient, and polluting sources of energy.

While Africa is home to 18% of the world’s population, it accounts for less than 6% of global energy use. Measured against the other continents, it consumes the least, both in total and per capita, and is the most energy poor. Its energy deficit affects hundreds of millions, hampers development, and keeps industrialisation rates low because electricity is expensive and unreliable across most of sub-Saharan Africa.

1.1. Primary energy consumption is the lowest in the world, both in total and per capita, and energy supply is growing too slowly to keep up with demographic growth.

Primary energy consumption was only 14.2 gigajoules per capita in 2022, four times lower than in developing markets in South and Central America, and almost five times lower than in the Asia-Pacific region.

In the absence of electricity, most African households consume waste and biomass energy sources such as firewood, charcoal, and agricultural residues – which make up most of all energy consumed on the continent. Left with refineries that are old, small and often uneconomical, the continent also supplies its transport sector with expensive and imported petroleum products. Last but not least, electricity infrastructure is plagued by inefficiencies and power losses, leaving industries to suffer from unreliable and expensive electricity supply.

This scenario contrasts severely with the potential of the continent to access and generate modern and sustainable energy by tapping into its vast solar and hydraulic potential and its abundance of natural gas. For instance, Africa has 60% of the world’s best solar resources but only 1% of solar generation capacity. Natural gas reserves in sub-Saharan Africa could also easily support 400 GW of power generation capacity – while replacing dirty and polluting diesel, coal and HFO – yet installed capacity in the subregion stands barely above 20 GW.

Overall, Africa’s growth in electricity generation capacity has averaged more than 2% a year over the 2012-2022 period, below the world average of 2.5%. Meanwhile, demographic growth has averaged 2.42% per year over the past 30 years, meaning gains in incremental energy generation are barely able to keep up with population growth. As a result, the energy deficit persists, and more than half of people on the continent live without reliable access to electricity.

Africa has underutilised its potential to access and produce modern energy

Comparison of Africa’s power potential and installed capacity by modern energy sources, in GW

| Source: AfDB, Power Africa, IRENA, AFC Research |

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29 IEA (2022), Africa Energy Outlook 2022, IEA, Paris, Licence: CC BY 4.0
30 IEA (2022), Africa Energy Outlook 2022, IEA, Paris, Licence: CC BY 4.0
31 Statistical Review of World Energy 2023, Energy Institute
Some progress has been made, but at the current rate none of the 2030 targets of ensuring access to affordable, reliable, sustainable, and modern energy for all will be met. The latest Energy Progress Report of the World Bank, the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations (UN), and the World Health Organisation (WHO) notes that to reach universal access globally by 2030, annual growth in electrification needs to grow by 1 percentage point per year from 2021 onward, instead of the 0.6 percentage point growth achieved between 2019 and 2021. If efforts don’t improve, 660 million people—560 million in Sub-Saharan Africa—will still not have access in 2030.

Global energy poverty largely affects low and lower-middle income African countries

Share and absolute size of population without access to electricity in the top 20 access-deficit countries in 2021

1.2. The energy deficit does not affect just electricity and is uneven across regions.

While energy poverty remains mostly unchanged across the continent, in Central Africa it continues to grow. Between 2010 and 2021, the number of people there without access to electricity grew by 26 million. The largest access deficit in that region is currently in the Democratic Republic of the Congo, where 76 million people live in the dark. In West Africa, 86 million people in Nigeria are without access to electricity – making the West African nation the country with the world’s largest absolute electricity access deficit.

Beyond electricity, access to modern and reliable energy is even more scarce. Nowhere is this more evident than in clean cooking, with 64% of Africans currently relying on dirty cooking fuels. As a result, almost one billion people use gathered wood, biomass, and agricultural and animal waste as cooking fuel and are impacted by their devastating impact on public health. Sub-Saharan Africa represented only 25% of the global access-deficit in clean cooking in 2010, but now represents 41% - the world’s largest share. Access is shrinking and the rate of those using dirty fuels is increasing by nearly 20 million people per year as populations grow but access rates do not.

If nothing is done to provide cleaner cooking alternatives, 1.67 billion Africans will be using wood and charcoal for cooking by 2050 according to the United Nations Framework Convention on Climate Change (UNFCCC).

The number of Africans without access to electricity decreases very slowly and continues to grow in Central Africa

Number of people in sub-Saharan Africa without access to electricity, in millions

<table>
<thead>
<tr>
<th>Region</th>
<th>2010</th>
<th>2019</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Africa</td>
<td>566</td>
<td>575</td>
<td>567</td>
</tr>
<tr>
<td>Eastern Africa</td>
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<tr>
<td>Central Africa</td>
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<td>190</td>
<td>186</td>
</tr>
<tr>
<td>Western Africa</td>
<td>101</td>
<td>123</td>
<td>127</td>
</tr>
</tbody>
</table>


An accelerated transition to LPG can maximise the use of African resources to provide modern and cleaner energy to households while offering a scalable solution to reduce pressure on forests.

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Until solutions are found and funded, reliance on wood fuel and charcoal will continue to exceed that of any other region globally and be a significant cause of deforestation in Africa. In a recent positioning paper on carbon markets released at COP28, the AFC notably advocated for an accelerated transition to liquefied petroleum gas (LPG) as a scalable solution to reduce pressure on forests.

In Brazil, where government subsidies cover 90% of LPG costs and distribution, nearly 95% of the population switched from firewood, charcoal, and kerosene to LPG for cooking between 1960 and 1980. While the direct impact on deforestation has not been quantified, it is estimated that a single household moving from woodfuel to LPG can save about 100 m2 of forest each year. In Brazil’s context, with over 95% of the population now using LPG or cleaner fuels, that would equate to savings of around 0.73 million hectares of forest annually, or nearly a quarter of Brazil’s current annual rate of deforestation.

Given the ecological and development benefits of LPG as a cleaner and scalable alternative to woodfuel and charcoal, it is now incumbent on Africa’s policymakers and institutions to advocate for adoption of LPG as a cleaner transition fuel, and expedite their own efforts given the high entry costs for the private sector. This is particularly the case in African countries where targeted financing can grow domestic and regional champions with potential to scale.
2.

Investments in hard energy infrastructure have been concentrated within a few countries only and largely reserved for clean energy projects.

Africa is the destination for around just 3% of global energy investments and only 2% of global spending on clean energy. Such low levels of investment explain the slow pace of energy supply addition over the past few years but also mask significant disparity in where global capital is directed.

2.1. Capital allocation and investments in energy are concentrated within a few countries only.

Investments in energy have been concentrated within higher income countries where public funding has supported expansion of the sector. Nowhere is this disparity more visible than in the growth of clean energy capacity over the past decade. South Africa’s Renewable Independent Power Producer Programme (REIPPP) for instance represents over a third of all energy projects with private sector participation on the continent between 2012 and 2022, which largely explains the significant capacity additions witnessed there.
Additional successes have been led by strong hydropower capacity addition in Ethiopia and Angola, and rapid scaling up of wind and solar capacity in Egypt, Morocco, and Kenya.

Both Egypt and South Africa now represent over a quarter of Africa’s total renewable energy capacity thanks to their success in securing private developers with public-private partnership (PPP) programmes and mobilising local, regional, and international investment in solar and wind. Data compiled by the Africa-EU Partnership also shows that the two countries represented most of the government spending on energy in the continent between 2014 and 2020. In Egypt for instance, the state-owned transmission company commissioned over 3,600km of 500 kV transmission lines during the period, multiplying its 500 kV grid network by 2.5 in less than a decade. This has paved the way for private sector investments into power generation and enabled the integration of large renewable energy capacity from wind and solar. Most other African markets where public funding is constrained do not have that luxury.

In addition to limited public finances, lower income countries possess a combination of regulatory and operational risks that make them less attractive investment destinations. Key risks include the poor financial health of state utilities, policy uncertainty, and higher risk environments that drive cost overruns and project delays. Due to the current macroeconomic environment, financing projects in the sector also faces numerous challenges such as rising interest rates, foreign currency shortages and currency convertibility problems.

According to the IEA, the cost of capital for utility-scale clean energy projects in Africa is at least two to three times higher than in advanced economies. This prevents developers from pursuing commercially viable projects that can deliver affordable energy solutions. Notably, the agency estimates that concessional capital of around $28bn per year is needed to mobilise $90bn of private sector investment by 2030, a more than tenfold increase of current levels.

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2.2. Limited resources mean that success in driving access to electricity has been limited and uneven. Island nations and countries with small populations have outperformed the rest of the continent in driving access to electricity. Within countries of 20 million people or more, only a few nations have managed to really gain ground, with strong growth in electrification rates registered between 2011 and 2021 in Kenya (+40%), Ethiopia (+31.2%), Uganda (+30.6%), Tanzania (+28.5%), Mali (+24.5%), Sudan (+23.4%), and Ghana (+22.2%).

Progress has been made by investing in a mix of grid-connected power plants and off-grid solutions and by investing in the expansion of transmission and distribution (T&D) networks. For instance, between 2011 and 2021, Kenya increased its geothermal generation capacity by 657 MW while embracing new technologies to commission 430 MW of wind energy, 140 MW of solar energy, and multiplied by 10 its off-grid renewable capacity.

In November 2022, it also commissioned the 500kV Kenya-Ethiopia High Voltage Direct Current (HVDC) transmission line - the first HVDC line in Kenya’s transmission network and the longest in the East and Central Africa region.

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**East African countries and nations with a small population have registered the largest gains in electricity access**

<table>
<thead>
<tr>
<th>Access deficit in 2021, in millions</th>
<th>Access rate in 2021, in %</th>
<th>Annualised increase in access over 2010-2021, in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>12</td>
<td>77</td>
</tr>
<tr>
<td>Rwanda</td>
<td>7</td>
<td>49</td>
</tr>
<tr>
<td>Eswatini</td>
<td>0.2</td>
<td>30</td>
</tr>
<tr>
<td>Lesotho</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Uganda</td>
<td>25</td>
<td>54</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>36</td>
<td>62</td>
</tr>
<tr>
<td>Tanzania</td>
<td>26</td>
<td>35</td>
</tr>
<tr>
<td>Mali</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Sudan</td>
<td>17</td>
<td>47</td>
</tr>
<tr>
<td>Togo</td>
<td>4</td>
<td>47</td>
</tr>
<tr>
<td>Liberia</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Zambia</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>Madagascar</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Guinea</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Mozambique</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Senegal</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Dem. Rep. Congo</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>South Sudan</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Burundi</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Central African Rep.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Niger</td>
<td>21</td>
<td></td>
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<tr>
<td>Suriname</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chad</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>


NB: Selected countries represent markets with the lowest rates of electrification and markets that registered the largest increases in access over the period.
2.3. Getting pragmatic about Africa’s energy needs.

Most data available on energy access in Africa tends to focus on households’ electrification over a more pragmatic analysis of the broader energy needs of African economies.

What Africa needs is electricity systems that also support industrialisation and economic growth, so new paradigms are required to look at the actual electricity deficit in Africa that consider both households and industrial needs. In 2022, Ministers and high-level representatives from the Democratic Republic of Congo, Ghana, Kenya, Malawi, Morocco, Nigeria, Rwanda, Senegal, Uganda, and Zimbabwe issued the Kigali Communique advocating for the pursuit of a modern energy minimum of 1,000 kWh/capita consumption as a realistic target for the continent in the short and medium-term.

Africa is the only region in the world that has not reached a modern energy minimum...

<table>
<thead>
<tr>
<th>Region</th>
<th>Electricity Consumption (kWh/capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceania</td>
<td>5,903.9</td>
</tr>
<tr>
<td>Americas</td>
<td>5,613.6</td>
</tr>
<tr>
<td>Europe</td>
<td>5,340.9</td>
</tr>
<tr>
<td>Asia</td>
<td>2,789.9</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>1,195.2</td>
</tr>
<tr>
<td>Africa</td>
<td>567.0</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>349.5</td>
</tr>
</tbody>
</table>


NB: Seychelles, South Africa, Libya, Mauritius, Namibia, Egypt, Algeria, Tunisia, Botswana, and Eswatini already have an electricity consumption per capita above 1,000 kWh/capita.

... and the continent’s modern energy gap is largely present within sub-Saharan Africa and low-income countries

Differential between electricity consumption levels and the modern energy minimum

Source: UN Energy Statistics. Electricity consumption data represents the yearly average for 2019 and 2021 to exclude COVID-19 period.

The metric was developed by the Energy for Growth Hub\textsuperscript{41} to consider not only energy needs from households but also electricity consumption across the broader economy to support development and industrialisation. It allows for 300 kWh of domestic consumption and 700 kWh throughout the economy for each person as a pragmatic indicator to measure and support development.

By analysing Africa’s energy sector against this new metric, new approaches can be developed for addressing the energy supply gap on the continent. North African countries other than Morocco, along with a very small number of countries in sub-Saharan Africa including the Seychelles, South Africa, Mauritius, Namibia, Botswana, and Eswatini, are already consuming over 1,000 kWh/capita. However, the rest of sub-Saharan Africa has a long way to go before reaching this threshold. Consumption in the sub-continent is on average 350 kWh per capita and so would need to increase threefold to reach the Modern Energy Minimum ambition set by the Kigali Communique.

Countries who performed particularly well in electrification rates over the past decade do not necessarily perform well against the modern energy minimum metric. Rwanda or Guinea-Bissau for instance, two countries with some of the highest gains in electricity access over the past decade, fall towards the bottom of the pyramid when analysed under this lens. A major reason is that off-grid renewables have largely supported successes in electrification so far, but fail to provide the kind of electricity required to truly support broad-based industrialisation and economic growth.

\begin{quotation}
Electricity consumption would need to grow threefold to meet the Modern Energy Minimum and meet basic developmental aspirations.
\end{quotation}

\textsuperscript{41} For details on the Modern Energy Minimum, please refer to the work of the Energy for Growth Hub.
Africa’s power infrastructure needs diversification, modernisation, and privatisation.

3.1. Africa’s electricity generation capacity stands at the same level as Germany and is largely concentrated in a select few markets.

AFC research shows that total installed (grid-connected) power generation capacity in Africa – a continent of 1.4 billion people – is just above 240 GW and stands at the same level as Germany – a country with a population of 84.5 million.

The continent’s electricity mix remains dominated by combustible fuels because Africa’s biggest electricity producers, including Egypt, South Africa, Algeria, and Morocco all rely largely on natural gas and coal to generate power. Combined, their grid-connected power generation capacity is double that of the rest of the continent – or 50 countries. Consequently, the composition of their electricity mix heavily influences the continent’s average.

While North Africa and South Africa rely on combustible fuels, sub-Saharan African markets are more diverse. They may have lower total electricity capacity but have greener mixes and a significant amount of hydropower. Hydropower represents 16% of the electricity mix on the continent, wind and solar approximately 3% each, with nuclear generation providing less than 1% of capacity. In Ethiopia, Zambia, the Democratic Republic of the Congo, and Mozambique, hydroelectricity represents more than 80% of electricity generated.

Four countries dominate the continent’s generation capacity; their generation mix is driven by combustible fuels

Source: UN Statistical Database, AFC Research. *less than 5 GW of Nigeria’s installed power generation capacity is conventional
**No data available for Angola, Cape Verde, Comoros, Djibouti, Eritrea, Lesotho, Maldives, Monaco, São Tomé and Príncipe

Electricity Mix

Thermal Coal
Thermal Oil/Diesel
Thermal Natural Gas
Hydro
Solar
Wind
Nuclear
Other

Egypt
South Africa
Algeria
Morocco
Nigeria
Libya
Angola
Niger
Ghana
Ethiopia
Sudan
Zambia
Kenya
Benin
Cameroon
Mozambique
Namibia
South Africa
Kenya
Zambia
Botswana
Sudan
Namibia
Angola
Gabon
Gambia
Comoros
Eritrea
Lesotho
São Tomé and Príncipe
Maldives
Monaco

Africa Finance Corporation
A look at Africa’s current electricity mix reveals two major opportunities to build a more future-proof power infrastructure. The first opportunity is the decarbonisation of thermal capacity, starting with coal-to-gas switching in South Africa and Morocco before displacing diesel and heavy fuel oil (HFO) in West Africa (Mauritania, Senegal, Mali) and East Africa (Kenya).

The second opportunity is the diversification of baseload within countries that are predominantly reliant on hydropower and therefore face climate-vulnerability risks, notably those around the Zambezi Basin. In Eastern and Southern Africa, such diversification could be supported by the development of domestic gas resources (Tanzania, Zimbabwe, Mozambique, South Africa) or geothermal energy as alternative sources of baseload electricity. Regionalisation of electricity trading via power pools also offers great opportunities to balance national grids by leveraging on each neighbors’ strength and resources.

“A look at Africa’s current electricity mix reveals two major opportunities around the decarbonisation of the thermal fleet and the diversification of baseload capacity generation.”
3.2. Brownfield investments opportunities offer great potential to bridge some of the electricity deficit in the short-term while building climate resilience. While new capacity additions are required to meet Africa’s growing electricity demand, brownfield investments also offer attractive opportunities to modernise Africa’s electricity infrastructure, improve its climate resilience, and support incremental gains in energy supply.

Coal plants are aging and offer conversion opportunities

Africa’s coal-based electricity generation fleet is aging rapidly and represents several gigawatts of power whose retirement will have a profound impact on baseload electricity supply. Global research shows that coal plants have retired at an average lifetime of 46 years. That currently represents almost 10 GW of coal generation capacity. 1.6 GW of which has been mothballed already.42

By 2030, 16.5 GW of African coal generation capacity will have reached its retirement age. This has direct implications for investments in decommissioning or reconversion of facilities to natural gas (South Africa, Morocco, Zimbabwe).

The largest coal power plants are in South Africa and Morocco, two countries with ambitious natural gas imports and gas development plans that can support coal-to-gas switching by 2030.43

Such opportunities focus on the decarbonisation of the thermal power sector by replacing coal with a cleaner source of baseload and must be accompanied with modernisation and upgrades of facilities with life extension works.

70% of Africa’s coal generation is 25 years or older

African coal power plants

Source: Global Energy Monitor

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42 Global Energy Monitor database.

43 South Africa’s draft Gas Master Plan released in 2024 provides for 2 GW to 16 GW of gas-to-power capacity development.
African dams are in need of modernisation and upgrades

African hydropower dams have witnessed two waves of development, one between the 1960s and 1980s, and a fresh one since the mid-2000s, with no particular river or basin focus. The first wave of development consists of hydroelectric facilities that are now aging. 44% of Africa’s current hydropower capacity was installed in the 1980s or before and over half of installed capacity is 20 years or older, and in need of modernisation and/or upgrades.

The International Hydropower Association estimates that 21 dams (4.6 GW) need $2.1bn to meet urgent modernisation needs and another 31 plants (10.1GW) will require $4.7bn by 2030 to ensure reliable and safe operations.

Dams in need of modernisation and upgrades are scattered across West, East, Central and Southern Africa with no geographical concentration. They offer interesting opportunities for private sector participation under concession agreements that would unlock capital into upgrades of the existing infrastructure and/or the installation of floating solar panels on reservoirs. This is particularly beneficial for dams that are vulnerable to droughts and climate change such as in Ghana or around the Zambezi River (Zambia, Zimbabwe).

African hydroelectric dams need $6.8bn to meet modernisation needs by 2030

African hydroelectric dams

Source: Global Energy Monitor

“Developing future-proof power infrastructure requires the conversion of the thermal fleet to gas and the modernisation of African dams.”

Making gas more easily available can help decarbonise the thermal power fleet

Thermal power plants fed with diesel, fuel oil or natural gas are recent in comparison with coal or hydropower plants. Thermal capacity really grew from 2005 onwards and is concentrated in North Africa with natural gas largely dominating the mix of Egypt, Libya, and Algeria.

Making natural gas more available across Africa could help ensure that the continent’s thermal power plants fleet has a lower emissions profile in the short-term, cuts reliance on imports of petroleum products, and becomes more future proof. We currently note a clear dominance of diesel, HFO and LFO in the thermal mix (black and dark grey) compared with pure natural gas plants (light grey) that provide cheaper and cleaner electricity. Most of these plants are dual fuel and function on gas only when available. This speaks to a lack of gas supply that would ensure the full conversion of most thermal plants that currently rely on imported, expensive and more polluting oil derivatives.

Large regional gas ventures such as the existing RompCo pipeline between Mozambique and South Africa, the future Mataia FSRU hub in Mozambique, and the Nigeria-Morocco Gas Pipeline should focus on making gas available to replace imported diesel and HFO once and for all.

Running thermal power plants on natural gas in the short-term, while equipping them with turbine technology that can blend hydrogen in the future, would align most projects with climate goals set by African nations by 2050 and 2060 while maximising the use of the continent’s domestic resources.

Thermal generation is concentrated in North Africa and heavily reliant on polluting and imported fuels (HFO, diesel)

![Diagram showing thermal generation capacity by type and start year across different regions in Africa.](source: Global Energy Monitor)
Renewable energy remains untapped potential

Last but not least, renewable energy capacity is growing exponentially but has so far been limited to a few countries. The capacity of solar and wind projects is also extremely small compared with other sources of energy such as coal and hydropower. The continent lacks large-scale clean energy facilities that can truly make a difference in its electricity mix.

The upcoming years should see the execution of gigawatt-scale projects in Egypt only where the grid can integrate such large capacity additions.

To witness a significant scale up of renewable energy, African markets must find ways to channel investments into transmission infrastructure – which has so far been largely public funded. In turn, new business models that embrace privatisation and decentralisation can help channel additional private sector participation in generation. In South Africa for instance, independent power producers (IPPs) were recently exempted from generation license requirements for generation facilities that have a point of connection on the transmission or distribution power system. Since then, the number and capacity of electricity projects registered with the regulator under these licensing exemptions has skyrocketed. 52 MW were registered in 2020, 86 MW in 2021, 1,658 MW in 2022, and over 3,000 MW in the first half of 2023 alone.

Renewable energy plants show a lack of large-scale clean energy ventures

Clean energy is witnessing a slow pace of development across Africa with a few exceptions like South Africa, Egypt, Morocco and Kenya.

Africa’s renewable energy story is only 10 years old

Source: Global Energy Monitor
3.3. Transmission infrastructure is limited and grid constraints will affect the integration of additional electricity.

To grow energy access, sustained efforts must be put towards channelling investments not only in generation but also in transmission and distribution. Unfortunately, investment in Africa has mostly focused on generation and distribution, leaving medium and high-voltage transmission largely underfunded. While PIDA targets 16,500km of new transmission lines by 2040, only 3,506km have been developed since 2012, or 21% of the target.

Africa is lacking resilient transmission and distribution networks that can connect its production and consumption centres and ensure the integration of various sources of energy into its energy mix. This is evident even in the continent’s largest economies. Grid constraints have notably undermined the procurement of wind energy under South Africa’s six renewable auctions in 2022, while the same year Nigeria’s grid collapsed four times.

Based on the latest data available across the continent, a 2017 World Bank Group study found that the 38 countries in sub-Saharan Africa had only 112,196 km of transmission lines of 100 kV and above, or 247 km per million people, one of the lowest per capita rates of any region included in the study. A robust grid and interconnectedness are key to high-performing power systems. They create economies of scale, lowering costs, and improve reliability by allowing supply to be shifted to the areas it is most needed. Estimates are that $3.2-4.3bn are needed every year between 2015 and 2040 for transmission projects. There are a couple reasons this relatively small gap is not being addressed. Generation projects can attract plenty of public and private capital due to comfort with revenue models, contract protections, and relatively little difficulty related to land use. In contrast, transmission projects have low margins and have been mostly limited to public and state ownership. According to the World Bank Group’s Private Participation in Infrastructure database, 98.2% of electricity infrastructure investments in Africa between 2010 and 2020 funded electricity generation projects. However, less than 0.3% went to transmission projects.

Several business models have started being implemented to channel private capital or DFI financing into Africa’s unstable grid network and under-performing distribution systems. With Africa50, Kenya is currently developing Africa’s first private transmission lines under PPP frameworks with two projects that will cost $300m and cover 237 km. Last year, British Investment International’s Gridworks also announced a new independent power transmission project in Tanzania and created a new, privately-owned and operated electricity distribution company in Burundi.

**Transmission infrastructure in Africa is limited HV/MV km per million people**

<table>
<thead>
<tr>
<th>Country</th>
<th>Transmission lines (HV/MV km per million people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1240</td>
</tr>
<tr>
<td>Chile</td>
<td>694</td>
</tr>
<tr>
<td>Brazil</td>
<td>610</td>
</tr>
<tr>
<td>Peru</td>
<td>339</td>
</tr>
<tr>
<td>Colombia</td>
<td>296</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>247</td>
</tr>
<tr>
<td>Sub-Saharan Africa (excl. South Africa)</td>
<td>229</td>
</tr>
</tbody>
</table>


45 “Why it’s time for private investment in sub-Saharan Africa’s electricity transmission sector”, Benjamin Attia, Energy for Growth Hub, April 2022.
46 Idem.
47 Idem.
Because Africa’s energy deficit is often limited to household electrification, prevailing analyses of the sector often underestimate the full scale and extent of the continent’s energy needs. To effectively tackle Africa’s energy deficit and align with its industrialisation agenda and development aspirations, more ambitious and pragmatic approaches are imperative.

To address the persisting energy deficit, Africa will need to create power markets that rely on liquid and credible off-takers while addressing affordability constraints for retail consumers. Progress is being made across several countries but tends to be focused within specific markets where baseload and grid infrastructure is already well-established. Elsewhere, most large energy ventures making progress in Africa (including electricity, hydrogen, and natural gas projects) are still oriented towards the export market and would do very little to develop reliable and integrated energy systems that can support inclusive growth. As Africa promotes more privatisation and decentralisation to increase energy supply, any response to its energy crisis must also consider several regional and global factors including climate resilience, a global energy transition that makes capital harder to access for gas projects, and untapped regional electricity trading.
Digital Infrastructure
• Despite significant growth in broadband penetration in the past decade, affordability constraints continue to price out hundreds of millions of Africans from accessing the digital world. Broadband remains too expensive for most and explains the persisting deficit in digital services and connectivity across the continent, where only 40% of Africans have internet access.

• Addressing this deficit is crucial to supporting economic growth and productivity in Africa and ensuring that the continent can fully leverage the benefits of the digital revolution. Interventions are required across all segments of digital infrastructure – the first, middle, and last mile – each presenting distinct needs and opportunities.

• While the first mile has seen considerable investment so far, recent incidents of damage to multiple subsea cables in 2023 and 2024 have highlighted the lack of diversity in subsea cable numbers and routes serving Africa. This underscores the vulnerability of the continent to single-path connectivity solutions, necessitating additional lines to provide redundancy and enhance resilience.

• Expanding terrestrial fibre and regionalising fibre networks are essential for the middle mile, along with the development of cross-border links to establish integrated digital corridors. This will ensure reliable and cost-effective access to bandwidth across Africa while decreasing reliance on subsea cables.

• Despite the growth in data centre development, Africa’s IT capacity remains insufficient to meet the continent’s needs for resilience, affordability and independence in data storage and exchange.

• Progress in the last mile is notable, but investments tend to focus on population centres, neglecting rural and remote areas. Infrastructure sharing and increased private sector participation are essential to extend broadband networks to the millions who remain without access.
The drivers for connectivity demand in Africa are strong. Africa’s population is expected to grow to 2.4 billion by 2050 from its current 1.4 billion. Hundreds of millions of people under the age of 30 will be drawn increasingly to some of the fastest growing cities in the world, from Lagos to Dar es Salaam. Those demographic trends will spark demand for more online services and much better internet connectivity than currently exists, particularly in terms of the coverage, affordability, and quality of the network. So far, Africa’s digital infrastructure has been widely seen as a success story for its ability to keep attracting global capital over the years and managing to secure substantial private sector participation. However, despite significant progress in undersea internet cables and backbone infrastructure, the continent remains far behind much of the rest of the world in the middle mile segment and last mile connections. 60% of Africans have no access to internet while lack of fibre prevents the distribution of quality bandwidth more locally. Digital services also remain too expensive and affordability is a major barrier to wider penetration as millions are still priced out of digital services.
First mile lacks resilience and redundancy while middle mile is in need of better regionalisation.

1.1. Africa has witnessed rapidly expanding coverage of subsea cables but needs route diversification to build resilience and redundancy.

Over the past two decades, rapid expansion of subsea cable networks has unlocked access to significant international bandwidth for African markets, driving internet penetration and the expansion of digital services across the continent. But while hundreds of millions of Africans have been brought online, middle mile and last-mile infrastructure remain limited and regional networks are yet to be built across several parts of the continent. Limited regional infrastructure and network deficiencies contribute to high costs of connectivity that price most Africans out of the digital world.

The past twenty years have encircled Africa into a cocoon of subsea cables that have made inbound international internet bandwidth easier and faster to access. After Guinea-Bissau connected to the ACE submarine cable in 2023, all African coastal countries now have at least one subsea cable landing, except for Eritrea.

For receiving markets, subsea cables have a direct impact on connectivity, enable faster internet speeds, and reduce internet prices. Equinix for instance – the latest cable that landed in Africa in 2023 – is expected to increase internet speeds five-fold in Nigeria by 2025 and three-fold in South Africa and Namibia. By the same year, internet prices should drop in each country between 16 and 21%, resulting in an increase of internet penetration by 7% in Nigeria and South Africa and by 9% in Namibia.

Thanks to these submarine cables, growth in Africa’s internet bandwidth between 2019 and 2023 far outpaced Asia and Latin America – 44% to 32% and 31% respectively. By the end of 2022, total inbound international bandwidth into Africa reached 36.7 Tbps, split between 12.9 Tbps to North Africa and 23.8 Tbps to sub-Saharan Africa where South Africa, Kenya, and Nigeria account for a concentrated two-thirds of all volume.

This figure is significantly higher than previous years, registering a threefold increase in only four years, but very low compared to available design capacity. In theory, total design capacity from the 33 submarine cables connected to sub-Saharan Africa could provide well over 800 Tbps – yet less than 24 Tbps was supplied to the region by the end of 2022.

For Africa’s first mile infrastructure to be effective and resilient, it needs more diversity in routes and ownership – especially as older sub-sea cables start to reach the end of their lifespan. Most coastal countries only have one landing station and very few cables extend all the way to South Africa. Most networks pass through Africa on their way to Europe but their landing in places like Djibouti or Egypt has historically played a limited role in connecting the continent. Analysis points to a lack of redundancy and diversity of routes and an overreliance on single-path connectivity solutions.

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49 Equinix Subsea Cable: Regional Economic Impact Assessment, October 2021. Assessment commissioned by Google and conducted by Africa Practice and Genesis Analytics.
52 “Improving Africa’s connectivity: more subsea cables are a good start”, Matt Walker, MTN Consulting, December 2018.
Such vulnerability comes to light during cable disruptions caused by problems like natural disasters[^54] – as recently experienced across the Atlantic coast in March 2024. Safeguarding Africa’s internet backbone against such risks calls for additional subsea routes but also alternative access like cross-border fibre links that can enhance connectivity, improve stability, and offer alternatives to submarine cables.

In times of disruption, redundancy allows operators and owners to spread their capacity over multiple cables, thereby assuring internet reliability and resilience. Most traffic on Africa’s eastern coast currently goes through Egypt for example, stressing the need for more alternative routes via places like Mombasa in Kenya.

Diversifying the submarine cable systems also favours competition as new players come into the market and create downward pressure on upstream internet transit pricing. Recent years have seen an increase in the demand for bandwidth, largely driven by major content and cloud service providers such as Google, Meta, Amazon of Microsoft – a drastic change from the past when bandwidth was mobilised for public internet services provided by carrier networks. These content providers use some 71% of subsea cables’ capacity now, compared with less than 10% ten years ago[^55]. They are the new major players in the market and executing some of the world’s largest subsea cablesincluding Equinao (Google) and 2Africa (Meta) connecting Africa.

[^54]: In August 2023 for instance, natural rock fall in the Congo Canyon caused breaks in multiple subsea cables, leading to severe network disruptions and a surge of internet traffic on alternative routes like Equinao.

[^55]: Submarine Cable Map 2023, TeleGeography.
Given the growth potential of Africa’s internet sector, a more diverse mix of investors has emerged in recent years — including content firms like Meta and Google, alongside traditional telco players — to fund major infrastructure projects like Equiano and 2Africa.

<table>
<thead>
<tr>
<th>Project</th>
<th>Highlights</th>
</tr>
</thead>
</table>
| Equiano | • Subsea internet cable financed by Google and activated in 2023 — third private international cable owned by Google and the 14th subsea cable they have invested in overall.  
• 15,000 kilometers (9,320 miles) starting in Portugal and ending in South Africa. It has branches to Nigeria, Togo, St Helena, and Namibia.  
• Equiano is designed with state-of-the-art space-division multiplexing (SDM) technology, with 12 fibre pairs and a design capacity of 144,000 Gbps. This is approximately 20 times more network capacity than the last cable built for the region. |
| 2Africa | • Subsea cable system connecting 33 countries across Africa, Europe, and Asia. At 45,000 km, it is the largest cable project in the world.  
• Built by a consortium of global and African partners, including Facebook, MTN GlobalConnect, Orange, Telecom Egypt, Vodafone, and WIOCC.  
• Expected to go live in 2024 with a design capacity of up to 180 Tbps – which will bring total design capacity of submarine cables serving the continent to over 1 Pbps.  
• Projected economic impact of up to $35bn within two to three years of becoming operational. |

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56 CNN, 2022; Submarinenetworks.com, n.d.;  
1.2. Terrestrial fibre is expanding but remains concentrated around population hotspots and lacks cross-border links.

With the activation of major new subsea cables like Equiano and 2Africa, Africa’s global backbone infrastructure is set to expand significantly in the coming years. To make the most of these investments, the continent’s connectivity on its shorelines must be matched with a robust terrestrial network that enables data to move efficiently throughout and between countries across the continent.

Africa’s headline middle mile capacity continues to grow consistently, with terrestrial fibre optic transmission networks growing by an average of 150km per day in recent years. The data shows consistent growth of fibre networks but faster construction of metropolitan fibre rings and fibre-to-the-home/building – (FTTH/B) networks that are being built twice faster now than in the early 2010s.

That growth of terrestrial fibre has brought more and more people closer to fibre optic networks but seems concentrated around population hotspots. Between 2010 and 2023, the number of people living within 10km of a fibre network increased from 131m to 409m, much faster than the population living within a 25km or 50km radius. As African populations urbanise rapidly due to rural-urban migration and natural population growth rates, fibre investment is increasingly concentrated in the most densely populated areas.

**Africa’s inventory of operational terrestrial fibre optic transmission networks is growing by an average of 150km per day**

Route kilometres of terrestrial transmission networks

<table>
<thead>
<tr>
<th>Metro Fibre Operational (last mile)</th>
<th>Fibre Operational</th>
<th>Fibre Under Construction</th>
<th>Fibre Planned</th>
<th>Fibre Proposed</th>
</tr>
</thead>
</table>

Source: Africa Bandwidth Maps, © Hamilton Research Ltd., 2023

Note: Approximately one-third of the total fibre inventory in Sub-Saharan Africa is within cities. The inventory of 1.1M DS0s of operational terrestrial fibre in June 2022, or about 216,127 km of operational fibre rings and FTTH/B (fibres-to-the-home/building) networks. These metro rings distribute bandwidth from fibre optic nodes to entities and subareas around each city. The FTTH/B networks provide the last mile access, delivering fibre bandwidths right to the door.

Estimates based on data from Hamilton Research Ltd.

Logically, investors are more inclined to invest in highly densely populated centres rather than white-splot. Urbanisation drives demand for more infrastructure and tends to go along with higher mobile penetration rates, higher average revenue per user, and faster adoption of new technologies. On the other side, costs associated with deploying broadband infrastructure in rural and remote sites are much higher and target lower income populations, making them less attractive investments. For instance, the average additional annual cost of mobile coverage sites is 18% more in rural areas and 35% more in remote sites due to additional costs of backhaul, power and tower/civil works. As a result, new investment usually duplicates existing networks rather than filling outstanding gaps. Institutions like the World Bank have already recommended that public investment and intervention could address this deficit via mechanisms such as universal access funds. Public sector funds in remote areas can also be allocated to ducting systems on alternative infrastructure like roads or rail lines or the incorporation of fibre into high-tension electricity distribution grids.

In a context where public funding is limited, such interventions would promote infrastructure sharing and open-access business models by maximising capacity utilisation from existing infrastructure. In Kenya for instance, state utility Kenya Power launched a fibre optic business in 2010 to ride 4,000km of fibre optic cables on its transmission and distribution network. Since then, it has signed lease agreements with several telecommunications operators who can even use it to roll out last mile networks.

The IFC estimates that about half of Africa’s fibre could still be owned by government networks, state-owned entities, and utilities that only partially use them. This publicly-owned infrastructure could be accessed by the private sector, especially Mobile Network Operators (MNOs) and data operators, to maximise its usage and efficiency. The kind of public-private sector cooperation put in place by Kenya Power – while not exclusive to Kenya – is a step in the right direction. It provides the required policy environment for infrastructure sharing and encourages private sector participation in fibre network utilisation and expansion.

In the last ten years, network expansion has brought more than 338 million more people within access to high capacity national and international backbone networks

Population within reach of operational fibre optic network (in million people).

Source: Africa Bandwidth Maps, © Hamilton Research Ltd., 2023
For now, and as the International Telecommunication Union (ITU) data shows, Africa’s current network of operational terrestrial fibre cables remains one of the smallest in the world both in length and density. Visualisation of the operational fibre optic cables and microwave networks shows the disparities in operational fibre routes across different global regions. The areas shaded in darker yellow or red in the map below have the highest population density. They also have the highest concentration of cable linkages (represented by blue lines).

However, the African continent stands out because it has significant swathes of higher-density areas with little or no coverage, particularly land-locked countries and within interior regions, such as the Democratic Republic of Congo and South Sudan. Lack of terrestrial infrastructure in landlocked countries leads to higher prices and lower internet penetration, and is the reason why they fare particularly low within most global digital indexes.

While economic value comes from borderless and continental scale, Africa also remains fragmented into small islands whose connectivity is hampered by limited infrastructure and national regulations that do not embrace regionalisation. Several cross-border links have been built over the past decade, but achieving reliability and competitive pricing requires at least two or more fibre optic links between neighbouring countries – something most markets are still missing. Recently announced projects along with national and regional development plans suggest that the inland terrestrial connectivity gap is starting to be addressed. The volume of intra-regional traffic backhauled to submarine cable landing points keeps increasing, supported by the completion of new cross-border links and capacity expansion programmes. Intra-regional traffic reached 1.914 Tbps at the end of 2022, compared with only 547 Gbps in 2018.

To maintain that momentum and develop the type of regional infrastructure that can build resilience to increase the quality and affordability of broadband, Africa needs more than just terrestrial fibre networks. Investments in data centres, global caches, and 4G/5G also form an integral part of the development of modern, independent, regional, and efficient digital corridors.

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64 The growth of Liquid Telecom’s One Africa network since 2009 offers one of the best example as it now spans 110,000km, establishes a direct terrestrial communication link between Cairo and Cape Town, and is now Africa’s largest independently owned network.
65 The Programme for Infrastructure Development in Africa (PIDA) for instance proposes several regional networks that seek to maximise regional synergies and make use of existing regional road, railways and/or pipeline corridors.
By 2030, the African Union has set a target that all Africans should have access to basic internet connection. The AU's ten-year transformation strategy, which is regarded as the foundation for the development of the ICT sector over the next decade, has two key objectives.

The first is to build a secured Digital Single Market in Africa by 2030 where free movement of persons, services and capital is ensured, and individuals and businesses can seamlessly access and engage in online activities in line with Africa’s Continental Free Trade Area (AfCFTA). The second is to ensure all Africans can access at least 6mb/s of internet capacity at all times, wherever they live on the continent, at an affordable price of no more than 1cts USD per mb, through a Digital Transformation Strategy for Africa (2020-2030)67.

1.3. Africa is experiencing a boom in data centre development but still accounts for just 1% of the world’s data capacity. Often misunderstood, data centres are a crucial component of global digital corridors and a pillar of a country’s independence and access to cheaper bandwidth. Africa has long relied on developed countries to provide voice and data interconnection, paying hundreds of millions of dollars every year in tromboning – the process through which traffic travels in and out of the continent to host providers located overseas.

Hosting content abroad has been cheaper due to a shortage of data centres in Africa, but ultimately more expensive for end users. As a remedy, the Internet Society called in 2010 for 80% of the traffic to be accessed locally and 20% internationally by 202068. While the target is yet to be met, Africa now has over 50 active internet exchange points (IXPs) located across 36 countries69. Yet, despite such rapid expansion, it still accounts for just 1% of the world’s data capacity, at around 250MW.

The African Data Centres Association (ADCA) estimates that more than 60% of that capacity is concentrated in South Africa – a market which has seen significant investments in data centers over the past decade. The ADCA also projects that demand for data centres will outpace supply by up to 300% in the coming years. To keep pace and achieve South African levels of capacity, the continent would need 700 new data centres, adding 1,000MW to its data capacity70. Even then, South Africa’s capacity is well below large global economies worldwide, so the gap would only be partially met71.

The capacity of Africa’s biggest data centre markets is still far behind that of developed markets

<table>
<thead>
<tr>
<th>Country</th>
<th>IT capacity in MW per million capita in Q1 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>82.18</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>47.21</td>
</tr>
<tr>
<td>Germany</td>
<td>31.83</td>
</tr>
<tr>
<td>South Africa</td>
<td>6.69</td>
</tr>
<tr>
<td>Morocco</td>
<td>1.43</td>
</tr>
<tr>
<td>Kenya</td>
<td>1.38</td>
</tr>
<tr>
<td>Egypt</td>
<td>1.03</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Source: Africa’s Key Data Centre Markets; DCByte/Africa Data Centres Association.

68 The initiative comes with a strong advocacy for the role of internet exchanges (IXPs) in creating local hubs for internet traffic exchange and content distribution through public peering, which delivers superior end-user experience at lower cost.
69 African IXP Association.
70 Africa Data Centres Association.
71 AFC research, sourced as ‘Africa’s Key Data Centre Markets, DCByte/Africa Data Centres Association’.
As for fibre, recent analysis notably points to a lack of competition and liberalisation to grow middle-mile infrastructure. African countries with the highest numbers of data centres are also the ones with a demonstrated track record of telecom liberalisation⁷², suggesting that competition must be promoted across the continent to incentivise investments. This is particularly the case in an era when data is decentralised across various actors such as eCommerce companies (Amazon), software companies (Microsoft) or content providers (Meta). This makes pure national strategies obsolete and increases the need for open access data centres and a regional approach to data infrastructure.

Until Africa can massively scale up its data centre capacity, most of its markets will continue to rely on tromboning with developed countries to carry its own intra-African traffic. By building additional IXPs, the continent can not only be more independent but also promote local traffic between local access providers, thereby lowering costs and the latency of traffic while generating greater network resilience.

Data centres act as relay and cash-in points, and content stored and consumed locally does not use bandwidth from subsea cables, which ultimately helps cut data costs. This is particularly needed for interior capital cities and landlocked nations for whom the cost of national backbone and carrier services to the coastal hubs is too high. These inland routes must promote competition and incentivise the growth of internet service providers (ISPs) and local content producers to address their capacity and affordability constraints.

Investment in new data centres does not happen independently from other indicators of digital transformation. Some industry stakeholders argue that Africa needs to reach a “critical mass” of data consumption for the economies of scale required to make new data centres a viable investment⁷³.

This issue of scale is not particular to data centre investments and affects the bankability of most infrastructure projects on the continent, especially digital ones. Nowhere is this more evident than in the growing usage gap in Africa. While broadband coverage has skyrocketed over the past ten years, Africa accounts for more and more people that are covered by broadband networks but not using them. Addressing the affordability constraint then becomes a necessity.

““To get to the level of South Africa, Africa would need 700 new data centres representing some 1 GW of data capacity.””

⁷² “One Million Kilometers of Fibre Optic Cables for Development”, Carlo Maria Rossotto, IFC, March 2021.
⁷³ Funke Opeke, founder and CEO of Nigeria’s MainOne, quoted in Data Centre Dynamics, 2022.
A large part of Africa is still unable to afford connectivity and digital services, which keeps access levels low.

Despite billions of dollars invested into Africa’s digital infrastructure in recent years, Africa’s mobile and internet revolution has been reserved for only a few as access to broadband remains limited and uneven between geographies and technologies. While reasons abound as to why penetration remains low, affordability is the major barrier as millions of Africans are still priced out of the continent’s digital transformation. This in turn has direct implications on infrastructure needs and technology adoption.

2.1. Most Africans are still priced out of connectivity.

Internet access is reserved for a minority of Africans. While continent-wide estimates stand at 40%, that figure drops to 28.5% if we consider only sub-Saharan Africa. Developed regions in Europe, the Americas, and the Commonwealth of Independent States (CIS) have twice that level of internet penetration.

Access is first and foremost proportional to income levels across most of the continent. Recent research shows that those in the bottom 40% of income have a 12% rate of internet access, while those in the top 60% of income in Africa have a 37% rate of internet access. In addition, those in the top 60% of income in Africa are almost five times more likely to have access to a computer than the rest. Even basic internet-enabled handsets remain too expensive for many and their affordability is the primary barrier preventing people from adopting mobile internet. Second, urban residents also have a much higher level of access (47%) than rural ones (12%).

Limited purchasing power means that while broadband coverage has increased in Africa, growth in usage and consumption has not kept pace. This “usage gap”, referring to the number of people who are covered by broadband networks but do not use them, is growing. In Sub-Saharan Africa for instance, the coverage gap for mobile internet connectivity has successfully decreased to 15% in 2022 (compared with 46% in 2015), but the usage gap has grown to 59% (from 41% in 2015). This represents 680m people in the region that are now covered by broadband networks but are not using them.
To scale up broadband penetration across developing markets, the Broadband Commission for Sustainable Development has set the entry-level for broadband services to less than 2% of monthly GNI per capita. The data shows the tremendous progress made to lower costs over the past decade, but the bottom line is that broadband is still not cheap enough. Between 2012 and 2022, the cost of a data-only mobile broadband basket of 2GB of high-speed data dropped from 18.6% of GNI per capita to 3.2% in 2022 – getting very close to the Broadband Commission’s affordability target. But despite very significant drops in the affordability of ICT basket prices in Africa, the continent remains the most expensive globally.

**Affordability remains a major constraint to broadband penetration**

Fixed broadband (5G) basket price in 2022, % of GNI per capita.

<table>
<thead>
<tr>
<th>Region</th>
<th>Price (2022)</th>
<th>affordability target (2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Americas</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>Arab States</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>World</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>CIS</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>1.1</td>
<td></td>
</tr>
</tbody>
</table>

Data-only mobile broadband (2G) basket price in 2022, % of GNI per capita.

<table>
<thead>
<tr>
<th>Region</th>
<th>Price (2022)</th>
<th>affordability target (2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Americas</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>World</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Arab States</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CIS</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>

Source: International Telecommunication Union (ITU).

2.2. Affordability continues to drive demand for mobile connectivity over more reliable and efficient fixed broadband.

Most African markets fare very poorly against the Broadband Commission’s affordability metric, with lower-income individuals and families clearly priced out of connectivity. A clear distinction also appears between the affordability of mobile broadband compared with fixed broadband, which explains the surge in mobile internet penetration over the past decade but the persisting low levels of penetration of fixed broadband.

ITU price data shows that, on average, Africans can expect to pay around $25 a month for a very basic fixed broadband subscription or $6.40 for a data-only mobile plan.  

The price of a fixed broadband connection in Africa is about the same as the global average cost in dollar terms. However, when that figure is expressed as a proportion of per capita gross national income, it’s clear that $25 a month is unaffordable for the average African user. That would consume almost 15% of their income compared to 2.9% as a global average.
Africa’s connectivity is largely mobile-based while fixed broadband penetration remains the lowest in the world

Broadband penetration per 100 people, 2021/2022

<table>
<thead>
<tr>
<th>Region</th>
<th>Fixed broadband</th>
<th>Mobile broadband</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seychelles</td>
<td>34.9%</td>
<td>135%</td>
</tr>
<tr>
<td>Mauritius</td>
<td>25.7%</td>
<td>120.7%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>13.6%</td>
<td>114.4%</td>
</tr>
<tr>
<td>Algeria</td>
<td>10.4%</td>
<td>106.2%</td>
</tr>
<tr>
<td>Egypt</td>
<td>9.7%</td>
<td>100.2%</td>
</tr>
<tr>
<td>South Africa</td>
<td>3.2%</td>
<td>99.6%</td>
</tr>
<tr>
<td>Morocco</td>
<td>12.5%</td>
<td>98%</td>
</tr>
<tr>
<td>Morocco</td>
<td>14.4%</td>
<td>94.4%</td>
</tr>
<tr>
<td>Botswana</td>
<td>20%</td>
<td>93.9%</td>
</tr>
</tbody>
</table>

Notes: Fixed broadband penetration is defined as the proportion of total population that has access to the internet via fixed broadband (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbps divided by population and multiplied by 100.

Mobile broadband penetration is defined as the proportion of total population that has access to the public switched telephone network (PSIN) using cellular technology. It includes the number of postpaid subscriptions and the number of active prepaid accounts.

Mobile broadband – while much cheaper – also needs better quality and deeper penetration. A data-only mobile basket of 2GB over a month has become cheap in Africa (3.2% of monthly GNI per capita in 2022), but a high-consumption basket of data and voice is still too expensive for many, at 9.3% of monthly GNI per capita in 2022.

Despite real progress, mobile broadband is still not cheap enough because of a lack of infrastructure and scale. The mushrooming of telecom towers across Africa has supported much progress so far and must continue. Countries where mobile broadband remains too expensive tend to be the ones with the lowest SIM penetration rates. For instance, Africa has an average of over 5,000 SIMs per telecom tower compared with 2,000 in India and less than 1,000 in China, according to TowerXchange data. Countries like Malawi, Burkina Faso, Nigeria, D.R. Congo or Chad combine low SIM penetration rates with high costs of mobile broadband. Scaling up the telco towers network in such countries would help address the continuing high costs of mobile broadband and bring more people into the digital world.

But while mobile broadband technologies provide more flexibility to end-users and are less capital-intensive to deploy, they are also less stable. In the same way as an off-grid solar bulb only gets you so far in accessing reliable and high-volumes levels of electricity, mobile networks offer only limited connectivity.

A cell tower that relies on microwave or satellite provides a lower signal speed and capacity than one served by fiber. So even with efforts to grow mobile penetration and connect new users, Africa still needs investments in fixed infrastructure.
Africa’s SIM penetration rates remain among the lowest globally

SIMs per tower in 2022, number

In addition, fixed broadband is more reliable, with higher capacity and, at scale, is more cost-effective for end users. Africa lags the rest of the world regarding fixed broadband subscriptions, both in terms of coverage and sector growth. Other developing markets are performing better because they have successfully lowered the cost of fixed broadband, to 2.8% of monthly GNI per capita in India and 0.45% in China for instance. As a result, China has already achieved a fixed broadband penetration rate of over 40% - a milestone that not a single African market has reached yet. In the African context, bringing the cost of fixed broadband further down would require several interventions to bring in investments into terrestrial broadband and fixed infrastructure, starting with more deregulation of the sector.

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79. The Cisco Digital Readiness Index, which provides guidance on how countries can improve their readiness to foster an inclusive digital economy, captures that deficit of digital infrastructure and broadband quality in Africa. Its latest ranking for 2021 lists 146 countries, including 40 in Africa; only Mauritius, Botswana and South Africa made it to the first half of the list. African markets score especially poorly in the “Technology Infrastructure” category which measures internet and broadband penetration and services.

2.3. Spending power will dictate the various degrees of technology adoption in Africa.

As Africa works towards a more integrated, efficient, and affordable digital market, it is witnessing varying degrees of technology adoption based on population’s income levels, infrastructure capacity and national policy frameworks.

Network coverage (2G, 3G, 4G, 5G) is increasing across the continent. In a sign that Africa’s telecoms infrastructure is advancing, new 3G networks have started to decline since 2022 as 4G continues to expand and 5G projects are initiated. By 2025, GSMA Intelligence estimates that 53% of Africa’s connections will be 3G, 33% will be 4G, 10% will be 2G, and 4% will be 5G.

North Africa will retain its leadership with the highest share of 4G and 5G coverage by 2025, followed by the Southern African Development Community (SADC). These coincide with Africa’s most developed markets and larger middle class while the rest of sub-Saharan Africa risks being left behind with respect to global digital transformation trends. While these trends point to growing 4G and 5G technology adoption, levels will indeed remain far below the rest of the world. By 2025, 5G adoption is expected to be some 8% in North Africa and 4% in sub-Saharan Africa, far below levels seen in Europe (over 40%) or China (over 50%).

Africa’s projected technology mix shows a limited evolution in the short term. The shift from 2G to 4G is significant, but 5G adoption will remain the lowest in the world.

Africa’s Projected Technology Mix

<table>
<thead>
<tr>
<th>Population coverage by mobile network 2022, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
</tr>
<tr>
<td>Africa</td>
</tr>
<tr>
<td>Americas</td>
</tr>
<tr>
<td>Arab States</td>
</tr>
<tr>
<td>Asia-Pacific</td>
</tr>
<tr>
<td>CIS</td>
</tr>
<tr>
<td>Europe</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>5G adoption, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
</tr>
<tr>
<td>Greater China</td>
</tr>
<tr>
<td>Europe</td>
</tr>
<tr>
<td>Latin America</td>
</tr>
<tr>
<td>CIS</td>
</tr>
<tr>
<td>North Africa</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
</tr>
</tbody>
</table>

Source: GSMA Intelligence, 2022

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GSMA, 2022 (The Mobile Economy Sub-Saharan Africa).
Technology adoption is broadly in line with affordability metrics, with the poorest countries and regions likely to remain stuck at 3G this decade. This is also tied to device availability and affordability, as the majority of smartphones in sub-Saharan Africa are still only 3G-capable. As Africa works to integrate value-chains at home and ensure local smartphones manufacturing, devices must remain cheap while enabling the consumption of higher quality 4G and 5G networks.

As much as 69% of smartphones used in sub-Saharan Africa as only 3G-capable according to GSMA Intelligence.

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As much as 69% of smartphones used in sub-Saharan Africa as only 3G-capable according to GSMA Intelligence.
Considering Africa’s digital infrastructure deficit and affordability constraints, regionalisation offers solid opportunities to bridge the infrastructure gap and reduce the costs of connectivity across the continent. By combining a network of modern and efficient data centres, internet exchange points (IXPs), data caches and backbone networks based on cross-border and high-speed fiber links, Africa can build economies of scale to develop modern digital corridors. Such a combination can also reduce reliance on overseas infrastructure and subsea cables, thereby building a more integrated and independent continent able to offer cheaper data and quality digital services to its rapidly growing populations. Making internet access more affordable would then create a virtual circle that is essential to unlocking more consumer demand for data and deliver better economies of scale that would make additional infrastructure investments viable for investors.
Industry & Manufacturing
Africa’s long-awaited structural economic transformation is either stalling or yet to gain momentum across most of the continent, despite repeated calls, efforts and plans to industrialise. Many African economies still rely on unproductive agriculture industries, resulting in the continent’s share of global manufacturing output remaining below 2%.

70% of Africa’s manufacturing activity is concentrated in only five countries: Egypt, Nigeria, South Africa, Algeria, and Morocco. Beyond these economies, industrialisation efforts are mostly driven by low-technology and low-productivity manufacturing.

Over the past two decades, there has been a general trend of stagnating industrial activity across much of Africa, with instances of de-industrialisation observed in key markets like South Africa.

Africa’s infrastructure deficit – especially in logistics and energy – remains a major obstacle to the continent’s industrialisation ambitions. Additionally, the reliance on extractivism limits local processing of key commodities such as crops, oil & gas, and minerals.

Successful industrialisation strategies will need to rely on the growth of technology-intensive manufacturing that maximises the use of African resources and leverages cross-border linkages and regional supply-chains. Mineral beneficiation presents a significant opportunity, given Africa’s abundant critical minerals and the increasing global demand for clean technologies. However, adopting pragmatic strategies for beneficiation in Africa requires a better understanding of each mineral’s value chain.
Despite the African Union’s ambitious Agenda 2063 targeting economic transformation through industrialisation and a skills revolution, manufacturing policies on the continent have yielded mixed results thus far. The sector’s contribution to GDP has remained stagnant since the 1990s, consistently below that of middle and upper middle-income countries as well as the global average. This stands in stark contrast to the numerous national and regional ambitions put forward during the same period to harness Africa’s industrialisation potential by developing supply-chains centred on the continent’s abundant natural resources, such as crude oil, natural gas, critical minerals, and arable land. The failure to develop manufacturing capacity and establish forward and backward linkages across borders means that Africa continues to export most of its raw materials instead of processing them domestically.

This results in persistent trade deficits with heavy import bills and the associated foreign currency requirements for finished products such as machinery, fuel, chemicals, and fertilizers. Despite some progress in North African markets, recent years have seen limited industrialisation in sub-Saharan Africa, primarily driven by low-technology manufacturing, which contributes to keeping value-added manufacturing low. In the case of South Africa, the manufacturing share of GDP has declined steadily to just half of what it was in the early 1990s.
African manufacturing is stagnating and remains largely below that of middle and upper middle-income countries.

1.1. African economies have remained predominantly agricultural and participate very little in global industrial output.

While the shift from agriculture into manufacturing has historically been central to a country’s development, African countries are yet to witness structural economic transformation. The share of manufacturing in the continent’s GDP has remained the same since at least the 1990s – at some 13% – while agriculture has maintained its predominant contribution at some 20% of GDP, according to World Bank data. In comparison, Asia’s GDP shifted drastically in favour of industry over the past decades, with the share of manufacturing jumping from less than 5% in the 1990s to 24% while that of agriculture witnessed the reverse trend and dropped from 24% in the 1960s to some 6% currently.

Beyond the Asia comparison, the share of manufacturing within Africa’s GDP also remains largely below that of middle- and upper middle-income countries and of the global average. In 2022, manufacturing value-added (MVA) represented 11.24% of sub-Saharan Africa’s GDP against a global average of 16.24%. Fewer than ten African countries are above that, including eSwatini, Algeria, Gabon, Equatorial Guinea, D.R. Congo, Central African Republic, Lesotho, and Uganda, with Morocco and Egypt falling just below the 16.24% threshold. In most of these countries, industrial output as a share of GDP is high because it is driven by a few single industries in otherwise under-developed economies.
This is illustrated by data on industrial jobs as a share of total employment, which show that only eSwatini, Algeria, Lesotho, Morocco, and Egypt combine productive industries with jobs creation. Elsewhere, weak industrialisation levels naturally translate into low employment in industry. On average, the percentage of employment in African industries is half that of upper middle-income and middle-income countries.

**Weak industrialisation levels translate into lack of jobs creation**

Employment in industry as a % of GDP of total employment

<table>
<thead>
<tr>
<th>Region</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Middle Income</td>
<td>26.16</td>
</tr>
<tr>
<td>Middle Income</td>
<td>13.06</td>
</tr>
<tr>
<td>Africa Western &amp; Central</td>
<td>11.75</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>10.96</td>
</tr>
</tbody>
</table>

Source: World Bank (modelling G20 estimates)

**Manufacturing’s contribution to GDP is below the world average across most African countries**

Manufacturing value added in 2022, % of GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eswatini</td>
<td>26.63</td>
</tr>
<tr>
<td>Algeria</td>
<td>23.12</td>
</tr>
<tr>
<td>Gabon</td>
<td>22.84</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>16.73</td>
</tr>
<tr>
<td>Central African Rep</td>
<td>16.51</td>
</tr>
<tr>
<td>Uganda</td>
<td>16.37</td>
</tr>
<tr>
<td>Morocco</td>
<td>16.13</td>
</tr>
<tr>
<td>Egypt</td>
<td>15.97</td>
</tr>
<tr>
<td>Senegal</td>
<td>15.10</td>
</tr>
<tr>
<td>Lesotho</td>
<td>14.90</td>
</tr>
<tr>
<td>Tunisia</td>
<td>14.42</td>
</tr>
<tr>
<td>Togo</td>
<td>13.84</td>
</tr>
<tr>
<td>Nigeria</td>
<td>13.59</td>
</tr>
<tr>
<td>Cameroon</td>
<td>12.94</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>12.44</td>
</tr>
<tr>
<td>Cote d’Ivoire</td>
<td>12.28</td>
</tr>
<tr>
<td>Mauritius</td>
<td>12.09</td>
</tr>
<tr>
<td>South Africa</td>
<td>12.04</td>
</tr>
<tr>
<td>Guinea</td>
<td>11.44</td>
</tr>
<tr>
<td>Namibia</td>
<td>11.17</td>
</tr>
<tr>
<td>Ghana</td>
<td>10.18</td>
</tr>
<tr>
<td>Rwanda</td>
<td>9.91</td>
</tr>
<tr>
<td>Benin</td>
<td>9.82</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>9.67</td>
</tr>
<tr>
<td>Madagascar</td>
<td>9.50</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>9.11</td>
</tr>
<tr>
<td>Tanzania</td>
<td>8.19</td>
</tr>
<tr>
<td>Zambia</td>
<td>8.08</td>
</tr>
<tr>
<td>Congo</td>
<td>8.06</td>
</tr>
<tr>
<td>Kenya</td>
<td>7.83</td>
</tr>
<tr>
<td>Mozambique</td>
<td>7.81</td>
</tr>
<tr>
<td>Eritrea</td>
<td>7.64</td>
</tr>
<tr>
<td>Angola</td>
<td>7.43</td>
</tr>
<tr>
<td>Mali</td>
<td>6.44</td>
</tr>
<tr>
<td>Seychelles</td>
<td>5.81</td>
</tr>
<tr>
<td>Botswana</td>
<td>5.38</td>
</tr>
<tr>
<td>Mauritania</td>
<td>5.28</td>
</tr>
<tr>
<td>Sao Tome e Principe</td>
<td>5.25</td>
</tr>
<tr>
<td>Cabo Verde</td>
<td>4.66</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>4.24</td>
</tr>
<tr>
<td>Djibouti</td>
<td>3.70</td>
</tr>
<tr>
<td>Libya</td>
<td>3.00</td>
</tr>
<tr>
<td>Chad</td>
<td>2.85</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>1.88</td>
</tr>
<tr>
<td>Gambia</td>
<td>1.71</td>
</tr>
</tbody>
</table>

Source: World Bank national accounts data, and OECD National Accounts data files. Data is for 2021 and 2022 (latest year available).

NB: no data for Burundi, Comoros, Eritrea, Liberia, Malawi, Sudan, Somalia and South Sudan.
On the other side, agriculture remains predominant but is dominated by subsistence farming. It is largely traditional and inefficient due to a lack of mechanisation, limited use of agricultural inputs such as fertilisers, and low rates of technology adoption. Labour and land productivity are low – Africa's cereal yields are less than half the global average and approximately three times smaller than those of North American farms. Consequently – and despite agriculture’s large contribution to GDP – Africa has the highest prevalence of undernourishment in the world: 19.7% of the African population was undernourished in 2022 according to the Food and Agriculture Organisation (FAO). This compares with 8.5% in Asia, 6.5% in Latin America and the Caribbean, and 7% in Oceania.

Agriculture represents an excessive share of Africa’s GDP... agriculture, forestry and fishing value added in 2022, % of GDP

<table>
<thead>
<tr>
<th>Region</th>
<th>Value Added % of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>1.03</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>2.36</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>4.55</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>5.97</td>
</tr>
<tr>
<td>Middle Income Countries</td>
<td>8.75</td>
</tr>
<tr>
<td>Low &amp; Middle Income Countries</td>
<td>8.97</td>
</tr>
<tr>
<td>Eastern &amp; Southern Africa</td>
<td>13.92</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>17.35</td>
</tr>
<tr>
<td>Western &amp; Central Africa</td>
<td>21.89</td>
</tr>
<tr>
<td>World (4.33)</td>
<td>0</td>
</tr>
</tbody>
</table>

...yet remains very unproductive and inefficient. cereal yields in 2021, in kg/ha

<table>
<thead>
<tr>
<th>Region</th>
<th>Cereal Yields (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>7,141</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>5,261</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>4,032</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>3,997</td>
</tr>
<tr>
<td>Low &amp; Middle Income Countries</td>
<td>3,692</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>2,394</td>
</tr>
<tr>
<td>Eastern &amp; Southern Africa</td>
<td>1,840</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>1,588</td>
</tr>
<tr>
<td>Western &amp; Central Africa</td>
<td>1,341</td>
</tr>
<tr>
<td>World (4.152)</td>
<td>8,000</td>
</tr>
</tbody>
</table>

Source: World Bank

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83 World Bank
Little growth of manufacturing over the past decades means that, despite being home to 18.5% of the global population, Africa’s share of global manufacturing value added (MVA) stands at below 2%. That small share is then concentrated in only a few countries with Nigeria, Egypt, and South Africa accounting for half of the continent’s manufacturing activity in 2021. When Algeria and Morocco are added to this group, the share rises to almost 70% of Africa’s manufacturing value added – split between only five countries.

### 70% of Africa’s manufacturing output is concentrated in only five countries

<table>
<thead>
<tr>
<th>Country</th>
<th>MVA 2021, current US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>$65.7bn</td>
</tr>
<tr>
<td>South Africa</td>
<td>$49.4bn</td>
</tr>
<tr>
<td>Algeria</td>
<td>$43.4bn</td>
</tr>
<tr>
<td>Nigeria</td>
<td>$21.9bn</td>
</tr>
<tr>
<td>Morocco</td>
<td>$21.9bn</td>
</tr>
</tbody>
</table>

Source: World Bank

The same disparity appears within UNIDO’s Competitive Industrial Performance Index (CIP), where Africa is the least competitive continent but with considerable heterogeneity between regions. The index ranks the industrial competitiveness of 152 countries, but only 33 African countries make the list. While Southern and Northern Africa are positioned in the upper half of figures, supported by the industrial performance of economies such as South Africa, Morocco, and Egypt, other African regions — Western, Central, and Eastern Africa — fall in the bottom of the ranking.

### Africa represents less than 2% of global manufacturing output

<table>
<thead>
<tr>
<th>Region</th>
<th>Share in world manufacturing value added (MVA) in 2021, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>sub-Saharan Africa</td>
<td>19.1</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>54.1</td>
</tr>
</tbody>
</table>

Source: UNIDO

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85 UNIDO.

86 UNIDO’s Competitive Industrial Performance (CIP) Index looks at three dimensions: capacity to produce and export, technological deepening and upgrading, and world impact. In Africa, in capacity to produce and export Eswatini leads, for technology Morocco leads, and in world impact South Africa takes the lead. Surprisingly, South Africa, which has the highest overall CIP, is far from the lead in the production/export dimension, which can be explained by its limited capacity to produce and export manufactured products considering the size of its population. In general, the low rankings of African countries on the CIP Index are mostly due to limited production and export capacity.
Considering rapid population growth, MVA per capita is growing at a slower rate than the global average: 0.7% per year from 2012 to 2019 in Africa compared with 2.1% per year over the same period globally.\(^{87}\)

Unfortunately, inconsistent data over long periods of time make it hard to analyse actual industrialisation trends on the continent or on a country-by-country basis. To identify which countries have shown signs of industrialisation and which countries are struggling with expanding their industrial base, we have looked at three different variables, including changes in the industrial share to GDP based on nominal added value; changes in the industrial share to GDP based on the real added value; and changes in the share of industry within total employment (modelled ILO estimate). While the nature and diversity of data sources calls for caution, we do identify some overall trends and patterns.

We find that only Gabon, Equatorial Guinea, Togo, and to a lesser extent Mali, Djibouti and Lesotho have demonstrated clear signs of industrialisation between 2000 and 2022. They are the only countries to post real positive changes in industrial share across the three variables for the period – even though their industrial growth was mostly led by low-technology manufacturing. Gabon’s industry grew from the mid-2000s onwards and was further supported by a 2010 ban on exports of raw logs that encouraged local wood processing. The opening of Arise IIP’s Gabon SEZ has helped to double the value of timber exports since then and improve fiscal revenues. In West Africa, Togo almost doubled the share of MVA within its GDP over the past decade alone and has multiplied its employment in industry by a factor of three since the start of the millennium. The country is now seeking to make better use of its cotton to boost local production and export of textiles via the Adétikopé Industrial Platform (PIA) of Arise IIP, from where it shipped its first cargo to the USA in 2023. The cotton-based garments industry is also responsible for supporting Lesotho’s industrial growth in Southern Africa, helping the country to maintain Africa’s highest share of employment in industry for many years.

\(^{87}\) “African industrial competitiveness report: An overview of the manufacturing industry in the region,” UNIDO.
Equatorial Guinea is a different case as industrialisation there has been supported by a successful monetisation of natural gas with the opening of a methanol production plant in 2001 and LNG export terminal in 2007, both destined for exports.

Beyond these countries, we find a series of mixed cases where positive changes in real value-added shares do not always coincide with changes in nominal value-added shares (D.R. Congo, Zimbabwe, Guinea, Burundi for instance).

They are followed by a third category where industrial jobs have grown a lot faster than on the rest of the continent (over 5% for the period) but the share of industry in GDP has decreased or stagnated for all of them (Senegal, Mozambique, Tanzania, Rwanda). Reasons vary but point to an increasing share of labour-intensive industries with low productivity or technological intensity. Finally, the analysis shows clear deindustrialisation in South Africa, Mauritius, Seychelles and Mauritania, each posting negative trends across all three variables.

The chart to the right illustrates most of the changes in variables for these countries. Countries not featured include North African markets where industrialisation levels are already high, markets where variables have changed very little over the period (Nigeria, Zambia, Botswana, Niger, Sao Tome e Principe, Ethiopia), and markets where data is not available over the period (Sudan, South Sudan).

Africa’s industrialisation is stalling or yet to pick up in most countries

Evolution of industrial shares in real GDP, nominal GDP and total employment

Source: UNSTATS, World Bank, AFC Research
The two biggest needs for Africa’s industrialisation are physical infrastructure and funding. Infrastructure constraints described in previous sections – especially Africa’s persistent energy deficit and logistics bottlenecks – have a direct impact on the continent’s ability to expand its industrial base.

Unreliable and expensive electricity supply is an impediment to the growth of energy-intensive or medium-high and high-technology industries such as food processing, materials manufacturing (aluminium, chemicals, glass, refining, steel etc), or water and wastewater treatment facilities. In the latest World Bank’s Enterprise Surveys for instance, sub-Saharan Africa registered the highest percentage of firms experiencing electrical outages (73.9%) and the highest share of firms owning or sharing a generator (51.6%). Efficient, modern, reliable infrastructure is also required for the development of a competitive agroindustry that enables the continent to transition away from subsistence farming. This move requires roads, railways, electricity, water, irrigation, and communications to grow yields and improve access to markets. Without this physical infrastructure, African perishable products cannot be kept fresh for transportation to agro-processing plants or for storage to minimise post-harvest losses.

To industrialise, Africa also needs access to capital. According to the latest UNIDO statistics, only one in three small manufacturing enterprises has a loan or line of credit. Access to credit is uneven across countries and regions and Sub-Saharan African countries, like most least developed countries (LDCs), suffer most from lack of credit access. Less than 16% of small manufacturing enterprises in sub-Saharan Africa have access to financial services compared with 44.2% in Latin America and 45% in Oceania (excluding New Zealand and Australia). In the current context of persistent inflationary pressures and high interest rates (see Section 1), borrowing costs are likely to remain detrimental to manufacturing businesses and will make it hard to unlock additional investments into African industry.

**1.3. Lack of physical infrastructure and limited access to credit continue to prevent the expansion of Africa’s industrial base.**

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**UNIDO Yearbook of Industrial Statistics.**
2. Africa can bet on a commodities-led industrialisation to maximise its industrial potential.

Lack of industrialisation and local transformation mean that African countries continue to export raw materials and import finished products. In fact, Africa’s dependence on imports for its consumption is the highest in the world as a share of its GDP. A large portion of its trade deficit is made up of finished and manufactured goods, indicating Africa’s production systems are inadequate and the continent is dependent on foreign manufacturing and finished goods to meet its needs.

2.1. Extractivism has so far made Africa an exporter of raw commodities and importer of finished products.

Lack of domestic processing infrastructure forces Africa to export most of its commodities raw without much valorisation or transformation. Côte d’Ivoire and Ghana, the world’s two biggest cocoa producers, still export 80-90% of their cocoa production despite recent progress in expanding domestic cocoa processing. Guinea, which holds the world’s largest reserves of bauxite and is the world’s biggest producer with Australia, exports nearly all its production overseas for refining into alumina used in aluminium production. By contrast, Australia, which produces about the same level of bauxite, processes 60% of it and can both refine its own alumina and produce aluminium – thereby capturing billions of dollars of additional value from its resources (see Box 1, Page 85).

The same patterns can be observed with respect to most commodities and products, including basic ones such as food and fuel. Africa holds 65% of the world’s remaining arable land, yet its imports of cereals and foodstuffs continue to grow. Food imports have increased significantly in recent years, driven by the demand for cereals, overseas imports of which neared 100 million tonnes in 2021.

Beyond cereals, many countries also import basic foodstuffs such as dairy products, edible oils and fats, meat and meat products, and sugars to meet domestic consumption needs. Africa possesses significant reserves of oil and gas, yet it faces a shortage of petroleum products for domestic consumption and depends on foreign refineries to process its own crude oil before reimporting it. The continent’s existing refineries, predominantly small and outdated except for a few in North Africa, Nigeria, and South Africa, are insufficient to satisfy the increasing demands of its populations. Consequently, Africa’s refinery throughput has declined, making it a net importer of petroleum products since 2015. Over the past decades, Africa has exported between 75-85% of its crude oil production, leaving minimal quantities for local transformation and refining into petroleum products.

The continent’s reliance on imports for basic food and fuel adds to its vulnerability to global commodity price fluctuations and is currently exacerbating inflationary and fiscal pressures (see Section 1).
Moving forward, Africa should make better use of these commodities to drive its industrialisation agenda. At the African Union Summit of 2022 in Niger, African leaders committed once more to the acceleration of commodity-based industrialisation through regional value chains. In doing so, they identified key priorities around the health and pharmaceuticals, automotive, mineral beneficiation, food and nutrition, and cotton and apparel sectors.

These represent a series of industries with low to high-technology needs that can tap into the diversity of the continent’s resources. To meet these objectives, governments agreed to enhance domestic resource mobilisation and allocate 5-10% of national budgets to industrial development; increase investments in infrastructure and energy; and develop sustainable special economic zones (SEZs) and industrial parks. To that effect, the number of SEZs is on the rise across the continent, with landmark projects planned, announced, or under-construction in most African markets (47 of the 54 economies).

While textiles and apparel have delivered some success stories in light manufacturing (Togo, Lesotho), recent industrialisation trends show a growing focus on investing in agroindustry and mineral beneficiation to diversify into medium- and high-technology-intensive value chains. In particular - and given growing global demand for critical minerals for the smartphone, electronics, and cleantech industries - the push for a commodity-based industrialisation that would localise the manufacturing and transformation of African minerals is gaining traction.

The growth of electronic and smartphone manufacturing value chains has already started to demonstrate Africa’s potential. In recent years, several African companies, including Mara Group in Rwanda, Onyx in South Africa, and VMK in the Republic of the Congo, have made significant strides in the precursor development market.

Additionally, China’s leading mobile manufacturer, Transsion, has successfully captured the market for affordable and reliable smartphones. Since 2011, every phone sold by Transsion in Africa has been assembled in Ethiopia, with its TECNO brand becoming one of the top smartphone sellers across the continent. Expanding mobile telephone supply chain capacities in Africa could further unlock potential within the electronics supply chain, paving the way for the production of tablets, laptops, high-performance servers, and data storage solutions.

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90 The development of an African commodities strategy that would move Africa from a global raw materials supplier to a continent that uses its own resources is a key part of the Agenda 2063 Programme for Infrastructural Development in Africa.

91 “Africa must industrialize: 10 key points that African leaders committed to at the just concluded summit on industrialization and economic diversification,” African Union, 1 December 2022.

92 According to the latest African Economic Zones Outlook (2021) of the Africa Economic Zones Organization (AEZO), more than 200 SEZs are operational in Africa and 73 projects have been announced for completion in 47 countries. This is a fourfold increase since 2000 when only 50 SEZs were in place. The zones are distributed across the continent with 29% in Northern Africa, 26% in Eastern Africa, 24% in Western Africa, 15% in Southern Africa, and 6% in Central Africa. More than half these zones follow the PPP model, with 38% operating under the public model and only 9% using the private model.

93 See Economic Development in Africa Report 2023, UNCTAD.
2.2. Global transitions to a low-carbon future offer Africa opportunities to join higher technology-intensive value chains.

To be competitive and sustain growth, African manufacturing must rely on technology-led industrialisation that integrates the continent within global value-chains and increases the technological intensity of its industries. Until now, medium-, medium-high and high-technology manufacturing has been concentrated within countries that exhibit the most industrial competitiveness such as Egypt, South Africa, and Morocco thanks to competitive chemicals, pharmaceuticals or motor vehicle manufacturing clusters.

But as a continent, Africa still has the lowest share of medium-high technology (MHT) manufacturing in the world outside of Oceania, which keeps productivity levels low. Its share of MHT manufactured exports is half that of North America (68%), Europe (64%), and Asia (63%).

Amid a transition to low-carbon economies and cleaner sources of energy, the world’s demand for minerals that are found in Africa is growing. These include lithium, nickel, cobalt, copper, uranium, rare earth elements (REEs), manganese or bauxite to name a few. So far, most of these minerals have been extracted for exports and processing overseas into storage battery systems, electric vehicles, fuel cells, steel, or aluminium. While Africa holds a significant share of these critical minerals, their processing overseas has created imbalanced critical minerals supply chains that keep the continent out of added-value beneficiation and manufacturing.

### Technology-intensive manufacturing is concentrated in North Africa, South Africa and Nigeria

Percentage share of total value added for each respective technology group, %

<table>
<thead>
<tr>
<th>Low-Technology</th>
<th>2000</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>23.6</td>
<td>25.2</td>
</tr>
<tr>
<td>Nigeria</td>
<td>15.3</td>
<td>22.7</td>
</tr>
<tr>
<td>South Africa</td>
<td>20.3</td>
<td>12.2</td>
</tr>
<tr>
<td>Morocco</td>
<td>6.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Algeria</td>
<td>7.7</td>
<td>4.2</td>
</tr>
<tr>
<td>Angola</td>
<td>1.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Ghana</td>
<td>2.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Kenya</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Tunisia</td>
<td>3.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.4</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium-Technology</th>
<th>2000</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>5.8</td>
<td>22</td>
</tr>
<tr>
<td>Nigeria</td>
<td>32.5</td>
<td>16.3</td>
</tr>
<tr>
<td>South Africa</td>
<td>28.8</td>
<td>17</td>
</tr>
<tr>
<td>Morocco</td>
<td>9.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Angola</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>Ghana</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Senegal</td>
<td>2.1</td>
<td>3</td>
</tr>
<tr>
<td>Tunisia</td>
<td>2.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Zambia</td>
<td>0.9</td>
<td>1.7</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Medium-High and High-Technology</th>
<th>2000</th>
<th>2020</th>
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<tr>
<td>Egypt</td>
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</tr>
<tr>
<td>South Africa</td>
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<td>24.5</td>
</tr>
<tr>
<td>Morocco</td>
<td>13.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Tunisia</td>
<td>5</td>
<td>4.9</td>
</tr>
<tr>
<td>Nigeria</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Ghana</td>
<td>1.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Kenya</td>
<td>2.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.5</td>
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<tr>
<td>Senegal</td>
<td>1.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Mali</td>
<td>0.4</td>
<td>1.7</td>
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</tbody>
</table>

NB: Shares in per cent of total value added of the respective groups: blue points show minimum/maximum values

Source: UNIDO International Yearbook of Industrial Statistics, 2022

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94 The need for a technology-led industrialisation and development has been recognised repeatedly by the United Nations in three resolutions proclaiming three separate industrial development decades, most recently for 2016-2025; in its 2030 Agenda for Sustainable Development which targets inclusive, sustainable industrialisation; and in the Programme of Action for Least Developed Countries for the Decade 2011-2020, which focused on building critical mass of productive manufacturing capacity.

In this context, mineral beneficiation offers a timely opportunity to monetise local natural resources, increase the technological intensity of African manufacturers, diversify value-chains and make them more sustainable by cutting costs and emissions related to the outsourcing of minerals refining and transformation overseas. In 2021 for instance, a study by BloombergNEF (BNEF), commissioned by AFC and its partners, demonstrated that it would be three times cheaper to produce battery precursors in the Democratic Republic of Congo than in the United States or China. The DRC has the cobalt resources and hydroelectric power necessary to be a low-emissions producer of these materials and at the same time compete on cost. Emissions could be cut by up to 30% compared to China if cathode precursor materials are produced in the DRC.

The acceleration of the green energy transition is already inspiring several reforms and policy moves to expand critical mineral value chains in Africa, with a recent push for more integration and beneficiation. In December 2022, Zimbabwe banned the export of unprocessed lithium ore, followed by Namibia in June 2023. Ghana’s government has also sent signals that it will follow suit, while Guinea has embarked on an alumina refining push forcing its bauxite miners to work on setting up refineries across the country. But for these policy moves to be successful and translate into a concrete expansion of Africa’s industrial base, they need to be accompanied by the development of regional value-chains and forward and backward linkages that maximise the resources of each market and promote infrastructure sharing.

**Future cross-border value-chains that unlock Africa’s industrialisation potential must support the development of horizontal and vertical linkages across companies, countries, and regions.**

The growth of African industries requires coordinated regional policy and a focus on maximising synergies from each respective market considering their levels of natural resources, technological capabilities, and inter-connections. Technology-intensive manufacturing typically requires a stable political and economic environment, ease of procuring raw materials and feedstock, efficient logistics to access markets, cheap and reliable electricity, land and water, and availability of labour.

In South Africa, recent years have demonstrated how unreliable power supply and underinvestment in logistics infrastructure can quickly turn the economic tide and affect industrial output. Because the country has the highest level of integration in the beneficiation of critical minerals, its current economic and infrastructure woes are giving other countries the opportunity to develop processing and beneficiating capabilities that could support the development of new regional value-chains. This is the case of the D.R. Congo and Zambia for instance; both currently working to establish a shared special economic zone focused on processing their vast copper reserves for development of the electric vehicle battery sector. To understand the infrastructure opportunities and challenges associated with the local processing of African minerals, we attempt to assess the potential for further localising bauxite-to-aluminium and copper manufacturing on the continent. We find that while sharing similar needs around energy access and logistics infrastructure, the beneficiation of both minerals has very different value-added propositions and calls for different approaches in value-chain development.
Box 1: The Case for Building an Aluminium Value-Chain in Africa

The demand for aluminium is set to grow, driven by global industrial transformation, population growth and the scaling up of clean technologies such as lightweight vehicles and solar energy. In theory, this presents a tremendous opportunity for Africa given that Guinea holds the world’s largest reserves of bauxite and is the top global producer of the mineral. In practice however, very little value addition occurs after bauxite is extracted as the rest of the transformation process is made overseas, far from African shores. As a result, most of the value of the aluminium supply chain is generated outside of the continent.

Turning bauxite into aluminium is a lengthy and energy-intensive process that requires refining bauxite into alumina before smelting it into aluminium metal. Bauxite is produced worldwide, with large supply centres in Guinea, Australia, and China, but its processing is concentrated within a few countries that have the refining and smelting capacities to do so. China, which houses over 200 smelters97, is the world’s largest bauxite processing centre.

Africa houses only a few alumina refineries and aluminium smelters. The operating ones are in Mozambique (MOZAL), South Africa (Hillside) and Egypt (EGYPTALUM). Additional facilities exist in Cameroon (ALUCAM) and Ghana (VALCO) but lack feedstock, energy, and capital to function. All the continent’s bauxite from West Africa is exported to China while processing plants in Mozambique and South Africa rely on imported feedstock from Australia and Brazil. Supply-chains are fragmented so materials are shipped back and forth across the oceans, increasing the carbon footprint of finished products.

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The value loss is significant considering that a tonne of alumina is worth five times more than a tonne of bauxite, and a tonne of aluminium is worth on average five times more than a tonne of alumina\[47\]. That loss for Africa is captured when comparing Australia and Guinea, the world’s two biggest bauxite producers, which produced about 100 million tonnes of bauxite each in 2022. Guinea, which has the world’s largest reserves, only has one refining facility that produced 336,100 tonnes of alumina in 2022 – compared with 76 million tonnes in China the same year – and does not have a single smelter. By taking an average of $50/tonne for bauxite and $360/tonne for alumina in 2022, the country’s bauxite industry represented some $5.3bn that year.

In comparison, and with the same quantity of bauxite extracted, Australia produced 20.3 million tonnes of alumina and 1.51 million tonnes of primary aluminium metal in 2022\[99\]. With six alumina refineries and four aluminium smelters, the country can process 60% of its bauxite and 20% of its alumina. From bauxite mining to aluminium production, its industry represents over $10bn in export earnings – twice what Guinea’s industry generates and almost half of Guinea’s entire GDP.

Capturing some of that lost value would require the development of new supply chains on the continent with a particular focus on accessing cheap energy. Aluminium production is one of the world’s most energy and carbon-intensive industries. Refining bauxite into alumina requires digestion and calcination with a combination of heat and power generation, while smelting relies on electrolysis that consumes high levels of electricity. Traditionally, one metric tonne of aluminium requires some 14,000 kWh of electricity, even though new technology can reduce this to some 13,500 kWh per tonne. To put this into perspective, it is 85 times more than Guinea’s per capita annual electricity consumption.

Such high electricity demand explains why most bauxite refineries and aluminium smelters are located next to abundant and cheap sources of electricity: coal in China, hydropower in Russia, or natural gas in the Middle East. These regions have successfully leveraged their low-cost hydroelectric power and gas reserves to industrialise and develop multi-billion-dollar industries. In China, for instance, the electricity demand from the aluminium industry is estimated to represent over 90GW of installed power capacity\[100\], or three times more than West Africa’s total installed grid-connected power generation capacity. In short, Africa must address its energy deficit and affordability if it wants to develop its aluminium value-chain.

Because it holds most of the continent’s bauxite reserves, West Africa is a prime location to localise refining and smelting but would need to strengthen its energy trade and cooperation to make gas more available and promote the trading of affordable green electricity coming from hydropower and solar.

West African markets seeking to produce aluminium for the region could rely on natural gas found in abundance from Nigeria to Senegal/Mauritania. The planned Nigeria-Morocco Gas Pipeline could boost gas availability in the region to support power and heat generation within bauxite refineries. Natural gas can also support the establishment of smelters – providing it is cheap – ensuring the establishment of an industrial base now that could eventually be fuelled by hydrogen in the long term, thereby ensuring the development of future-proof industrial infrastructure.

But to be competitive in the aluminium export market, West Africa would need to rely on low-carbon sources of electricity if it wants its future aluminium production to be competitive globally and not be penalised by the upcoming EU carbon tax. The region’s best available resource would be hydropower or a mix of renewable energy, which can only be secured via electricity trading. Hydropower is the region’s only scalable source of baseload green electricity, but most of its untapped potential is located away from mining centres. To access it, the promotion of electricity trading and the expansion of the regional power pool would become a necessity.

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\[98\] Based on average prices of $40-70 per tonne for bauxite, $350-360 per tonne for alumina, and $2,100-2,300 per tonne for aluminium.

\[99\] The Australian Aluminium Council

Box 2: The Case for Copper

Just like aluminium, the demand for copper is set for significant growth given its wide usage across power (wind, solar, nuclear, gas), transmission lines, distribution grids or transformers, but also in machinery and equipment, transport, infrastructure, and plumbing. This has implications for both the Democratic Republic of Congo and Zambia, the world’s second and ninth biggest copper producers.

However, evaluating the added value of copper processing is more complex than for bauxite, because the finished product is not a single unit measurable by tonnes – like aluminium – but a diverse range of products such as cars, machinery, cables, wire, or electronic appliances that are made from an array of inputs. To get there, copper essentially goes through two distinct processes that have their own value-chains. The first involves the mining of copper ore and its smelting and refining into cathodes, and typically happens around mining centres. Copper concentrates are fed into a smelter to create blister copper, which is then cast into anodes. Copper anodes are eventually refined by electrorefining to produce cathodes, which are the semi-finished products used to produce semi-manufactures. The processing of these cathodes into semi-manufactures forms the second stage of copper processing, when copper is turned into wire, tubes, castings, or alloys that are used in machinery, construction, and utilities. This second phase has traditionally happened next to manufacturing and consumer hubs in Europe, North America, and Asia.

This segmentation between stage 1 processing at the mines and stage 2 processing at manufacturing and consumption clusters is largely explained by added value and price differentials. While processing copper into concentrates and then refining it into cathodes adds significant price value (from 2.5 to 4 times higher), moving further into semi-manufactures generates limited gains.

On average, the unit price for semi-manufactures is only about a fifth higher than refined metal\textsuperscript{101}; while margins in copper fabrication have traditionally been lower than in its mining and refining\textsuperscript{102}. This explains why even Chile – the world’s largest copper producer – has not truly evolved into a major global copper fabricator beyond meeting the needs of its local industry and infrastructure.

Most of African copper is transformed overseas before being reimported as finished products

Copper inputs within the automotive value-chain

<table>
<thead>
<tr>
<th>Country</th>
<th>Copper reserves</th>
<th>Copper production</th>
<th>Refinery production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>196,000</td>
<td>2,200</td>
<td>2,100</td>
</tr>
<tr>
<td>Peru</td>
<td>81,000</td>
<td>1,900</td>
<td>1,700</td>
</tr>
<tr>
<td>China</td>
<td>27,000</td>
<td>2,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Congo, DR</td>
<td>31,000</td>
<td>770</td>
<td>550</td>
</tr>
<tr>
<td>Zambia</td>
<td>19,000</td>
<td>2,000</td>
<td>1,700</td>
</tr>
</tbody>
</table>

Source: USGS

\textsuperscript{101} Makgetla, Neva; Levin, Saul; Mtanga, Sithembiso (2019): Moving up the copper value chain in Southern Africa, WIDER Working Paper.

\textsuperscript{102} World Bank (June 2011). What is the Potential for More Copper Fabrication in Zambia? Report No. 62379-ZM.
Over the years, both the D.R. Congo and Zambia have made progress in their smelting and refining of copper. The former now refines about 75% of its production and exports copper cathodes; while the latter refines about half of its copper output and exports mostly copper anodes that have not gone through electrolytic refining yet. Most copper is sent to Asia – especially China, which is the world’s largest copper refiner – with additional exports registered from Zambia to South Africa, North America, and to Swiss traders.

Neither the DRC nor Zambia have truly moved into semi-manufactures and copper fabrication has remained limited despite repeated plans and policies to support the growth of the value-chain in both countries. Value-chain fragmentation is particularly visible in the automotive sector, given that Asia processes Congolese and Zambian copper into wires that are exported back to Africa – this time in Egypt, Morocco and Tunisia – to be processed into insulated wires that are shipped to European car manufacturers. Europe then ships back to Africa cars, vehicle components and machinery that all contain copper that was extracted but not transformed on the continent.

Previous experiences in Zambia have revealed several challenges associated with copper fabrication in the region\textsuperscript{103}, including lack of manufacturing clusters to anchor local and regional demand (except in South Africa); inefficient logistics that make it expensive to secure inputs required for alloys or consumer goods fabrication; and unreliable power supply. These factors ended up offsetting the little gains that downstream industries would get by being close to copper supply.

In that condition, what’s next for copper in Africa? Tighter supplies of copper globally have created price volatility that should provide an incentive to mine and produce more of the mineral in the coming years – especially given positive demand growth until 2040. In response, Zambia has already stated its ambition to produce 3 million tonnes of copper per annum in a decade, a fourfold jump from current volumes. It is also part of the Southern African Power Pool (SAPP) – Africa’s most sophisticated regional electricity trading network – and is the only country in Africa where private firms are present across the three segments of the power value-chain: generation, transmission, and distribution\textsuperscript{104}. Because mining represents over half of Zambia’s electricity consumption, having a liberalised power market is a significant advantage to boosting private sector investments into energy access and affordability. The country also houses the Copperbelt Energy Corporation, a utility largely dedicated to providing electricity to mines. It supplies power to both Zambian and Congolese miners and ambitions to commission 300 MW of renewable energy by 2027 and convert its 80 MW of diesel stations to gas\textsuperscript{105} to ensure more affordable and cleaner energy to the sector.

Logistics-wise, Zambia has also gone a long way since it opened Africa’s first one-stop border post (OSBP) in 2009 at Chirundu, on the Zimbabwean border. The crossing continues to offer a more efficient access to Southern African corridors and ports to the South, and will soon be complemented by a new western axis to Angola via the Lobito Corridor, and a revamped eastern axis to Tanzania via the rehabilitation of the TAZARA railway line. With these new corridors, Zambia can establish land links to its neighbours and both the Indian and Atlantic Oceans, and ensure that being landlocked is no longer a disadvantage.

As Zambia gets a new shot at boosting its copper sector, several new dynamics are in place that should help the country avoid its previous shortcomings. To start with, the country has a well-articulated industrial policy put in place in 2018 to increase the contribution of manufacturing to GDP to 15%, accompanied by a multitude of fiscal incentives within special economic zones.

Finally, and at times of increasing global polarisation, Zambia maintains strong ties with both Western and Eastern partners and combines political and social stability that make it a credible location to localise manufacturing and anchor new regional value-chains.

In its efforts to tap into its copper development potential, Zambia is also committed to regionalising the value-chain by cooperating with D.R. Congo, which produces copper in larger quantities on the Copperbelt across its northern border. By pooling resources, coordinating regional policy, and promoting infrastructure sharing, Zambia has an opportunity to capture a much larger share of the global copper value chain.

\textsuperscript{103} Makgetla, Neva; Levin, Saul; Mtanga, Sithembiso (2019): Moving up the copper value chain in Southern Africa, WIDER Working Paper

\textsuperscript{104} Saggese, Alligera; Shawa, Benjamin; Wani Shahrukh (2024): Positioning Zambia for a copper-plus future, IGC Policy Paper.

\textsuperscript{105} Africa Energy Outlook 2022, EA

\textsuperscript{106} Zambia has started engaging with both Namibia and Tanzania for natural gas pipelines out of Walvis Bay (~1,700km) and Dar es Salaam (~1,700km), which could provide supply security for a wide range of industries. As an alternative, new onshore gas discoveries in Zimbabwe over 2023/2024 are also located only 300km away from Lusaka.
Critical minerals beneficiation offers a unique opportunity to tap into growing demand for clean technologies while promoting industrialisation models that rely on medium-high and high technology manufacturing. But as demonstrated by bauxite and copper, not all local processing has the same advantages and benefits, and a deeper understanding of commodities value-chains is required to identify the most pragmatic industrialisation strategies for each African country.

Shifting away from the extractivism that has dominated African commodities for decades will not be a one-size-fits-all approach and must rely on a pragmatic development of cross-border linkages making the best of each country’s resources and needs. In that journey to industrialisation, Africa must also first and foremost address its infrastructure deficit – especially making energy reliable and affordable for industries and developing cross-border logistics that make it faster and cheaper to access inputs and trade goods.
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