

AI for Africa: Use cases delivering impact

Nigeria deep dive

August 2024



GSMA

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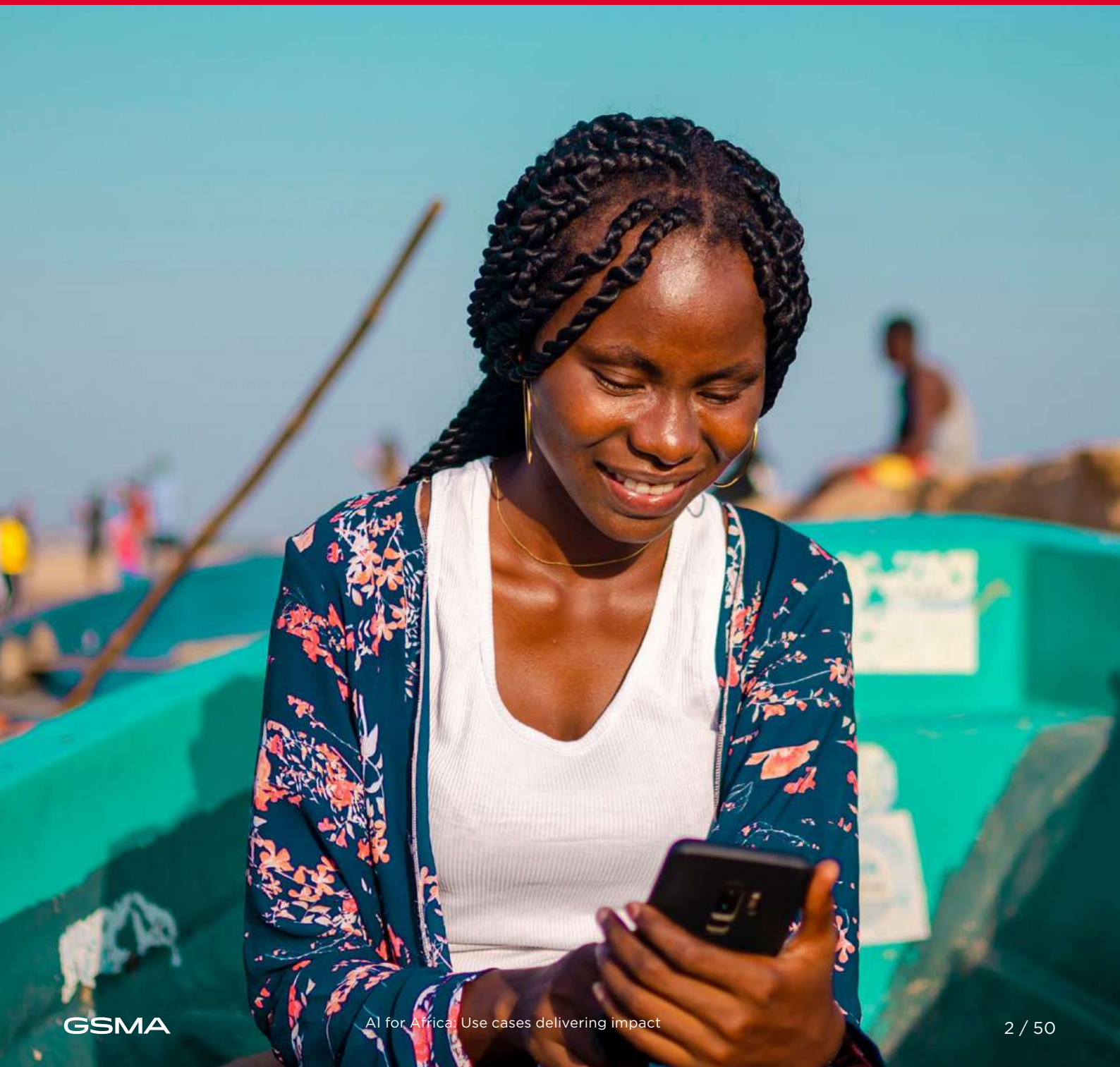
We would like to thank the many individuals and organisations that contributed to the research. A full list of organisations consulted for the research in Nigeria is listed in Annex 3. We are particularly grateful to Adedolapo Adegoroye (Tech Hive Advisory), Chioma Okoro (Wootlab Foundation), Christos Oyeniran (Lagos Business

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Contents

1.	Introduction	2
2.	Use cases delivering impact	4
	Agriculture and food security	6
	Energy	12
	Climate action	18
3.	Building a thriving environment	22
	AI fundamentals	24
	Broader enabling environment	32
4.	Recommendations	36
5.	Annexes	42

1. Introduction

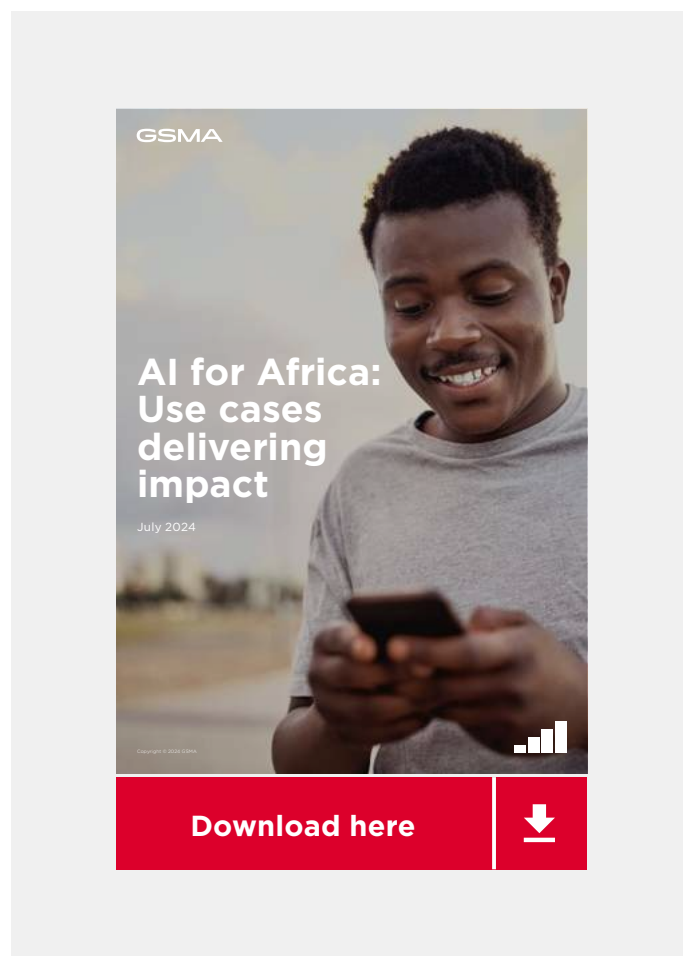


With over 220 million people, Nigeria is the most populated country in Africa and the sixth most populous worldwide. It achieved lower-middle-income status in 2014 but in the past decade, Nigeria's growth rates have decreased and its GDP per capita flattened, driven by macroeconomic distortions and external shocks. The country continues to face many social and economic challenges, including high inflation, insecurity, limited human capital, spatial inequality and widespread poverty. Estimates suggest that 39% of the total population lives below the poverty line.¹ Following a change in administration in June 2023, the country has been pursuing bold reforms to re-establish macroeconomic conditions for stability and growth.²

Despite facing development challenges, Nigeria has emerged as a technology leader in Africa. The government has fostered a conducive environment for innovation and is driving various initiatives for skill building and research and development. Nigeria has the highest number of tech hubs on the continent and has produced several successful startups. Sector investments support the deployment of local data storage capacity and Nigeria has made steady progress in expanding mobile network coverage, with 3G and 4G networks covering 99% and 84% of the population, respectively.³ However, the usage gap⁴ remains high and poor network performance undermines internet usage. Regular power outages still occur across the country, and a significant share of the population does not have access to electricity, especially in rural areas.

While there are key gaps that need to be addressed, there is huge potential for Nigeria to build on its growing tech ecosystem and existing digital foundations to unlock the potential of AI and accelerate its development trajectory. This report showcases existing and emerging AI-enabled use cases and solutions that can address development challenges related to agriculture and food security,

energy and climate action in Nigeria. It explores the key requirements for the development of use cases and provides an overview of the AI ecosystem to identify gaps and opportunities to harness the potential of AI for development. The report is one of three detailed country-level reports examining the potential of AI for development in Kenya, Nigeria and South Africa. It complements the primary report, '[AI for Africa: Use cases delivering impact](#)', which introduces key concepts around AI and includes regional and sectoral insights.



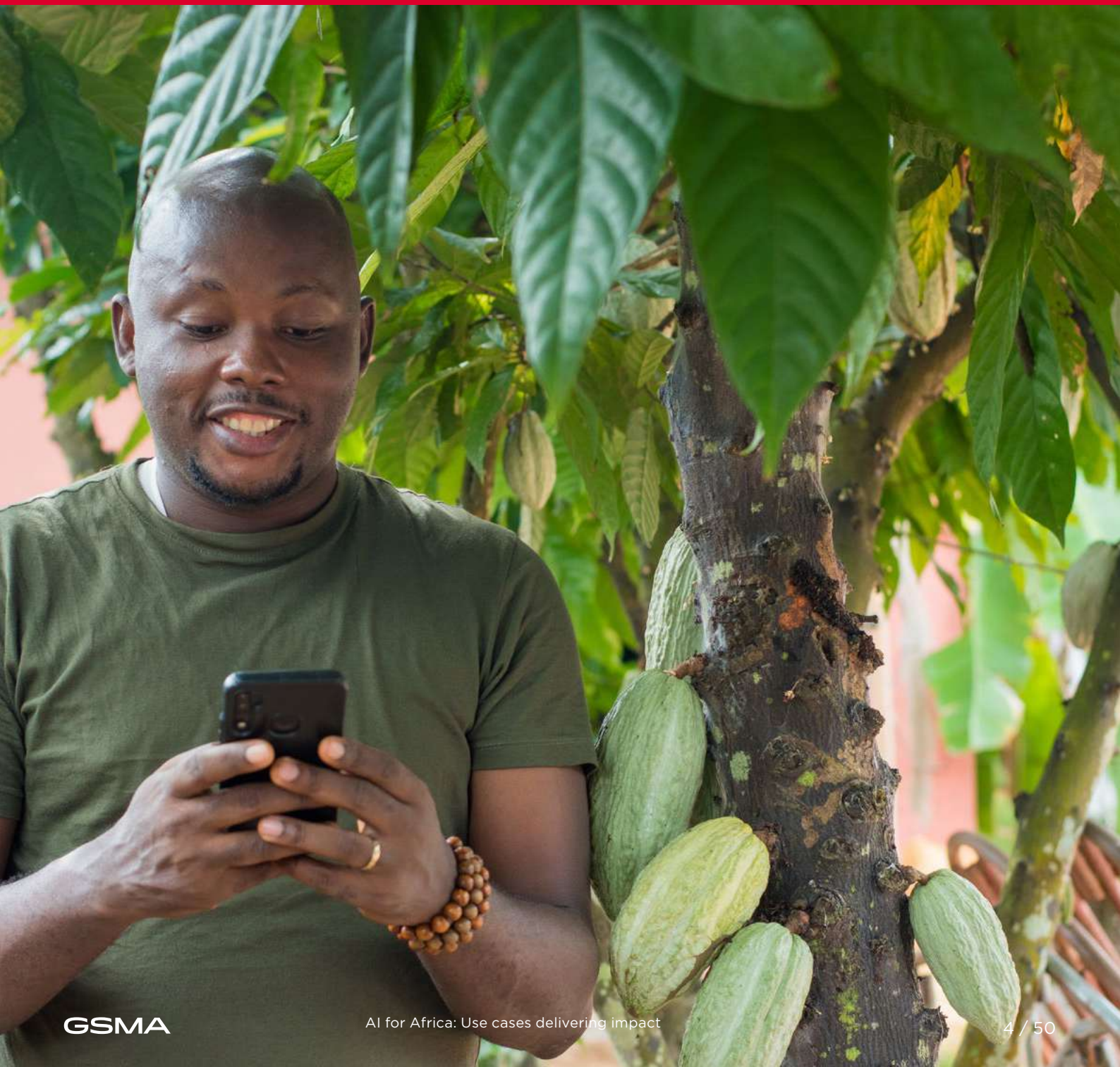
¹ [World Bank Nigeria](#)

² Ibid.

³ [GSMA Intelligence](#) estimates.

⁴ The usage gap refers to the proportion of the population that lives within the footprint of a mobile broadband network but does not use mobile internet. Typical barriers include affordability, literacy and digital skills, relevance, safety and security and access. See: GSMA. (2023). [The State of Mobile Internet Connectivity Report 2023](#).

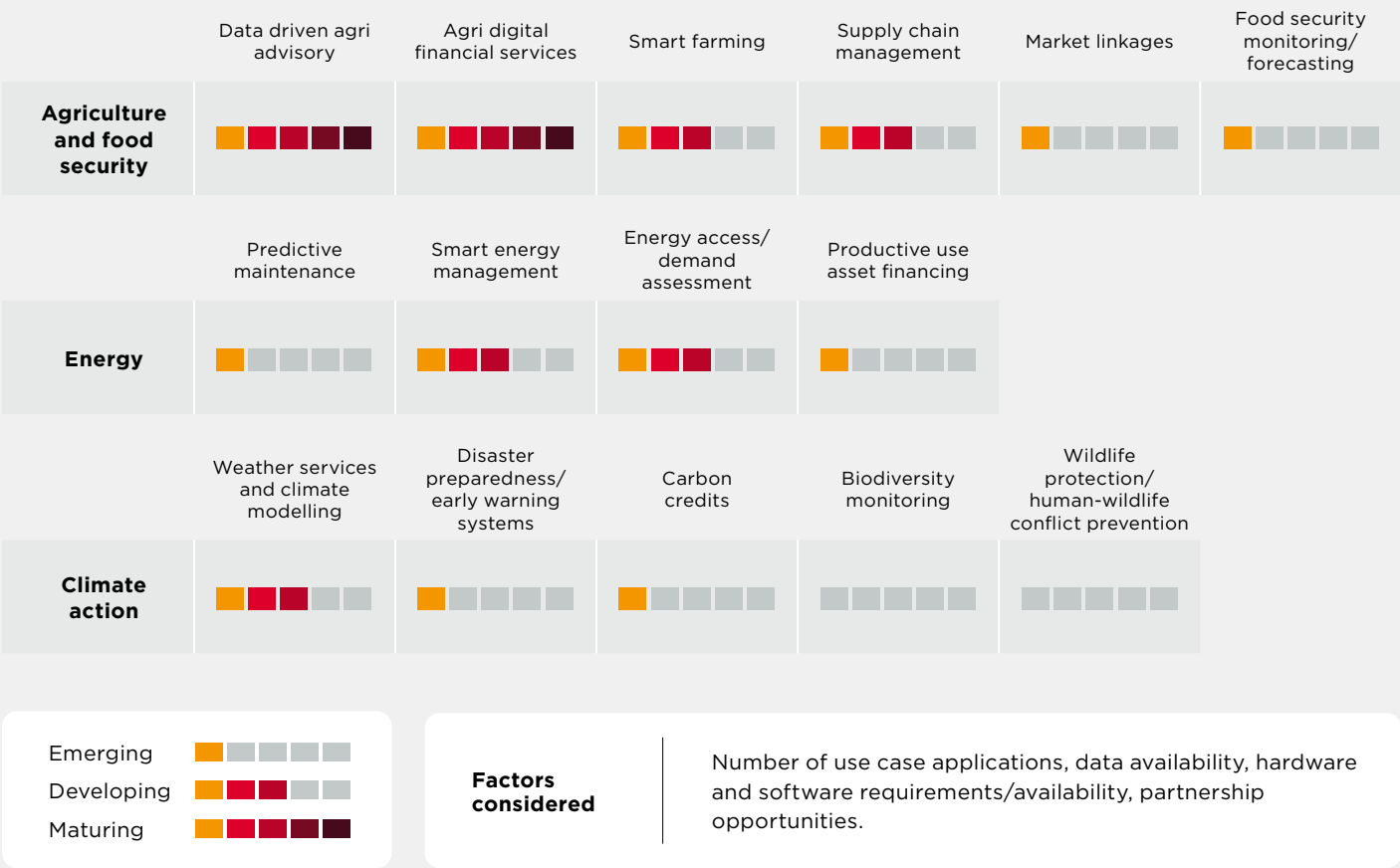
2. Use cases delivering impact



Nigeria’s National Development Plan (2021-2025) aims to unlock the country’s potential across all sectors of the economy to foster sustainable and inclusive development, in line with the global Sustainable Development Goals (SDGs). It acknowledges the challenges Nigeria faces, including in agriculture and energy, and recognises the role that technology and innovation can play in addressing these challenges.⁵ The new administration is also committed to secure funding to help build Nigeria’s climate resilience and leverage the digital economy to improve development prospects.⁶

AI can be transformative in advancing sustainable development efforts in Nigeria. The technology is already being used to develop solutions across sectors and use cases (Figure 1). This section explores the potential of AI in agriculture and food security, energy, and climate action in Nigeria. It includes spotlights on specific use case applications, with additional examples provided in Annex 1. The list of use case applications considered in Nigeria is provided in Annex 2.

Figure 1
Heatmap of AI use cases in Nigeria



Note: author’s assessment based on the sample of use case applications included in this research.

5 Federal Ministry of Finance, Budget and National Planning. (2021). [National Development Plan \(NDP\) 2021-2025 Volume I](#).
6 The Cable. (2023). [Tinubu presents first budget as president, prioritises economy, security, poverty reduction](#).

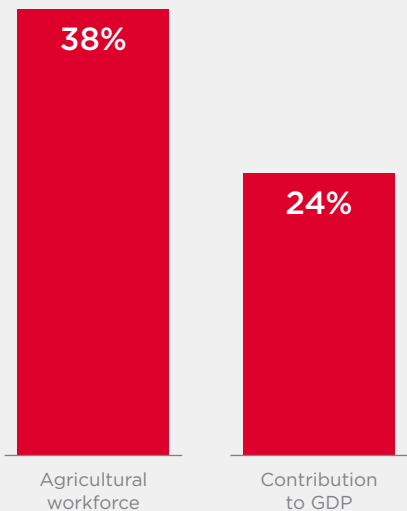
Agriculture and food security

Agriculture is a significant sector in Nigeria, employing almost 40% of the population and contributing to a quarter of its GDP. However, only 35% of the country’s arable land is cultivated. Some of the challenges faced by farmers include unpredictable weather, lack of quality inputs, insecurity and theft affecting yields. Limited storage efficiency results in post-harvest loss while inadequate logistics infrastructure limits market access. Access to formal financial services is also limited, with a large majority of farmers relying on their own savings or informal funding from their social networks.⁷ Nigeria also experiences periodic droughts and floods, adversely affecting agricultural output and increasing the vulnerability of populations, especially in rural areas.

Climate change, combined with insecurity and macroeconomic challenges, exacerbates food insecurity in Nigeria.⁸ In July 2023, the president declared a state of emergency on food insecurity, with 26.5 million people projected to face acute hunger in 2024.⁹ Protracted conflict and insurgencies intensify pressure towards a fragile resource environment, heightening food and nutrition insecurity, in particular for women and children. Acute food insecurity is particularly pronounced in the remote, conflict-affected areas in the northeast.¹⁰ The severe economic downturn, characterised by record-high food inflation, unemployment and rising poverty, further adds to these challenges.^{11,12}

Figure 2

Agricultural contribution to labour force and GDP in Kenya
(2022)



Source: [World Bank](#)

Table 1

Hunger assessment in Nigeria
(2023)

	GHI score (out of 100)	GHI rank (out of 125)	Severity scale
Nigeria	28	109	Serious
Sub-Saharan Africa	27	-	Serious

Source: [Global Hunger Index](#)

7 Agri Logic. (2022). [Addressing the \\$200 billion demand for finance for Agriculture and Agribusiness in Nigeria](#).
8 The Africa Report. (2024). [Nigeria: Food insecurity sparks wave of protests](#).
9 This represents a staggering increase from the 18.6 million people food insecure at the end of 2023. See: [World Food Programme Nigeria](#).
10 Some of the most food insecure states include Borno, Adamawa, Yobe, Sokoto, Katsina and Zamfara.
11 [World Food Programme Nigeria](#).
12 The New York Times. (2024). [Nigeria confronts its worst economic crisis in a generation](#).

The role of digital and AI

The use of digital technologies can mitigate the challenges Nigerian smallholder farmers face, and help agricultural value chains function better, especially at the last mile. Weather and climate services offer farmers vital information to adjust their practices based on anticipated conditions or respond to impending extreme weather events. These agricultural advisory services draw on a multitude of data sources to support decision-making, while agricultural digital financial services (agri DFS) enable access to inputs and assets for climate-smart practices.^{13,14} Nigeria's efforts to digitalise the wider economy have had significant spillover effects for agritech companies targeting smallholder farmers. Well-established agritech companies in Nigeria include Crop2Cash,¹⁵ Hello Tractor¹⁶ and Farmcrowdy.¹⁷

Integrating AI into these digital services has the potential to significantly enhance their effectiveness, and many agritech companies are increasingly seeking ways to leverage AI to amplify their impact and reduce costs. Predictive analytics powered by machine learning (ML) algorithms can support crop management and enable precision agriculture. For example, in Nigeria, companies such as Crop2Cash and Ignitia use AI to provide tailored recommendations to farmers based on weather, environmental and farm-level data. In July 2024, Crop2Cash launched its latest innovation, a generative AI-based National Hotline for agriculture (Spotlight 1). AI can also facilitate access to inputs and equipment through smart-sharing platforms and AI-powered credit scoring models leveraging alternative sources of data. ThriveAgric uses AI to onboard farmers on its platform and assess their creditworthiness for input financing,

while Hello Tractor leverages AI to power its farm equipment sharing application that connects tractor owners and smallholder farmers (Spotlights in Annex 1). Companies like ColdHubs and Koolboks offer opportunities for better supply chain management by providing AI-driven solutions that maintain optimal storage conditions for perishable products to reduce waste. It is worth noting that AI applications in Nigeria are largely led by local agritech startups, many of which offer bundled services aimed at digitising value chain activities to provide holistic support to smallholder farmers.

AI can also be leveraged to address food insecurity, helping to estimate and predict the number of food insecure individuals and identifying malnutrition hotspots. Food security monitoring and forecasting can serve as early warning systems (EWS) and help prevent or mitigate food security crises. ML algorithms that analyse historical and near real-time data on weather patterns, crop yields, market prices and food distribution enable the early detection of food shortages and inefficient resource allocation. For example, the World Food Programme (WFP) has developed a forecasting model to anticipate future levels of insufficient food consumption (Spotlight 2). Given the high levels of food insecurity in Nigeria, the ability to accurately forecast hunger will be critical to ensure timely interventions and targeted assistance to vulnerable populations. However, forecasting models are largely conditioned on data availability, especially comprehensive historical datasets, which entails regular and extensive data collection.

13 GSMA. (2021). [Digital Innovation for Climate-Resilient Agriculture: Using rainfall data from mobile networks for localised and scalable services](#).

14 GSMA. (2023). [Improving Farmer Livelihoods Through Digitised Agricultural Value Chains: Results and lessons from the GSMA Innovation Fund](#).

15 [Crop2Cash](#).

16 [Hello Tractor](#).

17 [Farmcrowdy](#).



Spotlight 1

Crop2Cash launches FarmAdvice, an AI-powered National Hotline for agriculture

Crop2Cash is a Nigeria-based agritech company dedicated to making formal financing accessible to smallholder farmers using technology. It supports farmers facing drought conditions in Nigeria by helping them manage financial risks, improve access to markets and inputs through a digital marketplace, and adapt their farming practices through climate-smart advisory services via USSD.

Crop2Cash's latest innovation, a National Hotline for agriculture launched in July 2024 called FarmAdvice, is an AI-powered IVR system that leverages generative AI technology to democratise access to agricultural knowledge and extension services. Smallholder farmers can dial a toll-free number on any type of device, 24/7, to interact with their own extension agent and receive real-time, personalised agricultural advice in their local languages (English, Yoruba or Hausa).

To achieve this, Crop2Cash fine-tuned large language models (LLMs) to absorb an extensive knowledge base on agriculture and localised all the information to fit the specific context of farmers in Nigeria, including by using local weather and remote sensing data. Partnerships with domain experts (e.g. government bodies, NGOs and leading agricultural institutions) ensure that the AI system is updated with the latest innovations and best practices in the sector. Crop2Cash is also working to integrate real-time market price information and build predictive models to forecast price trends for different crops based on gathered usage information. This will enable farmers to gain insights on what to plant and when to sell to maximise their income and improve their livelihoods.¹⁸

Crop2Cash has served over 500,000 farmers across 13 states in Nigeria and has reached over 700 local government areas. Farmers have already reported up to a 70% increase in income and a 35% yield increase from climate-smart inputs.¹⁹ FarmAdvice has the potential to further improve farmers' livelihoods and incomes by bridging the knowledge gap, providing instant and accurate advisory services, and paving the way for the transformation of Nigeria's agricultural landscape.

¹⁸ See: [Launch of the National Hotline for Agriculture by Crop2Cash](#).

¹⁹ [Crop2Cash](#).



Food security forecasting

Spotlight 2

WFP leverages machine learning to forecast food insecurity

The WFP has developed a forecasting methodology to predict insufficient food consumption, a key indicator of food insecurity, up to 30 days in advance. WFP ran a pilot in Adamawa, Borno and Yobe, which are considered to be the three most at-risk areas in Nigeria. They also piloted the model in Burkina Faso, Cameroon, Haiti, Syria and Yemen.²⁰

The forecasting model integrates historical data on two food indicators collected by the WFP, the Food Consumption Score and the Reduced Coping Strategies Index, which reflect households' eating behaviours, and are presented as daily time series. In addition to these indicators, they also integrated data on events that can affect food security such as market prices, conflicts, rainfall and vegetation. Datasets are sourced from WFP, as well as ACLED, an NGO specialising in disaggregated conflict data collection, analysis, and crisis mapping, CHIRPS, a 35+ year quasi-global rainfall dataset, and MODIS, a satellite-based sensor used for Earth and climate measurements. They ensured all data had the same format by using data sources that could describe these events via time series.²¹ The model harnesses an advanced ML approach known as reservoir computing.

WFP's forecasting model represents an initial step towards the application of forecasting approaches to food insecurity at a high spatial and temporal granularity, and the results show the value of continuous near real-time data collection at a sub-national level. While forecasting models have proven feasible,^{22,23} long-term forecasts remain challenging and strongly conditioned by data availability.²⁴

20 Foini, P., et al. (2023). [On the forecastability of food insecurity](#). Scientific Reports, 13, 2793.

21 GitHub: [JSI WFP dataset](#).

22 Martini, G., et al. (2022). [Machine learning can guide food security efforts when primary data are not available](#). Nature Food 3, 716–728.

23 Wang, D., et al. (2020). [Stochastic Modeling of Food Insecurity](#). World Bank Policy Research Working Papers.

24 Foini, P., et al. (2023). [On the forecastability of food insecurity](#). Scientific Reports, 13, 2793.

Key takeaways and considerations for AI deployment

Agricultural use case applications represent around half of the total applications identified in Nigeria, similar to Kenya. As Table 2 shows, most applications fall under data-driven agri advisory and agri DFS, where AI is used to provide customised advisory for climate-smart practices at the farm level and unlock access to financial services. These maturing use cases have the most potential for impact and scale in the short term, but their continued expansion requires access to precision agriculture technologies such as IoT sensors or drones. These technologies are critical enablers to collect data at the farm level, such as soil moisture or crop health, but the high upfront acquisition costs and technical knowledge required to operate the devices are major barriers to adoption. To address these challenges, Nigerian startup Zenvus sells GPS-equipped hardware to government agencies and farmer cooperatives, which establish device-sharing plans for farmers and provide training support.

AI applications that provide access to markets and inputs are at a developing or emerging stage, with only a few examples identified in smart farming, supply chain management, and market linkages. Developing more AI-enabled solutions for supply chain management would also support food security efforts – beyond existing food security monitoring and forecasting efforts – and help tackle the physical security challenges associated with food distribution. There is potential to use AI to monitor the movement of food products from farm to market, ensuring quick, secure, and cost-effective shipment of goods.²⁵ Similarly, there is potential to accelerate the use of AI for market linkages, to enable farmers to efficiently connect with

buyers, optimise pricing and facilitate value chain integration. However, the availability of real-time market dynamics data and the interoperability of data management systems may constitute a barrier to their development.

Mobile devices are the primary channel through which users access AI-enabled services. Yet infrastructure gaps, limited access to mobile internet and low smartphone penetration pose significant barriers to adoption and usage in Nigeria. According to the GSMA 2023 Consumer Survey, affordability was the single most important barrier to mobile internet adoption, with 38% of men and 33% of women citing handset cost as a challenge.²⁶ Ensuring access through low-tech delivery channels and leveraging smallholder farmers' social networks will continue to be critical in the short term. Relevant examples include Crop2Cash's USSD-based system, which makes services accessible to farmers who do not have a smartphone or mobile internet, and ThriveAgric's platform, which can function offline and update when agents regain connectivity. In the longer term, fostering access to mobile phones, promoting digital skills and literacy, and enhancing user-friendliness will be essential for the adoption and active usage of AI-enabled services, including among marginalised groups such as women farmers.

²⁵ AI in Nigeria (2024). [Nigeria AI Landscape and Startups Report 2024](#).

²⁶ GSMA. (2024). [The Mobile Gender Gap Report 2024](#).

Table 2
Mapping of use cases in agriculture and food security in Nigeria

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Data-driven digital advisory	Customised advisory for climate-smart agricultural practices at the farm level (i.e. precision agriculture)	Weather data, climate data, remote sensing data, agronomic data, environmental data, domain specific data, local language data	Smallholder farmers, extension agents, farmers cooperatives	USSD, SMS, apps, extension agents	Informed decision making, optimised resource allocation, increased yields, improved livelihoods and resilience to climate change	Agroexchange Technology, Babban Gona, Crop2Cash, Farmz2U, IAPrecision, Ignitia, Kitovu, Riwe Technologies, ThriveAgric, Zenvus
Agri DFS	Access to financial services, creditworthiness assessment for input or labour financing, and insurance	Farm data, geospatial data, socioeconomic data, behavioural data	Agritech startups, farmers, cooperatives, financial institutions	Mobile banking apps, online portals	Economic empowerment, digital financial inclusion, access to resources and risk-coping mechanisms	Crop2Cash, Riwe Technologies, ThriveAgric, TradeBuza
Smart farming	Crop and livestock management and mechanisation equipment	Weather patterns, crop types, agricultural activity, socioeconomic data	Farmers, community-based agents	Mobile apps, digital marketplaces	Optimised use of farm inputs, increase in productivity and incomes	Croprnuts, FarmSpeak, Gwin Technologies, Hello Tractor
Supply chain management	Optimisation of processing, storage, and distribution to reduce post-harvest loss	Storage and logistics data, market prices and trends, weather information	Farmers, cooperatives, agribusinesses	Mobile apps, online portals	Reduced food waste, better quality standards, improved market access	ColdHubs, Figorr, TradeBuza
Market linkages	Digital marketplaces and analysis of market trends, demand-supply dynamics and price fluctuations	Production data, market supply and demand data, market price data, geospatial data, logistics and inventory data	Smallholder farmers, farmer cooperatives, agribusinesses	Mobile apps, SMS, USSD	Supply chain optimisation, market and price transparency	Farmcrowdy, ThriveAgric
Food security monitoring/ forecasting	Real-time monitoring and forecasting of food security trends	Food consumption data, health records data, socio-demographic data, climate and environmental data, satellite data, political stability data, insecurity data	Humanitarian organisations, NGOs, government agencies, community-based organisations	Desktop-based data visualisation dashboards, workshops and trainings	Timely and targeted interventions, improved response strategies and resource allocation	WFP



Energy

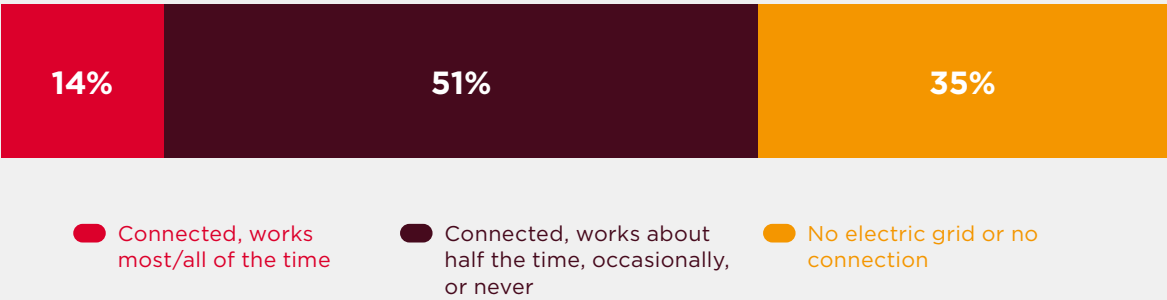
Nigeria has the world’s largest absolute electricity access deficit.²⁷ Lack of access to the electricity grid affects 45% of the population, which is approximately 90 million people. Large disparities exist between urban areas, where 84% of the population has access to electricity, and rural areas, where only 26% of the population has access to electricity. However, those who are connected to the grid face frequent power outages and hence do not get a reliable supply,²⁸ with only 14% reporting having electricity that works all or most of the time (Figure 3). Chronic grid outages are estimated to amount to 4,600 hours per year (over half the year). Power shortages in Nigeria cost the economy around \$28 billion – equivalent to two per cent of its GDP.²⁹

Most households and businesses rely on power from petrol and diesel-run generator sets that are costly and highly polluting. Nigeria has more off-grid diesel generator capacity than on-grid power generation capacity (Figure 4) and only 17% of Nigerians have access to clean cooking fuels.³⁰ The energy sector accounts for the largest source of greenhouse gas emissions, representing 60% of total emissions in Nigeria.³¹ Despite an abundance of renewable energy sources such as solar and wind energy, the country is yet to maximise their potential (Figure 5).

Nigeria’s power sector is largely privately owned. Following the Electric Power Sector Reform Act of 2004, the sector was divided into six generation companies (GenCos), 11 distribution companies (DisCos), and the Transmission Company of Nigeria (TCN), which remains government-owned. Very little investment has gone into strengthening transmission and distribution performance since privatisation was completed in 2013. Technical and commercial losses are extremely high due the poor technical condition of infrastructure and large-scale electricity theft. This is exacerbated by inadequate metering of customers and non-settlement of bills in the public sector.³²

Low tariffs represent a major challenge for the Nigerian energy sector. Tariffs are too low to cover costs, leading to underinvestment and poor service, which in turn makes raising tariffs politically difficult. This creates a cycle where inadequate revenue exacerbates infrastructure deficiencies, hindering the sector’s ability to meet growing energy demands and provide reliable service to consumers. In 2020, the Nigerian government announced plans to introduce service-based tariffs aimed at addressing this challenge. It plans to break this cycle by linking the amount a consumer pays to the quality of service the same consumer receives.³³

Figure 3
Grid reliability in Nigeria
(% of survey respondents, 2020)



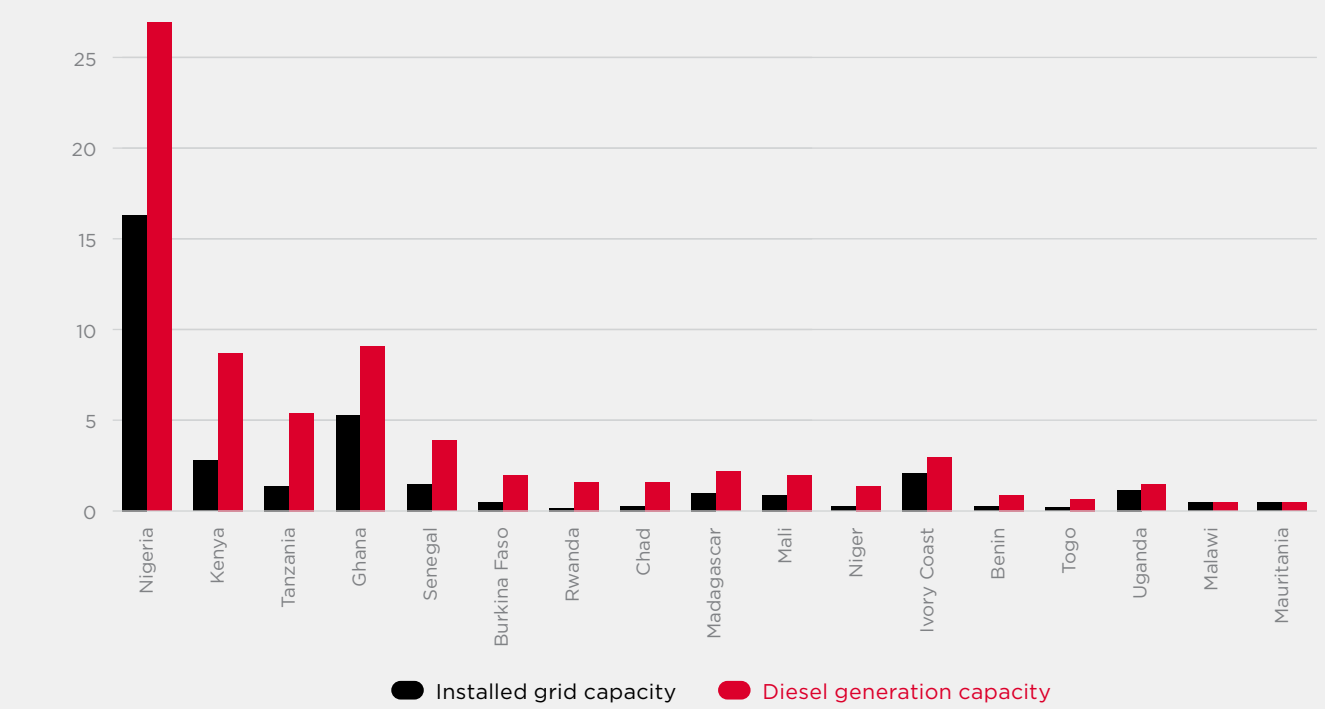
Respondents were asked: Do you have an electric connection to your home from the mains? [if yes:] How often is electricity actually available from this connection?
Source: [Afrobarometer](#)

27 IRENA. (2021). [Tracking SDG 7: The Energy Progress Report 2021](#).
28 World Bank. (2023). [Nigeria - AF Power Sector Recovery Performance Based Operation](#).
29 World Bank. (2020). [Nigeria to Keep the Lights on and Power its Economy](#).
30 [Tracking SDG 7](#).
31 IUCN. (2022). [A Review of Nigeria's 2021 Climate Change Act: Potential for Increased Climate Litigation](#).
32 World Bank. (2023). [Nigeria - AF Power Sector Recovery Performance Based Operation](#).
33 GSMA. (2023). [IoT and Essential Utility Services: Nigeria market case study](#).

Figure 4

African countries with more diesel generator capacity than grid capacity

(Gigawatt)

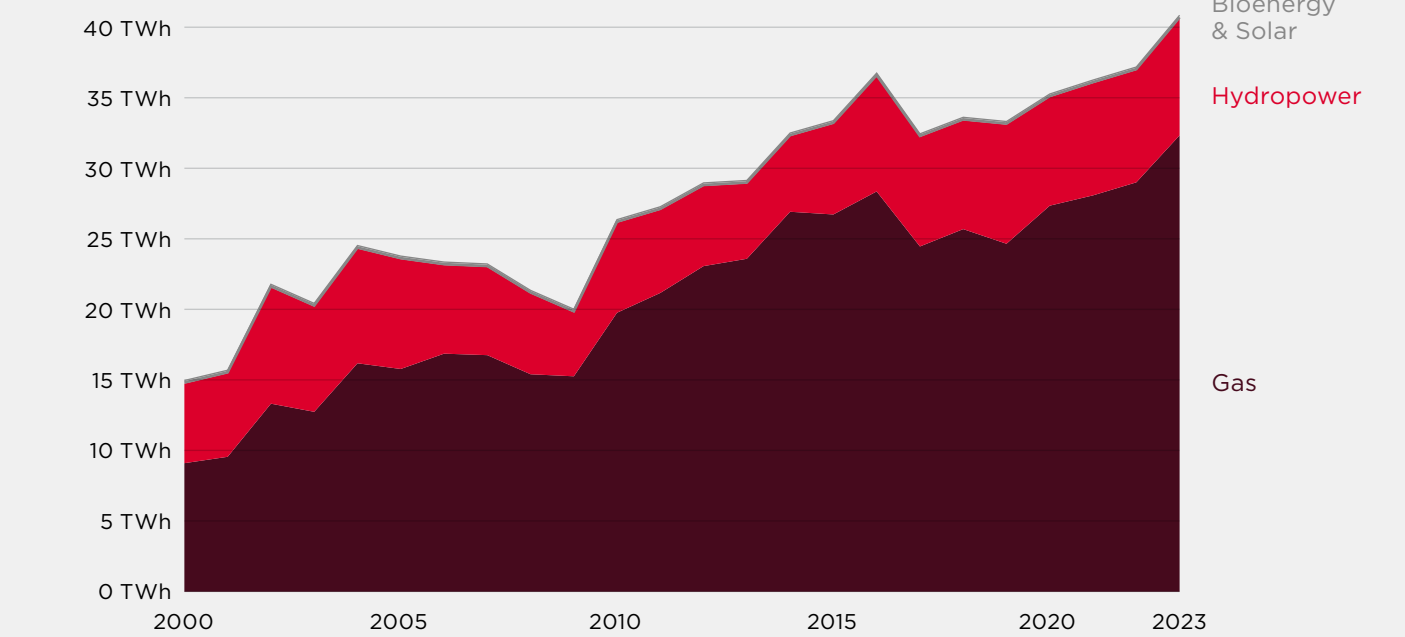


Source: [Energy Monitor](#)

Figure 5

Electricity production by source

(Terawatt-hours, 2000-2023)



Note: Electricity is just one component of total energy consumption, the others being transport and heating. The electricity mix should not be misinterpreted as the breakdown of the total energy mix.

Source: [Energy Institute](#)

The role of digital and AI

The government has been committed in recent years to leveraging digital technologies to improve grid infrastructure and help DisCos run more efficiently. It announced plans for mass deployment of smart energy meters to reduce transmission and distribution losses and pave the way for tariff innovation as part of the 2020 reforms. Initiatives like the National Mass Metering Programme aim to promote local manufacturing, while MOJEC established a plant in Nigeria with an annual production capacity of 1.5 million meters. AI can play a significant role in enhancing grid efficiency, improving revenue collection rates and giving consumers a larger supply of power by decreasing outages. In Nigeria, Beacon Power Services has developed an AI-enabled grid management platform that offers energy providers and utilities real-time visibility on network performance and allows them to distribute electricity more efficiently (Spotlight in Annex 1).³⁴

Digital technologies are also supporting the deployment of mini-grids, which are one of the most effective ways to extend energy services to off-grid communities. Smart meters can monitor and control mini-grids, providing real-time insights into household energy usage and improving operational efficiency. While Nigeria trails other markets, launching its first mini-grid site in 2017 – seven years after Kenya³⁵ – mini-grids are becoming more prevalent as they play a key part in Nigeria's ambitious rural electrification programme.³⁶ The initiative, supported by the World Bank, has taken a market-driven approach to mini-grid development and catalysed the deployment of more than 100 new solar-powered mini-grids as of 2023.³⁷ Further acceleration is needed, given the considerable infrastructure gaps in Nigeria, representing a significant investment. AI can address this gap by reducing costs. In Nigeria, Husk Power Systems leverages predictive AI to increase service extension and to forecast supply and demand, thereby increasing its operational efficiency and enhancing its sustainability (Spotlight 3).

In the off-grid sector, Nigeria has also seen an increase in solar home systems (SHS) to offer clean, reliable and affordable energy solutions. Startups like Lumos leverage IoT-based PAYG models to provide SHS to rural as well as urban and peri-urban households and businesses, reducing reliance on fossil fuel-based generators. IoT-based solutions are also becoming increasingly prevalent in other areas, such as clean cooking and cooling. While the country's low levels of formal financial inclusion have limited the addressable market for providers of PAYG solutions, recent estimates suggest that mobile money is rapidly growing in Nigeria.³⁸ Increased demand for IoT-based PAYG solutions in Nigeria's energy sector will likely spillover to AI due to the high complementarity between the two technologies. For example, SHS provider Azuri Technologies integrated AI into its technology to enable real-time analysis of user consumption patterns.

Given the considerable infrastructure gaps in Nigeria, there is also huge potential for AI to improve planning and deployment of both on-grid and off-grid energy solutions. Geospatial data modelling can support energy prioritisation and micro-level planning required for last-mile access. In Nigeria, organisations like Fraym (Spotlight in Annex 1) and TFE Energy's Village Data Analytics (VIDA) use satellite imagery and ML to identify locations with high demand for electricity and estimate optimal locations for off-grid energy solutions such as mini-grid or SHS.³⁹ Nithio, a climate fintech platform, supports energy access by providing a sustainable, risk-informed approach to finance aggregated receivables for the off-grid solar sector (→ ***Spotlight in Kenya report***).⁴⁰ Nithio also looks at projected customer creditworthiness and the different types of financing off-grid solar providers would need to extend energy access to different sets of communities, such as commercial capital for low-risk customers and grant or results-based financing funding⁴¹ for higher risk and lower-income customers.

34 GSMA. (2023). *Innovator Spotlight Series: Tackling the urban energy challenge through digital innovation*.

35 GSMA. (2023). *IoT and Essential Utility Services: Nigeria market case study*.

36 Ibid.

37 World Bank. (2023). *Solar Mini Grids Could Sustainability Power 380 million People in Africa by 2030 - if Action is Taken Now*.

38 GSMA. (2024). *State of the Industry Report on Mobile Money 2024*.

39 Omdena AI Innovation Challenge: *Identifying optimal spots for solar power in Nigeria using satellite imagery*.

40 Nithio.

41 In an RBF scheme, funders make payments to an agent who assumes responsibility for achieving predefined results. Funding is then released upon the independent verification of achievement of these results by a third party. Such approaches shift the financial risk associated with the non-delivery of results from the donor to the recipient. See: GSMA. (2023). *Digitalising Innovative Finance: Emerging instruments for early-stage innovators in low- and middle-income countries*.



Spotlight 3

Husk Power Systems uses AI for the electrification of rural communities

Husk Power Systems is a US-based solar mini-grid developer that has pledged to install 2,500 mini-grid projects in Africa by 2028 to eradicate energy poverty. The company is focused largely on projects in Nigeria, where it plans to use AI to overcome significant hurdles in the market, such as the absence of regulatory frameworks for small power plants and difficulties in securing funding.

To address these challenges, Husk has adopted a pay-as-you-go (PAYG) model for electricity sales, avoiding the upfront costs for customers and ensuring revenue streams over the lifespan of its plants. This approach relies on detailed usage pattern analysis and cost optimisation, where AI can play a significant role by reducing the need for manual management. Husk leverages predictive AI to forecast supply and demand and deploys AI-powered algorithms to deliver electricity to its customers at the lowest cost at any given time. Piloting AI systems since 2020, Husk has managed to reduce diesel generator usage by 40% while increasing solar utilisation by 20% and extending battery lifespans by up to six months. These efficiencies translate into cost savings for both the company and customers.⁴²

Husk is also set to broaden the application of AI by extending beyond supply management to include demand-side strategies to shape demand patterns, introduce time-of-use pricing and other mechanisms to enhance energy production efficiency and reduce prices. This expansion includes developing an e-commerce platform to sell and finance electrical appliances, with plans to integrate AI for personalised customer recommendations. Having achieved financial profitability in 2023, Husk boasts the industry's lowest levelised cost of electricity, paving the way for sustainable expansion with four projects per month in Nigeria.⁴³

⁴² Latitude Media. (2024). [Why Husk Power believes AI is key to electrifying rural communities](#).

⁴³ Ibid.

Key takeaways and considerations for AI deployment

Multiple energy use case applications were identified in Nigeria – more than in Kenya and South Africa – which is reflective of the significant market and impact potential in the country given the infrastructure gaps. Most of the use case applications identified in the energy sector in Nigeria fall under smart energy management, where AI is used to optimise energy production, distribution and consumption in both the on-grid and off-grid sector. Given Nigeria's technical and commercial losses in the grid infrastructure, and utilities' low revenue collection rates, solutions that leverage AI to help energy utilities run more efficiently, like Beacon Power Services, present high potential for scale. Off-grid solutions such as mini-grids or PAYG SHS are also increasingly incorporating AI to adjust energy output and optimise system performance. The resulting reduction in inefficiencies and increase in revenue can drive accelerated expansion efforts and contribute to the ongoing effort to eradicate energy poverty. With the rapid expansion of Nigeria's mobile money market, there is potential for acceleration of PAYG-based solutions in remote areas. However, the high costs of the hardware required to collect data and their ongoing maintenance can constitute a major barrier for financially constrained public utilities and private energy providers.

We also identified several use case applications for energy access and demand assessment, where AI is used to map and monitor energy-scarce areas to identify energy needs and develop targeted energy planning strategies to bridge the access gap, although they remain at a developing or emerging stage. Productive use asset financing, where AI is used for innovative finance mechanisms, also appears to be an emerging use case with high potential for impact, as illustrated by Nithio's back-up servicer provision in the event of distributor failure. Despite their potential for impact, the deployment of these use cases depends on the availability of rich datasets such as geospatial, socioeconomic, demographic and climate data, as well as advanced data analytics capabilities. This can constitute a major barrier for local innovators and current players are mostly international organisations with cutting-edge AI/ML capabilities and the necessary resources to collect or access specific datasets.

Table 3
Mapping of use cases in energy in Nigeria

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Predictive maintenance	Forecasting of equipment failures, optimisation of maintenance schedules, and minimisation of downtime	Energy generation data, equipment performance data, maintenance logs, sensor data	Power plant operators, maintenance teams, energy generation companies	Monitoring alerts via mobile applications, web-based platforms	Enhanced energy infrastructure reliability and efficiency, optimised maintenance schedules, improved customer service	Beacon Power Services
Smart energy management	Optimisation and real-time monitoring of energy production, distribution and consumption	Energy consumption figures, temperature readings, humidity levels, user behaviours, equipment status	Households and commercial energy consumers, facility managers, energy service providers	Mobile apps, online dashboards	Reduced energy waste, optimised energy consumption, cost savings, increased sustainability	Arnergy, Azuri Technologies, Beacon Power Services, Husk Power Systems, Inq, ICE Solar, Koolboks, Odyssey Energy, OneWattSolar
Energy access/demand assessment	Mapping and monitoring of energy-scarce areas for targeted and tailored service extension	Socioeconomic data, household survey data, population and demographic data, geospatial data, climate data and energy needs of public institutions, and productive uses	Renewable energy companies, government agencies, industry organisations, development partners	Desktop/online dashboards	Evidence-based energy planning, improved access for underserved areas	Fraym, Husk Power Systems, ICE Solar, Omdena, VIDA
Productive use asset financing	Digitised innovative finance mechanisms to enable asset financing (e.g. off-grid solar and clean cooking appliances) and increase access to energy	Socioeconomic data, geographic information, repayment history, energy consumption	Off-grid communities, solar energy providers, financial institutions	Mobile apps, online platforms	Increased access to clean energy, improved livelihoods, economic empowerment of underserved communities	Nithio

Climate action

While Nigeria has very low greenhouses gas emissions, it is highly vulnerable to the impacts of climate change. Nigeria accounts for only 0.3% of global emissions,⁴⁴ despite being the sixth most populous country in the world. It is the 53rd most

vulnerable country to climate change and lags in terms of readiness for climate adaptation (Table 4). Temperatures across Nigeria are expected to increase by 1.8°C by the 2050s and by approximately 3.7°C at the end of the century (Table 5).⁴⁵

Table 4
Vulnerability to climate change and readiness to improve resilience
(Rank out of 185 countries, 2021)

	Country Index Rank	Vulnerability Rank	Readiness Rank
Nigeria	154	53	179

Vulnerability measures a country’s exposure, sensitivity and ability to adapt to the negative impact of climate change. Readiness measures a country’s ability to leverage investments and convert them to adaptation action.
Source: [ND-GAIN Country Index](#)

Table 5
Projected changes in temperature and precipitation
(2020-2099)

CMIP5 Ensemble Projection	2020-2039	2040-2059	2060-2079	2080-2099
Annual Temperature Anomaly (°C)	+0.5 to +1.5 (+1.0°C)	+1.3 to +2.8 (+1.8°C)	+2.0 to +4.2 (+2.7°C)	+2.9 to +5.7 (+3.7°C)
Annual Precipitation Anomaly (mm)	-18.6 to +21.5 (+0.4 mm)	-25.6 to +29.6 (-0.3 mm)	-28.0 to +39.4 (+2.3 mm)	-36.0 to +47.0 (+1.6 mm)

Note: Bold value is the range (10th - 90th percentile) and values in parentheses show the median (or 50th percentile)
Source: [World Bank](#)

Nigeria is home to distinct climate zones, triggering extreme vulnerability to diverse climate hazards. The country experiences significant fluctuations in rainfall patterns, resulting in climate hazards such as floods, storms, droughts and wildfires. Drought and irregular rainfall, combined with rising temperatures, inhibits the country’s hydropower systems and undermines agricultural production, reducing food security. Rising sea levels threaten cities like Lagos and coastal areas, increasing their vulnerability to flooding, with approximately half of the country’s local government areas at risk of flooding.⁴⁶ Nigeria also grapples with biodiversity loss and environmental degradation, driven by deforestation, high levels of pollution, waste generation, rapid urbanisation, mineral exploitation,

coastal erosion and desertification. Nigeria has one of the world’s highest rates of deforestation, losing 3.7% of its forest every year.⁴⁷

The role of digital and AI

Digital solutions play a pivotal role in addressing challenges that are linked to climate change by supporting mitigation strategies, building the resilience of vulnerable communities and driving sustainable use, management and protection of natural resources. For example, mobile-based early warning systems (EWS) provide timely alerts for disasters and climate-related events such as heatwaves and flooding,⁴⁸ while weather and climate

44 International Energy Agency: [Emissions in Nigeria](#).
45 World Bank. (2021). [Climate Risk Country Profile Nigeria](#).
46 Africa Renewal. (2023). [Nigeria prioritizes climate action to mitigate natural disasters](#).
47 United Nations: [Nigeria REDD+ Readiness Programme](#).
48 GSMA. (2021). [The Climate Crisis: Mobile-enabled solutions in humanitarian emergencies](#).

services support farmers to better adapt to the effects of climate change. Recently, climate finance has enabled the growth of innovative solutions for natural resource management (NRM), such as payment for ecosystem services (PES), where local communities receive financial incentives for managing land or natural resources.^{49,50}

AI has the potential to be integrated into climate tech solutions to enhance their effectiveness and impact. Google Research has developed AI models

to forecast floods to alert people up to seven days before a disaster strikes, allowing for effective early warning and disaster preparedness. Google Floods is available in over 80 countries, including Nigeria where Google conducted a pilot with UNOCHA (Spotlight 4). In the realm of climate finance, Chemotronix is using AI, along with other emerging technologies like IoT and blockchain, for its carbon credit platform. The technology is used to collect environmental data to measure, report and verify emissions.



Disaster preparedness and EWS

Spotlight 4

Google and UNOCHA use AI for flood forecasting and disaster preparedness

Google Research has invested in developing and applying AI modelling to advance the field of flood forecasting to help communities around the world better anticipate and prepare for the effects of climate change with AI-based EWS for natural disasters.⁵¹

In Nigeria, Google conducted a pilot in collaboration with the UNOCHA Centre for Humanitarian Data in 2023 to provide flood alerts based on Google's flood forecasts. To provide flood forecasting, Google monitors historical and real-time water measurements and precipitation forecasts. It uses data that is either publicly available or available to Google through partnerships with local governments. Based on this information, Google runs two types of ML models: hydrological models, which provide forecasts of river water levels, and inundation models, which provide forecasts for the extent of flooding on the ground. This helps Google identify who to notify and provide flood maps on Google Maps.⁵²

The pilot enabled the UNOCHA in Nigeria to test Google's hydrological and inundation forecasts to estimate expected flood impact. The UNOCHA team and other humanitarian stakeholders received alerts and were able to further disseminate warnings to first responders and staff on the ground. The two organisations plan to work on more projects, such as forecasting severe flood events and rapid mapping of ongoing floods.⁵³

49 GSMA. (2021). [The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change](#).

50 GSMA. (2024). [State of the Industry Report on Mobile Money 2024](#).

51 Google Research. (2024). [Using AI to expand global access to reliable flood forecasts](#).

52 Google Research. [Flood forecasting](#).

53 Google. (2024). [How AI flood forecasting can help communities in need](#).

Key takeaways and considerations for AI deployment

Despite some positive initiatives, few climate use case applications were identified in Nigeria, as Table 6 shows. Many climate-tech innovations are climate-smart agriculture solutions and clean energy solutions that contribute to climate change adaptation and mitigation. Several stakeholders attributed the lack of climate-focused use cases to climate not being considered as a priority issue in Nigeria's current development agenda and thus not being perceived as a commercially attractive industry for investors. There is a trade-off between the long-term impact of climate change and the immediate needs of the population, such as access to food and reliable and affordable energy.

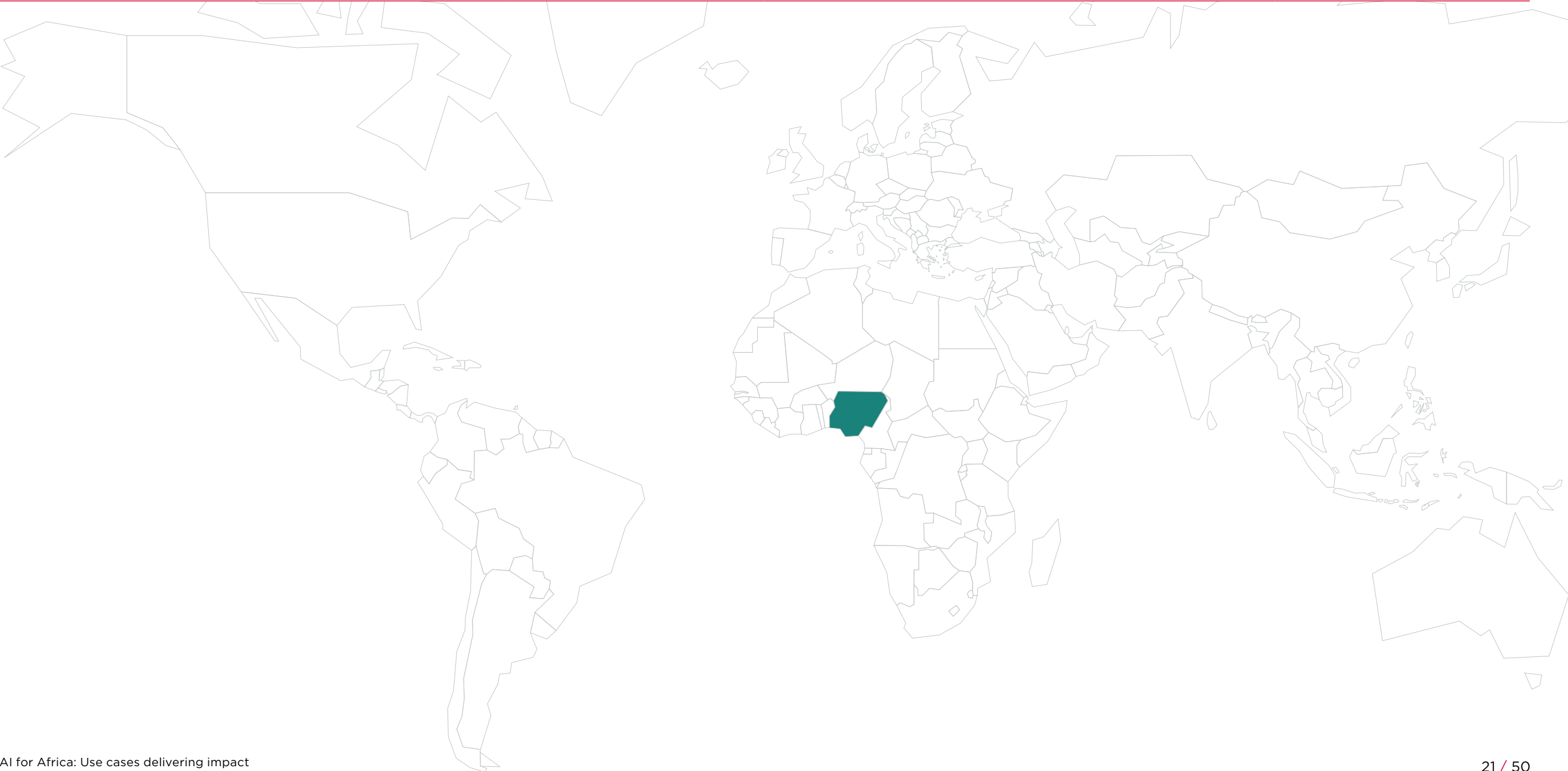
Major challenges relating to limited data availability and lack of compute capacity also hinder the deployment of AI for climate action in Nigeria as it makes it more difficult to conduct research and analysis and make forecasts over a specific geographical area. In other countries such as Kenya, AI projects for climate, and especially NRM, are primarily led by Big Tech actors like Microsoft AI for Good Lab and IBM Research Africa, but these entities are not present in Nigeria. In addition, Microsoft recently announced the closure of its African Development Centre, which was initially launched in 2022.

Despite this, there are pockets of momentum around the opportunity to leverage AI for climate action. Several of the 45 grantees of the Nigeria AI Research Scheme, selected in December 2023, seek to address climate-related challenges. These include leveraging satellite imagery and AI for rapid detection and response to oil spills and assessing the vulnerability of local communities to climate change through AI.⁵⁴ Given the high rates of deforestation in Nigeria, there are untapped opportunities in ecosystem and biodiversity mapping and monitoring, where AI is used to assess and track changes in ecosystems, species distribution and habitat health. Similarly, given the high levels of pollution in cities like Lagos, there is significant potential for climate modelling to understand the future impact of climate change and derive strategies for climate change adaptation.

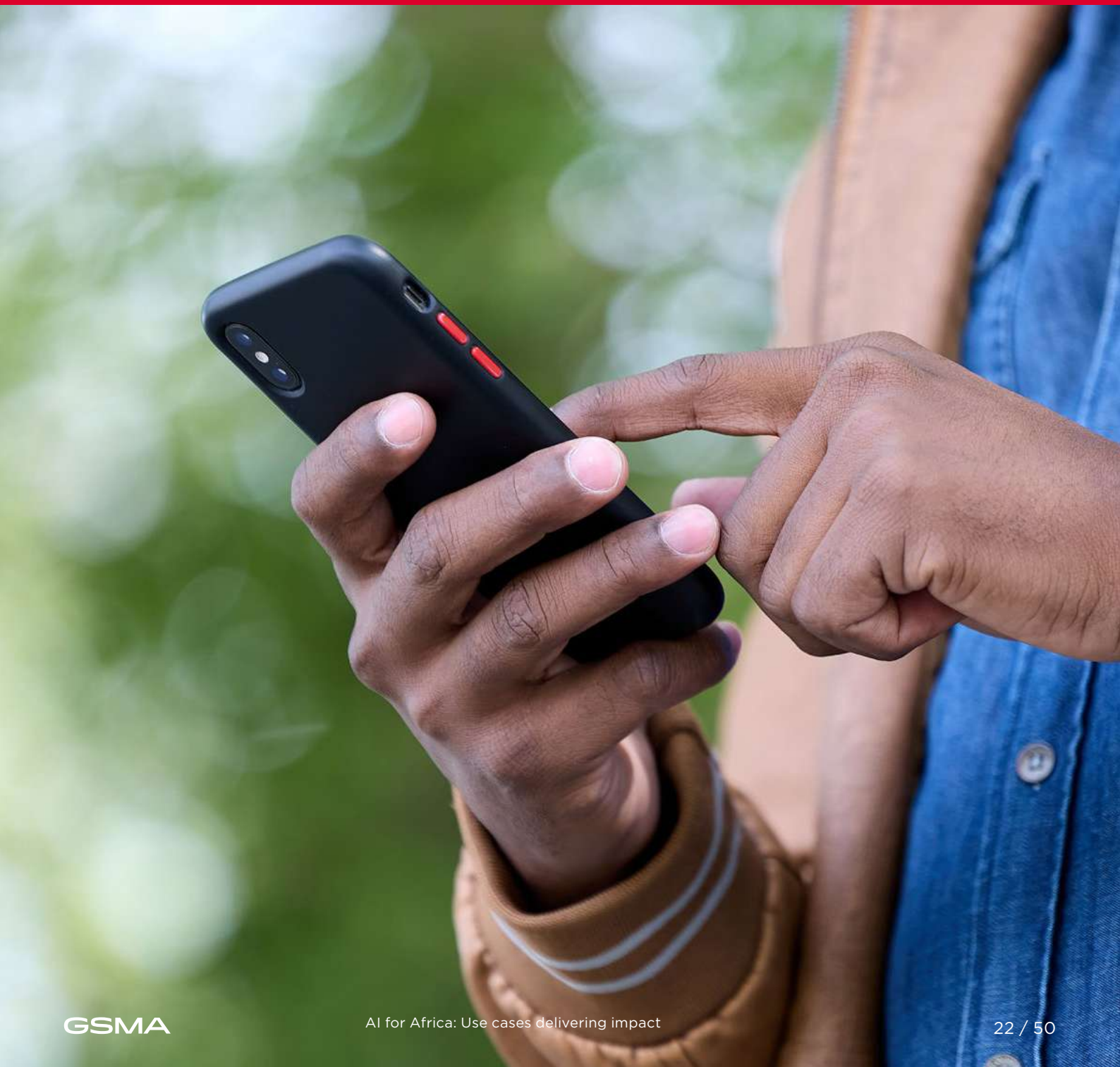
54 NAIRS: [Announcement of Selected NAIRS Grantees](#).

Table 6
Mapping of use cases in climate action in Nigeria

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Disaster preparedness and EWS	Predictive analytics and real-time disaster assessment and monitoring to mitigate impacts	Disaster data, environmental data, geospatial and remote sensing data, social media and crowdsourced data, infrastructure data, population and demographic data, MNO data	Local communities, disaster response agencies, humanitarian organisations	SMS notifications, mobile apps, radio	Enhanced preparedness and response, timely and targeted interventions to reduce loss of life	Google Floods
Carbon credits	Monitoring, analysis and optimisation of carbon trading activities to facilitate compliance, trading decisions and carbon footprint reduction strategies	Carbon emissions and pricing data, market activity data, data on emissions reduction projects, financial data, supply chain data	Businesses, corporations, carbon offset projects	Online platforms or mobile applications for trading carbon credits	Reduction of greenhouse gas emissions, incentives for carbon sequestration projects	Chemotronix



3. Building a thriving AI environment



The successful development and deployment of AI-enabled use cases depends on the establishment of robust AI fundamentals, encompassing factors such as data availability and quality, skills and digital literacy, and infrastructure and compute capacity. It also relies on the broader enabling environment, which includes critical enablers such as strategic partnerships, sufficient and targeted investment

and funding, conducive policy frameworks, and dedicated research and development (R&D) efforts. Figure 6 illustrates key actors involved in building and strengthening Nigeria's tech and AI ecosystem along these enablers through various initiatives. This section explores existing gaps and opportunities to strengthen Nigeria's ecosystem and unlock the potential of AI to support the SDGs.

Figure 6

Key ecosystem players in Nigeria

Government agencies and initiatives	    
Development partners	    
Digital infrastructure/ HPC providers	      
Data and NLP initiatives and organisations	      
Capacity building initiatives and organisations	     
Academic and research institutions	      
MNOs and Big Tech players	    

AI fundamentals

Data

The development of AI-enabled use cases and solutions requires availability and access to high-quality and trustworthy data. Existing and emerging use cases identified in Nigeria show the diversity of data needed for AI models, from micro and macroeconomic data to sector-specific data such as climate and weather data or energy consumption data. While locally relevant data is increasingly available, it remains limited and tends to be built in silos, which acts as a major constraint for local innovators.

The government recently launched the National Geospatial Data Repository and the Electronic Civil Registration and Vital Statistics System (e-CRVS), which can be leveraged by multiple industries to gain a more accurate view of the size, distribution, composition and characteristics of the population for governance activities.⁵⁵ These datasets can be useful for use cases that require socioeconomic and demographic data, such as agricultural DFS, food security monitoring or energy access demand forecasting. However, they need to be regularly updated to be useful, and complemented by additional domain-specific datasets, which remain limited.

Development actors and international organisations play a significant role in helping to bridge the data gap in Nigeria. For example, the Bill and Melinda Gates Foundation (BMGF) awarded GRID3 \$20.3 million to build data solutions over the next four years in Nigeria and DRC. The project focuses on the health sector but could be beneficial to other sectors too.⁵⁶ CropWatch, a cooperation programme of which Nigeria is a member, collects and analyses satellite data to monitor crop growth and climate conditions to improve farm management. Nigerian experts trained through the programme customise the CropWatch platform to the local context.^{57,58}

Organisations such as the Humanitarian OpenStreetMap Team (HOT) contribute to the development of local datasets and generate spatial data on urban infrastructure for better service delivery. Through projects like Eco-Smart Cities, HOT integrates satellite and ground-based sensor data with OpenStreetMap information to identify pollution hotspots and vulnerable communities. This comprehensive data aids stakeholders in making informed decisions for effective air quality management and sustainable urban development.⁵⁹ HOT also partnered with Code for Africa and the Pulitzer Centre on Crisis Reporting to map Makoko, a slum area in Lagos to make a case for improved public services and land ownership (Spotlight 5).

The development of language-based generative AI solutions, which rely on user prompts, offers transformative potential across sectors but remain nascent due to the limited availability of local language datasets. Existing LLMs have mostly been trained with data in English, which limits their relevance for last-mile users. Conventional data collection methods have traditionally neglected the requirements of end users, instead prioritising academic or urban-centric datasets. Fine-tuning existing LLMs, or building alternative models, requires collecting data that authentically captures the nuances and diversity of language usage, particularly at the grassroots level. There is a need for bottom-up approaches, encouraging community involvement in data collection through techniques such as voice journaling, to ensure the data accurately reflects their lived experiences. Access to such data is critical for organisations like Viamo, which is currently piloting its AI voice-based assistant in Nigeria after a successful initial pilot in Zambia (→ **Spotlight in the landscape report**).

55 Nigeria National Population Commission. (2023). [Launching of the national geospatial data repository, the digital civil registration and vital statistics system and the inauguration of the national CRVS coordination committee](#).

56 Grid 3. (2023). [Grid 3 secures \\$20.3M to support Nigeria and DRC with core spatial data](#).

57 UNCTAD. (2023). [Using satellite technology to transform agriculture in developing countries](#).

58 African News. (2023). [Nigeria Collaborates with China to Commence the Crop-Watch Programme in Nigeria](#).

59 Humanitarian OpenStreetMap Team: [Mapping for climate change ready cities - Nigeria and Ivory Coast](#).

“Voice journaling is a way to capture the reality of the authentic language and experiences of low-income individuals, allowing them to be the voice of the data that you are building.”

- Civil society organisation

Several initiatives are starting to build more relevant LLM solutions. In April 2024, the government announced the launch of its first multilingual LLM, a collaborative effort from the Ministry of Communications, Innovation and Digital Economy (FMCIDE), the National Information Technology Development Agency (NITDA), the National Center for Artificial Intelligence and Robotics (NCAIR), Nigerian AI company Awarri and Data.org, a global non-profit tech organisation.⁶⁰ The LLM will be trained on five low-resource languages and accented English to ensure stronger language representation in existing datasets for developing AI solutions (Spotlight 6). Data Science Nigeria (DSN) is also building hyperlocal text and audio datasets, models and applications to support the development of generative AI solutions, leveraging its large network of local data collectors.⁶¹ Similarly, the Lacuna Fund provided funding to NaijaVoices to build a 500-hour voice dataset in three Nigerian languages—Igbo, Hausa, and Yoruba—to support the development of AI solutions across various sectors, including agriculture.⁶²

Affordability remains a major barrier, due to the resources and time needed to train datasets, which ranges between weeks and months. Initiatives that build LLMs are often dependent on grants and donor funding, posing limitations to their viability and potential for scale. There are untapped opportunities to leverage big data from the private sector, such as MNOs who have voice recordings that could be used to build and train locally relevant LLMs. Access to mobile big data, once aggregated and anonymised, could also provide insights to inform energy planning as well as disaster risk management.⁶³ Currently, several barriers limit telco engagement, including the lack of a viable commercial return, strict industry compliance in terms of data privacy, and limited awareness of the potential of the data, and thus its value.

⁶⁰ Techpoint Africa. (2024). [Nigeria launches first multilingual LLM after drafting initial National AI Strategy](#).

⁶¹ [Data Science Nigeria](#).

⁶² Lacuna Fund. (2022). [Announcing Awards for African Language Datasets - 2021 NLP Awardees](#).

⁶³ GSMA. (2019). [Mobile Big Data Solutions for a Better Future](#).



Geospatial data

Spotlight 5

The MapMakoko project leverages drone technology and community data for better urban planning

Makoko is one of Africa's floating inner-city slums, with a third of the community built on stilts in a lagoon off the Lagos mainland. The rest of the settlement is on swampy land with little sanitation and few public services. It is estimated that around 300,000 people live there, but the lack of baseline data means the official population is unknown. The slum does not feature much on current maps, and there is very little information on its geography, population density, or land ownership.

Code for Africa partnered with Pulitzer Centre on Crisis Reporting and the HOT to map the area, using fixed-wing drones to photograph and algorithmically map the community, training women as drone pilots. Land-based data collectors help annotate the aerial maps with key buildings and infrastructure and how they are used. The resulting open geodata is expected to provide community leaders, residents, planners, and development organisations exact information on key data for urban planning and service delivery. Code for Africa also plans to make the data available in community gathering points to help residents use it for better planning or campaigns, and share the maps and data with emergency response and public health and service agencies in Lagos state to ensure they have the best available geodata for planning interventions.^{64,65}

64 Humanitarian OpenStreetMap Team: [Code for Africa: Using drones to map Makoko, one of Africa's largest slums.](#)

65 Humanitarian OpenStreetMap Team: [Mapping Makoko using Drones and Canoes.](#)



Spotlight 6

Startup Awarri builds Nigeria's first government-backed LLM for low-resource languages

Created in 2019, Awarri is a Lagos-based social enterprise dedicated to leveraging technology to address Africa's pressing social challenges by bridging the technical skills gap and fostering economic empowerment through job creation, education, and innovation. Awarri is developing Nigeria's first multilingual LLM in partnership with NITDA, NCAIR, and Data.org. The project aims to create new datasets in indigenous Nigerian languages and accented English, enabling developers to build AI tools with a deep understanding of Nigeria's cultural and linguistic nuances.

Following the launch of its AI research lab in November 2023, which employs 100 workers responsible for gathering and annotating data, creating language models and AI apps, Awarri launched LangEasy in April 2024. This platform allows anyone with a smartphone to help train the model through voice and text inputs. Users are prompted to read sentences aloud and save the audio on the app, thereby crowdsourcing data for Awarri's LLM. Awarri collaborates with data collectors across Nigeria to gather text and voice samples through LangEasy. While building its model from scratch, Awarri is also training OpenAI's GPT-4 foundational model with its dataset to capture nuances in local languages. The initial phase targets 24,000 hours of audio, scaling up to 500,000 hours for the subsequent version, with billions of text tokens planned for pre-training and hundreds of thousands of instruction samples for fine-tuning.

The project is still in its early stages and must overcome several challenges to be viable and ensure safe and responsible AI. Concerns include Nigeria's infrastructural constraints, which could impede progress, and the lack of clarity over data ownership and the potential open-source nature of the LLM, raising questions about public access and commercial use of the collected data. Ensuring clear guidelines for data usage and storage is crucial, especially given the collaborative nature of data collection through public contributions. Despite these challenges, the initiative has the potential to be transformative for the development of AI in Nigeria, paving the way for enhanced linguistic representation and technological advancement.⁶⁶

⁶⁶ Rest of World. (2024). [A little-known AI startup is behind Nigeria's first government-backed LLM](#).

Compute and infrastructure

Nigeria's compute journey is in its early stages, but significant acceleration is anticipated in the coming years. Positioned as a rising giant, Nigeria stands to benefit from substantial server expansion, moderate supercomputing capacities, growing investment in quantum computing, developments in cloud infrastructure and data centre expansion.⁶⁷ However, critical challenges remain around underlying infrastructure and access and affordability of high-performance computing.

Data centres are rapidly expanding in Nigeria, driven by private sector investment and increased data storage demand. The increasing number of subsea fibre optic cables, through which big data travels, requires massive storage capacity, leading to the deployment of hyperscale data centres. Companies like Kasi Cloud, Rack Centre, and Open Access Data Centres are currently building hyperscale data centres to accommodate for increasing data storage needs.^{68,69} This will unlock new opportunities for local storage capacity, as a significant portion of government data and total data is stored in international markets.⁷⁰ However, critical challenges such as energy and electricity issues persist, hindering the operational reliability of data centres. Inadequate power infrastructure and frequent power outages pose significant challenges to the uninterrupted functioning of data centres, highlighting the need for sustainable energy solutions in Nigeria's computing infrastructure development.

Access to enabling hardware and software capabilities also constitutes a major barrier to the development of the local ecosystem. Local actors such as startups and research institutions struggle to afford the requisite computing resources to build and train AI models. Dependence on foreign GPUs, billed in dollars, further exacerbate this because of the naira devaluation. Similarly, cloud computing tokens from Big Tech companies such as Google and Amazon Web Services remain too expensive. Several experts mentioned the possibility of billing cloud services in local currency to address some of these challenges, but unlocking domestic capital remains an obstacle. Greater demonstrated demand is needed before

Big Tech companies adopt naira billing and, with a minimal focus on Africa relative to other markets, this remains unlikely. There is willingness from the government to support local innovators, as illustrated by NITDA's procurement of GPUs to be installed at NCAIR, but more efforts at a wider scale are needed to overcome this challenge.

Edge computing, whereby smartphones act as computing device, can act as a second-best solution in low-resource environments. Edge computing brings computation and storage capabilities closer to the devices or 'edge' of the network, reducing latency and improving real-time processing. However, higher mobile phone penetration, and the adoption of better performing devices, will be critical in Nigeria. Most people at the last-mile use lower-end smartphones with relatively low-cost chips, on which AI applications do not work.

"If we equip people with better phones and provide adequate financing, we could shift the focus and invest in better computing at the edge rather than computing in the cloud."

- Agritech startup

As capabilities in computing continue to develop, there is a need to complement these advancements with USSD-based or offline solutions for AI services to reach last-mile populations. For example, Crop2Cash delivers advisory services through a USSD interface designed to be simple and easy to use, with menu options and prompts that guide farmers, while Viamo's generative AI voice-based assistant 'Ask Viamo Anything' is specifically designed for those without internet access. However, the transition from online to offline solutions presents unique challenges, particularly in terms of complexity and cost. Unlike online solutions that rely on existing internet infrastructure and cloud-based services, the development of offline AI assistants involves additional engineering processes and infrastructure requirements.

67 Tony Blair Institute for Global Change. (2023). [The State of Compute Access: How to Bridge the New Digital Divide](#).

68 TechCabal. (2024). [Nigeria's 8 subsea cables spur new investment in hyperscale data centres](#).

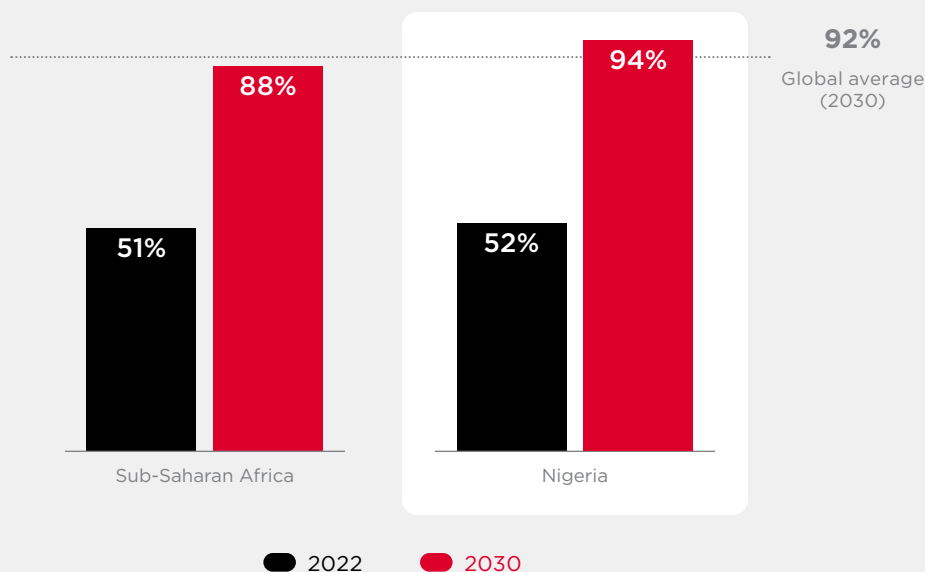
69 Nairmetrics. (2024). [Nigeria set to attract over \\$600 million investments through data centres - Ayotunde Coker](#).

70 The Guardian. (2021). [70% of govt agencies host data abroad despite \\$220m local infrastructure](#).

Figure 7

Current and projected smartphone adoption in Nigeria

(% of connections, 2022 vs. 2030)



Source: [GSMA Intelligence](#)

Capacity and skills

A range of skills are required to design and develop AI for development use cases. Climate and agri-related AI applications such as biodiversity mapping and environmental monitoring are based on geospatial models that require specialised training and knowledge in geographic information system (GIS) techniques, before being translated into user-friendly data visualisation platforms that provide advisory services and can inform evidence-based policymaking. Expertise in data science, ML and statistical modelling is crucial for developing accurate forecasting models.

Some Nigerian universities have proactively begun offering AI-related courses or introducing AI into existing degree programmes. For example, Covenant University offers a PhD in Computer Sciences that includes AI as a specialisation area.⁷¹ Similarly, the University of Lagos, the University of Ibadan, and the University of Ilorin have started incorporating AI into relevant courses. However, these initiatives are currently limited in scope and primarily concentrated in urban areas. In addition, many academic institutions fall short in adequately preparing students for the demands of the industry, due to several interrelated barriers.

There are a limited number of teachers with strong AI experience and qualifications in Nigeria, and universities are typically unable to afford hiring them, which affects the quality of the courses taught. AI-related courses remain theoretical in nature, and universities lack the infrastructure and devices, such as computers, that allow students to gain practical skills. There is also a lack of understanding around the complementary skills needed to build robust ML models, such as foundational mathematics and statistics. Many students turn to courses like software engineering, which focus on programming and interface design, rather than pursuing the rigorous mathematical training that is essential for AI and data science.

“Statistical foundations are crucial for AI because machine learning techniques are statistical techniques. If you understand them, you will be able to programme them but you can’t programme what you don’t understand.”

- University researcher and professor

⁷¹ [Covenant School of Postgraduate Studies](#).

The skills gap can also be attributed to the absence of course standardisation. There is a lack of uniformity in the design of AI courses, as universities have some level of freedom to customise their curricula. This can lead to variations in the skills and knowledge acquired by students across different institutions and pose challenges for employers seeking consistent skill sets in the workforce.

Limited collaboration and knowledge sharing between academia and industry means that the content taught in educational programmes is often outdated, and teachers are not actively updating their material to keep pace with the rapidly changing tech industry. This can result in students learning concepts that are no longer relevant or missing out on crucial advancements. Since graduates are not adequately equipped with the skills required for the job market, employers looking to hire local talent spend a lot of time and capital training new hires before they can be effective in the given role, which acts as a major barrier for organisations.

Despite these challenges, there are positive signs of progress, and various initiatives are underway to bridge the skills gap. In 2023, five federal Nigerian universities were selected to receive the EU Erasmus+ grant to establish a master's degree in AI. Referred to as EmbeddedAI, the project aims to enhance the skill set for modelling, designing and analysing AI on embedded systems for engineers by strengthening higher education training and curricula with international standards and technologies.⁷² There are examples of intra-government collaboration, as illustrated by the launch of the 3 Million Technical Talent (3MTT) programme by FMCIDE and NITDA. The initiative will focus on 12 technical skills for three million Nigerians, including AI and ML, software development, cloud computing and cybersecurity.⁷³

Private sector initiatives have also emerged, such as DSN, which aims to build a local AI talent ecosystem (Spotlight 7). MNOs such as MTN Nigeria and large tech companies like Microsoft are designing upskilling programmes and working with local stakeholders.⁷⁴ Students and developers also rely on self-learning with online courses, which are now widely available. However, there are barriers to using these resources, including the difficulty of identifying adequate

courses to build in-demand skills, limited access to mentors or teachers to reach out to, and the high data usage required to complete the courses, which can be costly.⁷⁵

Beyond the technical skills needed to build the ecosystem, the development and adoption of AI-enabled solutions necessitates strengthening digital skills and literacy within the wider population, especially at the last-mile. Smallholder farmers need basic digital skills to interact with mobile apps and access services such as climate information and farm management advisory. Similarly, government officials need to be proficient in using digital tools and platforms for effective service delivery and decision-making.

Nigeria currently exhibits low digital literacy rates, making it difficult to accelerate the adoption and usage of digital technologies and digitally-enabled services. According to the 2023 GSMA Consumer Survey, literacy and digital skills is still a key barrier to mobile internet adoption, with 42% of men and 51% of women reporting difficulties with reading and writing as a challenge.⁷⁶ Those who are more likely to report this barrier tend to be poorer, women, living in rural areas and over the age of 35 years old. Initiatives seeking to build digital skills need to focus primarily on these groups, which are disproportionately affected by structural inequalities such as access to quality education and schools or opportunities to learn digital skills.

⁷² [EmbeddedAI](#).

⁷³ [3MTT](#).

⁷⁴ MTN Foundation: [ICT and Business Skills Training Phase 6](#).

⁷⁵ Google Research. (2019). [AI in Nigeria](#).

⁷⁶ GSMA. (2024). [The Mobile Gender Gap Report 2024](#).



AI skills

Spotlight 7

Data Science Nigeria provides comprehensive AI training for young Nigerians

Data Science Nigeria (DSN) is one of the leading AI non-profit organisations committed to building Africa's AI talent ecosystem with a mission to train one million AI talents in Nigeria, and developing solutions across multiple sectors.

DSN operates as a platform that brings together a diverse community of data scientists, ML practitioners, researchers, educators, and industry experts. It provides a range of initiatives and programmes designed to empower individuals with the skills, resources and opportunities needed to thrive in this rapidly evolving field. Through its extensive network, the organisation facilitates collaboration, knowledge sharing and capacity building in AI and data science.

One of its flagship initiatives is its comprehensive training and mentorship programme, which leverages a practitioner-led model where experienced and hands-on data scientists in Nigeria and in the diaspora train and mentor young Nigerians. The programme encompasses workshops, bootcamps, hackathons, seminars and online courses that cover various aspects of AI. By offering hands-on training, practical insights and mentorship from industry leaders, DSN equips its members with the expertise to tackle real-world challenges through emerging technologies.

Broader enabling environment

Partnerships

Partnerships enable access to a diverse range of essential resources required to support AI deployment across use cases. All five types of stakeholders identified in our primary report - data providers, hardware and software providers, technical partners, domain experts and financial partners - play a role in building AI-enabled solutions in Nigeria. Big Tech players and data analysis companies act as a hardware and software providers and technical partners by offering support to local actors who do not have the required compute resources and technical expertise. For example, Atlas AI, a predictive analytics company, supported Hello Tractor by providing ML capabilities and deep domain expertise to build a predictive model for tractor utilisation (Spotlight in Annex 1). Similarly, ICE Solar, which develops solar energy projects, partnered with Microsoft to use its Azure ML platform to process large amounts of market data, thereby identifying areas with potential for expansion.⁷⁷

Non-profit organisations such as NGOs or research institutions serve as data providers and domain experts due to their specialised knowledge and expertise and on-the-ground operations. They can provide locally relevant primary and secondary data, and support participatory approaches to data collection. For example, Viamo partners with domain experts working in Nigeria, such as UNICEF and Mercy Corps, to leverage their data to fine-tune pre-trained LLMs. Access to this data enables Viamo to gradually build a corpus of locally relevant and domain-specific data, which is essential for its generative AI voice assistant. In addition, pre-established partnerships with telcos allowed Viamo to leverage existing infrastructure for efficient reach, including in last-mile communities, using free airtime to onboard users. So far, Viamo has signed exclusive national agreements with MNOs, such as Airtel in Nigeria, and aims to sign multiple agreements in its countries of operation to scale up the service.⁷⁸

At the ecosystem level, cross-sector partnerships also help strengthen the enabling environment for AI development, as illustrated by the collaboration between FMCIDE, NITDA, NCAIR, Awarri and Data.org to develop Nigeria's first multilingual LLM. In addition, Microsoft and UNDP launched the AI4Dev Reference Group, which includes private sector organisations, civil society organisations (CSOs), academics, and policymakers. It seeks to conduct analysis and map out trends in emerging technologies, advise on how to leverage AI to achieve the SDGs and mitigating risks associated with AI.⁷⁹ Microsoft also created the Digital Skills Nigeria programme to support FMCIDE in its efforts to provide upskilling opportunities for young Nigerians. The programme partners with organisations such as the Wootlab Foundation, DSN, and Tech4Dev to provide a wide range of courses in areas like cloud computing, data science, and AI, including generative AI.⁸⁰

While these initiatives reflect a heightened momentum in supporting AI deployment in Nigeria and demonstrate the commitment of stakeholders to collaborate, few partnerships are focused on improving access to compute, which remain limited to specific use case applications. Identifying partners and developing innovative access mechanisms will be critical to democratise access to compute resources in Nigeria, especially for local entrepreneurs and researchers.

⁷⁷ Afrik 21. (2019). [Nigeria: Microsoft and ICE Commercial Power join forces to provide off-grid to SMEs.](#)

⁷⁸ The Africa Report. (2024). [Viamo to offer free ChatGPT-driven information for Africans with basic phones.](#)

⁷⁹ UNDP. (2023). [Microsoft and UNDP Commission the AI4Dev Reference Group.](#)

⁸⁰ [Digital Skills Nigeria.](#)

Financing

A range of public and private financing actors are driving ecosystem growth, deploying a mix of financing mechanisms. Nigeria has been a leading funding destination for the past 10 years and is considered a hotspot for venture capital for the technology sector at the regional level, along with Kenya and South Africa. In 2023, Nigeria attracted over \$575 million in venture capital funding, positioning it as the third highest recipient in the region.⁸¹

However, many stakeholders pointed out that funding for deep tech remains limited in volume and value. Risk aversion appears to be one of the main barriers for investors, resulting from a lack of understanding about emerging technologies and a preference for more established sectors. This has been further exacerbated by strong currency devaluation, contributing to the uncertain investment environment.

“It’s this classic innovation adoption curve where everyone is excited about new technologies, but there is a lot of risk aversion, and no one is willing to be the first mover.”

- Non-profit organisation

In addition, the bulk of the funding that local developers receive for their AI solutions comes from foreign investors, which accounts for around 98% of the funds raised by Nigerian startups. Consequently, the offshore domiciliation and ownership of intellectual capital, proprietary assets and data makes it harder to develop the AI ecosystem in Nigeria.⁸²

Table 7
Investments in tech and AI in Nigeria
(\$ millions, 2023)

Investment in tech startups	575
VC investments in AI	2.9

Sources: [Briter Bridges](#) and [OECD.AI](#)

Grant funding represents a significant source of funding across development sectors, largely led by multilateral donors and international organisations. The GSMA, through its FCDO-funded Innovation Funds, has supported various organisations in Nigeria, including Crop2Cash, Hello Tractor, and Koolboks. Multilateral donors are also committed to supporting the building blocks of the AI ecosystem. Partners such as the FCDO, IDRC, USAID, the BMGF and SIDA have combined forces to support proven use cases as well as policy and capacity building efforts across Africa, including Nigeria.

Policy

Nigeria has a relatively enabling policy environment and seems ahead of its regional peers in terms of AI governance. The government launched multiple tech-related policies, which can serve as a building block for further AI development (Table 8). Nigeria is one of the few African countries to have signed the Bletchley Declaration, a global commitment to tackle the potential risks of AI relating to misuse and unintended consequences, in 2023.⁸³ According to Oxford Insights’ Government AI Readiness Index, Nigeria performs better than the Sub-Saharan average on various indicators, including governance and ethics, government vision and data representativeness.⁸⁴

Nigeria published its National Digital Economy Policy and Strategy (2020-2030) in 2019, where it identified AI as an important technology to support the development of the digital economy. The government is currently in the process of finalising a national AI strategy,⁸⁵ with policymakers notably adopting a co-creation approach by engaging key stakeholders in the policy development process.⁸⁶ A dedicated team was tasked with conducting a comprehensive assessment of the existing AI ecosystem, identifying gaps and opportunities. Open calls for proposals also enhanced inclusivity, ensuring diverse representation and perspectives in the policy formulation process. This collaborative process demonstrates the government’s commitment to transparency and representativeness. NITDA also announced in 2023 that it was in the process of drafting a code

81 Briter Bridges. (2024). [Africa Investment Report 2023](#).
82 Google Research. (2019). [AI in Nigeria](#).
83 Department for Science, Innovation and Technology. (2023). [Countries agree to safe and responsible development of frontier AI in landmark Bletchley Declaration](#).
84 Oxford Insights (2023). [Government AI Readiness Index 2023](#).
85 A draft document of the National AI Strategy was released to the public for input on 2 August 2024, after this report was finalised. See: FMCIDE. (2024). [National Artificial Intelligence Strategy](#).
86 Dr Bosun Tijani. (2023). [Co-creating a National Artificial Intelligence Strategy for Nigeria](#).

of practice for the use of AI, which would relate specifically to the use of generative AI and protection from misinformation and use of personal data.

Nigeria has also made progress in reforming policies. It enacted a new Data Protection Act (NDPA) in 2023, replacing its 2019 Data Protection Regulation with more comprehensive legislation.⁸⁷ The key provision of the NDPA is the establishment of the Nigeria Data Protection Commission to oversee the implementation and enforcement of regulations around the processing of personal data, and a

Governing Council, tasked with the formulation and provision of overall policy direction.^{88,89} This legislative update reflects the government's proactive approach to ensuring compliance with best practices in data management and privacy. However, certain aspects remain ambiguous, particularly regarding the cross-border transfer of data. While the guidelines default to prohibiting such transfers, they also permit exceptions, based on adequacy of data protection and derogations.⁹⁰

Table 8

Key AI-related policy initiatives in Nigeria

➤ National AI Strategy	Nigeria is in the process of finalising its inaugural national AI strategy. This strategic initiative aims to drive transformative growth through AI technology.
➤ National Science, Technology and Innovation Policy (NSTIP)	The NSTIP, revised in 2022, underscores the importance of science, technology, and innovation for sustainable development. It aims to leverage AI, digital technologies, and research to address development challenges such as poverty and energy access. The policy also emphasises the role of indigenous knowledge systems, arts and culture in Nigeria.
➤ National Digital Economy Policy and Strategy (NDEPS)	The NDPES aims to harness digital technologies for economic growth and poverty reduction. It recognises the potential of digital transformation and innovation in achieving these goals. The NDEPS focuses on areas such as broadband expansion, e-government, digital skills training, local content promotion, and cybersecurity measures to position Nigeria as a leading ICT hub in Africa.
➤ Nigeria Data Protection Act (NDPA)	The NDPA establishes a legal framework to protect personal information and creates the Nigeria Data Protection Commission to oversee data processing. It mirrors the EU General Data Protection Regulation (GDPR) but includes unique legal principles. The main goal of the NDPA is to protect privacy rights as outlined in Nigeria's constitution.
➤ Cybercrimes Act	The Cybercrimes (Prohibition and Prevention) Act of 2015 counters cyber threats and illegal activities. It underlines the importance of cybersecurity, intellectual property rights, and the preservation of vital national information infrastructure.
➤ Nigeria Startup Act	The Act provides a regulatory framework for the development of startups and an enabling environment for the establishment, development, growth, and operation of startups and technology-related talents in Nigeria.

87 National Assembly Journal. (2023). [A Bill for an Act to Provide a legal framework for the protection of personal information, and establish the Nigeria Data Protection Commission for the regulation of the processing of personal information, and for Related Matters.](#)

88 KPMG. (2023). [The Nigeria Data Protection Act, 2023.](#)

89 KPMG. (2023). [Nigeria Data Protection Act 2023 Review.](#)

90 INPLP. (2023). [Cross-border data transfer: Navigating compliance under the Nigerian Data Protection Act 2023.](#)

Continuous focus on ensuring implementation and compliance with regulatory frameworks will be needed. Several barriers still pose a challenge to the effective implementation of policies. There is a pressing need to bridge the skills gap and to build expertise among government officials. More broadly, the lack of infrastructure makes it challenging to ensure that policies promoting AI development and usage can be effectively executed. Similarly, limited funding for R&D undermines the ability of policymakers to innovate, build capabilities, make evidence-based decisions, and maintain competitiveness, ultimately hindering the successful implementation of policies aimed at fostering AI development.

Research and Development

R&D has traditionally not been a high priority for the public and private sector, as evidenced by low past contributions. Government and private sector spending was estimated at less than 0.5% and 0.1% of GDP respectively in 2021.⁹¹ There is generally a dearth of R&D culture in government and academia, and limited collaboration between the private sector and academic research institutes. According to the Global Innovation Index 2023, Nigeria ranks 119 (similarly to Kenya) out of 132 economies for R&D and 122 for university-industry R&D collaboration.⁹² This has also contributed to a lack of AI researchers, exacerbated by a shortage of talent with advanced skills in AI-related fields, essential for driving R&D initiatives in AI.

Recognising these challenges, the government has made strides to develop the research ecosystem. In 2020, NCAIR was created with a mandate to promote R&D on emerging technologies and their practical applications in priority areas for the country. The facility and digital fabrication laboratory focuses on key AI fields such as NLP and computer vision, as well as IoT, drones and robotics.⁹³ Working with NITDA and NCAIR, FMCIDE provides capital to local AI researchers through the Nigeria AI Research Scheme and 4IRTA platform.^{94,95}

Of the 45 grant recipients from the research scheme, 29 are researchers, while the remaining recipients consist of startups or technology companies. Non-government actors are also filling in gaps in R&D, leveraging private sector and domain expertise. For example, the AI4Dev Reference Group, launched by Microsoft and UNDP, will act as an R&D platform for stakeholders such as private sector organisations, CSOs, academia, and policymakers.⁹⁶ As a positive sign of university-industry collaboration, Covenant University signed a Memorandum of Understanding with OBT Translate, a deep learning AI platform and neural network system for languages, to conduct research on AI, NLP and linguistics.⁹⁷

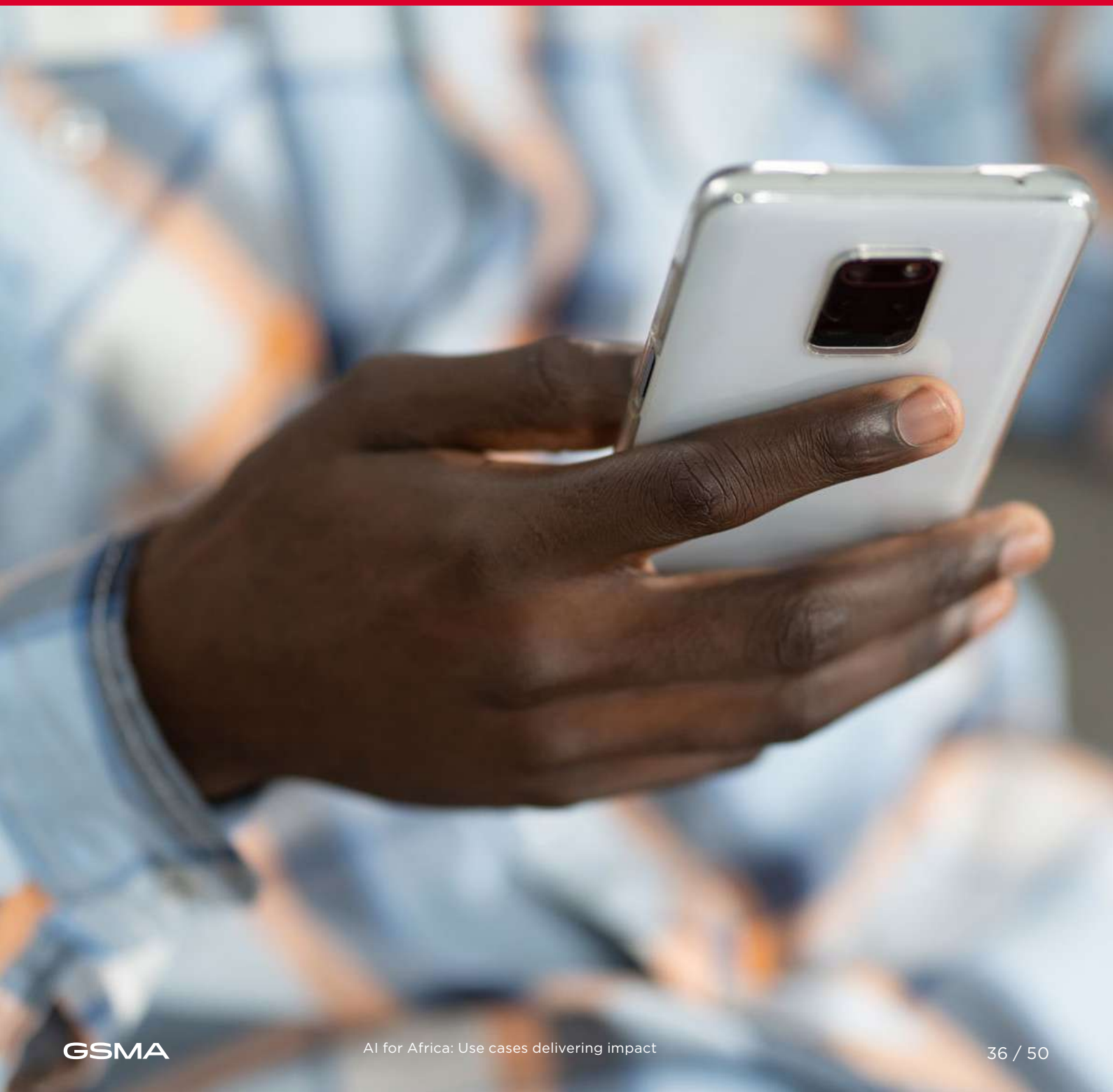
Table 9
Nigeria’s rankings for R&D capabilities
 (Rank out of 132 countries, 2023)

	R&D	University-Industry R&D collaboration
Nigeria	119	122*

*indicates an area of weakness relative to income group
 Source: [Global Innovation Index](#)

91 Citris Policy Lab. (2021). [Artificial Intelligence for Economic Development in Nigeria](#).
 92 WIPO: [Global Innovation Index](#).
 93 NCAIR.
 94 Ministry of Communication, Innovation and Digital Economy. (2023). [Accelerating our Collective Prosperity through Technical Efficiency](#).
 95 National Information Technology Development Agency: [Fourth Industrial Revolution Technology Application](#).
 96 UNDP. (2023). [Microsoft and UNDP Commission the AI4Dev Reference Group](#).
 97 PUNCH. (2023). [Covenant varsity, firm partner on AI, language translation device](#).

4. Recommendations



Recommendations to accelerate AI deployment

Different stakeholders across the public and private sectors, development partners and multilateral organisations can take a number of actions and collaborate to ensure that impactful AI innovations in Nigeria can be developed and scaled. Table 10 presents some key findings and recommendations to support various components of the AI ecosystem, considering Nigeria’s unique opportunities and challenges. These recommendations work in concert with those published in the primary report ‘[AI for Africa: Use cases delivering impact](#)’.

Table 10
Key recommendations to support AI deployment and adoption in Nigeria

Increase the availability and accessibility of high-quality data	
	Invest in localised domain-specific data collection: AI startups and research institutions lack access to local-level and domain-specific datasets that can help them customise their solutions to local challenges. Supporting the financing of hardware and devices – including drones, IoT sensors, smart meters, and smartphones – could accelerate data collection across sectors, especially for grassroots initiatives. In parallel, it is essential to increase the production and facilitate access to secondary data such as domain-specific research outputs to ensure AI solutions are built on comprehensive and contextual datasets that accurately reflect the unique characteristics and needs of the local context. <i>Relevant stakeholders:</i> DFIs (e.g. World Bank), development partners (e.g. FCDO, BMGF), research institutions (e.g. International Institute of Tropical Agriculture)
	Support language data development and local initiatives: Local languages are not adequately represented in Nigeria’s existing language datasets, although promising initiatives, like Awarri, are emerging. There is a pressing need to expand local language data availability, by creating new datasets and fine-tuning existing LLMs, particularly focusing on capturing the diversity of language usage at the grassroots level. This entails supporting the scaleup of small-scale programmes, such as NaijaVoices or DSN, with funding and facilitating partnerships. In addition, there are untapped opportunities to leverage underutilised data such as call detail records (CDR), which will require close collaboration with MNOs and alignment of incentives for all parties involved. <i>Relevant stakeholders:</i> Development partners (e.g. FCDO, IRDC, Lacuna Fund), research and academic institutions (e.g. DSN), MNOs and industry associations (e.g. GSMA)
	Ensure safe and responsible data collection: Many initiatives to build local language datasets take a community-based and participatory approach to data collection. However, there is a lack of clarity over data ownership and the potential open-source nature of some of the LLMs being built, raising questions about public access and commercial use of the collected data. Clear guidelines for data usage and storage are crucial given the collaborative nature of data collection through public contributions. There is an opportunity for MNOs to leverage CDR data, which requires safeguarding data privacy through randomised, aggregated and anonymised data, and following global standards and best practices for data protection (e.g. GSMA’s AI Ethics Playbook).⁹⁸ <i>Relevant stakeholders:</i> AI builders and startups, NGOs and CSOs, government agencies and policy organisations (e.g. NDPC, NITDA), e.g. MNOs and industry associations (e.g. GSMA)

98 GSMA. (2022). [The AI Ethics Playbook & Self-Assessment Questionnaire](#).

- ▶ **Streamline data handling and management processes:** While Nigeria has made strides in terms of building government capacity and making government data available, AI practitioners face challenges due to the limited quality of existing datasets. It is crucial to establish a robust management plan that ensures seamless data cleaning and processing, and regular updates. Government agencies should prioritise upskilling their staff in data curation and analysis techniques to improve the quality and reliability of national datasets. They could also conduct regular audits of existing datasets, ensuring their integrity and reliability for AI applications.

Relevant stakeholders: Government agencies (FMCIDE, NITDA), multi-stakeholder initiatives (e.g. AI Collective, AI4Dev Reference Group), development partners (e.g. FCDO)

Build short- and long-term capacity for infrastructure and compute

- ▶ **Invest in baseline infrastructure and clean computing:** Nigeria has attracted significant local and foreign investment in infrastructure, with several hyperscale data centre expected to be operational in 2025. Given Nigeria's projected smartphone penetration and 5G expansion, expanding the country's data centre capacity will be essential to meet increasing data storage demands. To support this growth, Nigeria needs to invest in reliable power infrastructure and implement policy frameworks that incentivise infrastructure development. There is a significant untapped opportunity to prioritise clean sources of energy such as solar and wind, similar to Kenya's Olkaria Ecocloud data centre. Establishing a dedicated roadmap to build AI infrastructure is critical for Nigeria to integrate these various considerations and effectively leverage its potential for sustainable digital transformation.

Relevant stakeholders: Private sector (e.g. data centre providers, Big Tech, MNOs), Government agencies (e.g. FMCIDE), industry associations (e.g. Renewable Energy Association of Nigeria).

- ▶ **Enhance access to high-performance computing:** A comprehensive approach is needed to address challenges related to access to hardware and software capabilities and tackle affordability issues. The government should allocate dedicated funding and provide subsidies, grants and tax incentives to startups and research institutions to offset the costs of acquiring high performance computing resources, especially GPUs. Negotiations with major cloud service providers should be pursued to explore the possibility of billing in local currency, which would mitigate the impact of currency devaluation. Development partners can support existing initiatives, such as NITDA's GPU procurement programme, and invest in shared AI and computing hubs. Promoting local assembly or distribution centres can reduce costs associated with foreign currency fluctuations.

Relevant stakeholders: Government agencies (e.g. NITDA, NCAIR), DFIs and development partners (e.g. World Bank, FCDO), Big Tech (e.g. Google, AWS).

- ▶ **Prioritise edge computing capabilities:** As Nigeria's compute ecosystem evolves, there is an opportunity to leverage distributed edge computing on smartphones. The government and private sector can enhance smartphone accessibility by offering financing options and incentives. Considering Nigeria's infrastructure gaps and the limited availability of high-performance devices however, it is crucial to support the development of edge computing solutions that can operate on lower-end smartphones, providing AI capabilities even in low-resource environments. Addressing key barriers to mobile ownership is also essential to ensure adoption of AI-enabled services, which are largely available through digital channels.

Relevant stakeholders: Government agencies, MNOs, industry associations (e.g. GSMA)

Foster the development of adequate skills for AI builders and users

- **Capitalise on Nigeria's young population:** Given its population size and share of young people, Nigeria benefits from a huge potential pool of AI talent. By enhancing AI and data science education, the country can tap into this resource, fostering a new generation of skilled professionals capable of developing and implementing AI solutions tailored to local challenges. Nigeria should also implement strategies to mitigate brain drain, such as supporting career development, investing in state-of-the-art research facilities, and fostering a vibrant AI community. Government bodies could provide scholarships for AI education and seek partnerships with development partners and global universities, contingent upon students returning to Nigeria to contribute their expertise to the country.

Relevant stakeholders: Government bodies (e.g. FMCIDE, Federal Ministry of Education/Federal Scholarship Board), development partners (e.g. FCDO, IDRC), CSOs and capacity building organisations

- **Enhance AI and data science education:** Nigeria can capitalise on the potential offered by its young population by encouraging universities to incorporate AI and data science into their curricula and develop standardised courses to ensure consistency in the skills and knowledge acquired by students. AI courses should integrate a range of AI-related skills, including foundational mathematics and statistics, in addition to the already popular software programming courses. Investing in upskilling teachers and professors is critical, particularly those in institutions outside of major cities. In parallel, fostering robust collaboration between academia and industry is essential to mitigate the theoretical-practical gap. Government support should prioritise enhancing infrastructure for practical learning, such as equipping universities with computers and facilitating access to AI software. Closer collaboration with industry experts and organisations specialising in AI skills development, such as DSN, will further enhance the quality and relevance of educational courses and offer students practical experiences through joint projects.

Relevant stakeholders: Government agencies (e.g. Federal Ministry of Education), universities, CSOs and capacity building organisations (e.g. DSN, Wootlab Foundation, Rise Networks, Digital Skills Nigeria)

- **Accelerate digital literacy and skills development for AI users:** Most AI-enabled services are accessed via digital channels and mobile devices, yet digital literacy rates in Nigeria remain low, posing a significant barrier to AI adoption. It is crucial to raise awareness about AI among potential users and to expand funding for digital skills and literacy training programmes. Priority should be given to marginalised groups such as women and rural populations, who face greater challenges in accessing and utilising digital technologies effectively. As generative AI solutions continue to emerge, such as Crop2Cash's national agriculture hotline and Viamo's voice companion, integrating related skills like prompt-engineering into training programmes becomes essential. In parallel, upskilling government officials is essential to ensure they can effectively leverage online data platforms and dashboards for making informed policy decisions.

Relevant stakeholders: Development partners and industry associations (e.g. GSMA), government bodies (e.g. FMCIDE), AI startups and solution providers

Strengthen the development of the wider AI ecosystem by fostering an enabling environment

- ▶ **Establish a clear roadmap for policy implementation:** As Nigeria finalises its national AI strategy, the government should create a clear roadmap for implementation and could consider appointing a dedicated oversight body to ensure clear ownership and enforcement. The roadmap should include plans for capacity building of policymakers and government staff and lay out responsible ministries and agencies, budget considerations, and a timeframe for implementation. In addition, the government should finalise the AI code of practice and clarify existing guidelines for cross-border data transfers to ensure consistent application and compliance. It should allocate adequate resources to the Nigeria Data Protection Commission (NDPC) to ensure robust enforcement of the new NDPA.

Relevant stakeholders: Government agencies (e.g. FMCIDE, NITDA, NDPC), development partners and multilateral organisations (e.g. FCDO, UNESCO)

- ▶ **Encourage cross-sector collaboration through PPPs:** Encouraging collaborations between local actors (e.g. startups, researchers) and data providers, hardware and software suppliers, technical partners, and domain experts will help leverage a broad range of resources and expertise necessary for the development of AI-enabled services. There is a critical need to enhance access to computing resources through public sector collaboration with global GPU manufacturers and cloud service providers. More PPPs between government entities, private sector investors, and development partners are needed in Nigeria to co-finance AI projects and infrastructure (e.g. like the initiative between Microsoft, G42 and the government in Kenya).⁹⁹ Partnerships between the private sector and academic institutions, for example tech companies partnering with universities to co-develop curricula, provide guest lecturers, offer mentorship and sponsor practical learning initiatives, can support skills-building and help scale existing R&D initiatives.

Relevant stakeholders: Development partners (e.g. FCDO, BMGF, IDRC), Big Tech (Google, AWS, Microsoft), AI startups

- ▶ **Establish risk mitigation strategies for AI investment:** There is a need to increase investor awareness and understanding of deeptech to reduce risk aversion towards the sector. Local investors and startups could benefit from workshops to understand and navigate funding processes, financing management, and pitching to investors. Highlighting successful AI use cases and their impact can help build confidence in emerging technologies. In parallel, establishing risk mitigation mechanisms such as government-backed guarantees or insurance for investors can help offset perceived risks associated with currency devaluation and uncertain investment environments, while the use of blended finance tools can help startups build foundational AI capabilities and test solutions before attracting commercial capital.

Relevant stakeholders: Development partners (e.g. FCDO), incubators, accelerators and multistakeholder initiatives (e.g. AI Collective, AI4Dev Reference Group), government agencies.

⁹⁹ ▶ Microsoft. (2024). [Microsoft and G42 announce \\$1 billion comprehensive digital ecosystem initiative for Kenya](#).

- ▶ **Promote local investment and ownership:** There is a need to encourage local investments into the AI ecosystem. Financial incentives, such as tax breaks or reductions, reduced tax rates on returns from investments in AI, as well as subsidies or grants to local investors, can lower the entry barriers and make investments more attractive. Government and regulatory bodies can enforce regulations that promote local ownership and retention of intellectual capital and proprietary assets. This could involve mandatory local registration of patents and trademarks for AI innovations developed domestically, legal frameworks that support local companies in safeguarding their innovation, and preferential access to government contracts, grants, or subsidies for locally domiciled firms.

Relevant stakeholders: Government agencies (e.g. FMCIDE, Nigeria Investment Promotion Commission).

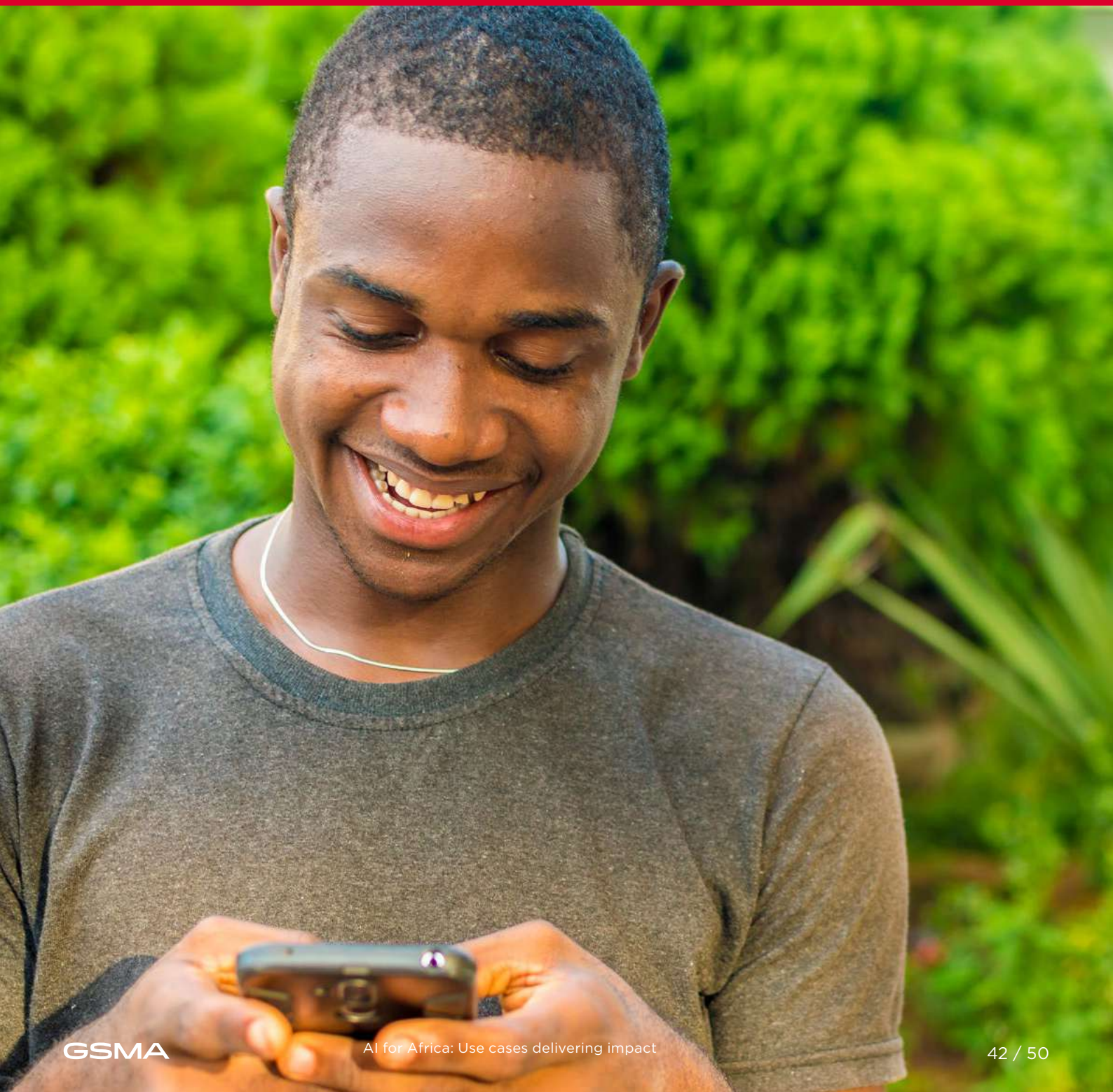
- ▶ **Boost public and private sector funding for R&D:** Research institutions and development partners can raise awareness on the role of R&D and encourage public and private sector spending in this area. They should advocate for the creation of a dedicated research network within universities and support access to R&D infrastructure for students and researchers. The government could expand the Nigeria AI Research Scheme to support more grantees and ensure it takes a localised and inclusive approach, for example by earmarking funding for women researchers and for projects addressing local development challenges. The government could also offer tax incentives, subsidies, or grants to private companies that invest in R&D for AI and encourage businesses to collaborate with academic institutions on research projects.

Relevant stakeholders: Government agencies (e.g. NITDA, NCAIR – AI Collective), development partners (e.g. FCDO, IDRC – AI4D Africa programme), universities and research institutions.

- ▶ **Build connections with the Nigerian diaspora:** Brain drain has resulted in many of Nigeria's qualified data scientists and AI researchers moving overseas for employment opportunities. Initiatives such as mentorship and job support programmes, networking events to bring together angel investors with AI startups, and academic exchange programmes can help leverage this diaspora and facilitate increased connections between global and Nigerian startups, universities, and capacity building organisations to accelerate AI development in the country.

Relevant stakeholders: Development partners (e.g. FCDO/IDRC – AI4D Africa programme), CSOs and capacity building organisations (e.g. DSN), multi-stakeholder initiatives (e.g. AI4Dev Reference Group), AI experts in the diaspora.

5. Annexes



Annex 1: Additional spotlights

Spotlight 8

Enhancing agricultural productivity with ThriveAgric's AI-driven platform

ThriveAgric seeks to leverage technology to empower smallholder farmers through its Agricultural Operating System (AOS). The AOS app facilitates farmer onboarding, input financing, supply chain efficiency, and sustainable agricultural practices, alongside farm monitoring, advisory services and post-harvest inventory management. ThriveAgric has progressively integrated AI capabilities across the range of services offered by the platform.

AI is used to streamline the onboarding process for smallholder farmers, who are assigned a unique digital identity, linked to their respective farm and agricultural activities. The onboarding and farm mapping data, such as soil texture, slope and proximity to water, is then used to assess farmers' creditworthiness, enabling access to input financing. The data is currently collected by field agents through AOS, but ThriveAgric also plans to deploy sensors in the near future.

The AOS platform provides tailored recommendations to farmers, helping them to make informed decisions to optimise crop yields, mitigate risks and adapt to changing environmental conditions. ThriveAgric also collects weather data from government agencies and private weather companies, integrating it with farm data into AI models. This generates personalised recommendations for planting times, irrigation schedules and fertiliser application. Furthermore, ThriveAgric is currently developing and testing the use of AI for market intelligence to provide farmers with timely insights into market trends, commodity prices, and demand-supply dynamics, thereby assisting them in identifying optimal selling strategies. However, data collection is currently conducted manually, which is time-consuming and limited in scale.

The primary delivery channels for ThriveAgric's data-driven advisory services are mobile applications and SMS notifications. Agents equipped with the AOS app can interact directly with farmers, and SMS alerts are used for notifications such as weather forecasts or market updates. Notably, the solution is designed to function offline. Agents can onboard farmers and capture farm data even in areas with no internet connectivity, then once they regain access to 2G or 3G connectivity, all the data captured offline synchronises to the cloud.

First launched in a small town in Kaduna State, ThriveAgric now operates across all states in Nigeria, and plans to expand to other countries such as Kenya and Ghana. To date, it has onboarded over 800,000 farmers across more than 2,600 communities. ThriveAgric also plans to build sustainability by partnering with Rabobank and the carbon credit platform Dorewa.¹⁰⁰

¹⁰⁰ ThriveAgric.

Spotlight 9

FarmSpeak uses AI and farm-level data to optimise smallholder poultry farming

FarmSpeak Technology designs smart monitoring and management systems for livestock farmers in the poultry sector in Nigeria – where 85 million people are actively involved – to optimise their production. Despite having the largest annual egg production and second-largest chicken population in Africa, Nigerian farmers are unable to meet the local demand for poultry and poultry products.

FarmSpeak developed a suite of tailored solutions digitising farm management, revolving around two main solutions. Their hardware device, PenKeep, uses IoT technology to continuously capture the microclimatic parameters of a poultry house, including temperature, humidity, air quality, water level, and water temperature. This data is then integrated in FarmSpeak (FS) Manager, an AI-powered farm management software that provides farmers with pen-specific data and insights to inform key decisions within the farm. Once relevant farm-level data, such as bird inventory, feed and water intake, bird weights and medication as well as expenses and sales transactions, is keyed into the system, FS Manager leverages advanced analytics to precisely predict and monitor poultry productivity, aid in planning future production cycles, and generate financial and production reports for farmers.

Key insights provided by FS Manager include feed conversion ratios, bird growth, weight curves, detailed bird mortality analyses, immunisation and feed recommendations based on production stages, and real-time poultry market price information for buying and selling birds and eggs. FS Manager is available through an app where recommendations are displayed. Due to the seamless integration between PenKeep and FS Manager, farmers are promptly alerted whenever adjustments to pen microclimate conditions are required. Using these solutions, farmers can streamline record-keeping, access tailored insights and make data-driven decisions to optimise their poultry farming operations, ultimately enhancing productivity and profitability.¹⁰¹

¹⁰¹ GSMA. (2024). [Unlocking the productivity of smallholder poultry farming in Nigeria: The role of farm-level data in Farmspeak's tailored advisory services.](#)

Spotlight 10

Hello Tractor harnesses predictive AI for farm equipment sharing

Hello Tractor is a digital platform connecting tractor owners and farmers through a farm equipment-sharing app and GPS fleet management solution. This helps farming communities improve planning and preparedness amid unpredictable rainfall patterns. Hello Tractor worked with predictive AI company Atlas AI to build a predictive demand model for tractor utilisation to optimise tractor availability in Nigeria and Kenya.

The model developed by Atlas AI and Hello Tractor uses ML to understand the underlying drivers of demand for tractor services. Analysing data on weather patterns, crop types, agricultural activity and socio-economic status, the model then predicts where demand will be strongest throughout the year. This has enabled Hello Tractor to proactively recruit tractor owners in places where there is forecasted to be a shortage of tractors, as well as plan where to build and expand their growing network of community-based mechanisation hubs. In addition, proprietary and third-party data provided by Atlas AI, such as socio-economic data and crop information, played a pivotal role in the suitable placement of Hello Tractor's innovation hubs, which are one-stop shops for machinery, maintenance, agri-inputs, and market linkages.¹⁰²

Hello Tractor currently operates in 16 African countries and has to more than 4,500 tractors and combines, servicing more than a million farmers and 2.9 million acres, all organised through a network of more than 2,500 booking agents.¹⁰³ Scaling the use of AI could further enhance Hello Tractor's ability to optimise resource allocation, improve service delivery and expand their impact on agricultural productivity and food security across Africa.

Spotlight 11

Fraym enhances energy planning with advanced data insights

Fraym is a data analytics company that helps public and private sector organisations solve some of the most pressing challenges by providing granular population data and insights. In Nigeria, Fraym developed a data visualisation platform to help policymakers and practitioners make more informed decisions about their strategies and operations to plan the expansion of least-cost access to electricity and clean cooking.

To address gaps in energy access, Fraym integrated satellite imagery and household survey data into its proprietary software, FUSEfraymTM to enable comprehensive understanding of the current state of demand-side considerations like ability and willingness to pay, productive uses, electricity growth and demand. Using ML and predictive AI, the software provided key insights for pathways and opportunities for least cost electrification options from grid, mini-grid, SHS to LP, electric cooking, and biogas.^{104,105}

Fraym partnered with Sustainable Energy for All (SEforALL) under its Universal Integrated Energy Planning programme, and received funding from the ShellFoundation. Its geospatial data modelling can be replicated for any country to illustrate supply-side solutions, along with a variety of demand-side factor, to identify pathways and opportunities for expanding energy access.¹⁰⁶

¹⁰² Atlas AI: [Powering the Mechanisation Revolution in Smallholder Agriculture with AI](#).

¹⁰³ GSMA Innovation Fund: [Hello Tractor](#).

¹⁰⁴ Fraym: [Energy](#).

¹⁰⁵ Fraym: [Fraym Partners with SEforAll to Support Energy Access in Nigeria](#).

¹⁰⁶ SEforAll: [Nigeria Integrate Energy Planning Tool](#).

Spotlight 12

Enhancing grid efficiency with AI: How Beacon Power Services helps utilities

Beacon Power Services is a US and Nigeria-based utility company that provides energy management software and analytics for utilities. It provides data and grid management solutions to help Africa's power sector distribute electricity more efficiently. The company is currently working with four utilities in Nigeria and Ghana, covering more than eight million customers (residential and commercial).

In 2022, Beacon Power Services announced that it had closed a seed round of \$2.7 million to improve electricity access and expand into new markets. By offering real-time visibility on network performance, the company's AI-enabled grid management platform, Adora, helps tackle some of the fundamental problems faced by African power distribution companies. The platform connects to every utility asset and customer node on the grid, allowing energy providers to pre-empt outages and identify network losses, respond to them quickly and distribute electricity more efficiently. In addition, their Customer and Asset Information Management system factors in the unique conditions within which utilities operate, such as poor address systems, and help them digitise their data, which serves as a foundation for network improvements.

According to Beacon Power Services, its digital solutions help energy utilities run more efficiently, increase profitability, and give consumers a larger supply of power by decreasing outages. This is crucial for a nation like Nigeria, where many DISCOs have low revenue collection rates and high aggregate technical, commercial and collection losses.¹⁰⁷

Annex 2: Full list of use case examples considered in Nigeria

Agriculture and food security

▶ AirSmat	Startup that uses an AI-powered platform to boost sales, revenue and sustainability for farmers.
▶ Agroexchange Technology	Startup that uses satellite data to provide crop health information and monitoring as an EWS for farmers.
▶ Babban Gona	Social enterprise that uses AI through a smartphone tool that detects crop and soil health.
▶ ColdHubs	Social enterprise that uses AI to manage solar-powered cold storage units, mitigating post-harvest losses.
▶ Cropnuts	Company that launched an AI-based soil testing and digital crop advisory service for smallholder farmers called AgViza.

¹⁰⁷ GSMA. (2023). [Innovation Spotlight Series: Tackling the urban energy challenge through digital innovation](#).

▶ Crop2Cash	Startup that uses satellite data and ML for farmer credit assessment and to provide data-driven digital advisory services.
▶ Farmcrowdy	Startup that uses AI and ML for their digital platform which provides farmers with tools related to data and market analysis, pricing decisions, yield projection and optimisation, and GPS/weather tracking.
▶ FarmSpeak	Startup that developed a climate-smart regulating device to provide livestock farmers with an AI-powered farm management app that helps them digitise their operations and diagnose poultry disease.
▶ Farmz2U	Startup that helps farmers farm better with tailored agricultural expertise using data and market access via system integrations.
▶ Figorr	SME that uses IoT-powered solutions on their cold storage products to monitor temperature, humidity and location to minimise post-harvest loss.
▶ Gwin Technologies	Startup that uses a smart mobile diagnostic tool using AI to support animal health.
▶ Hello Tractor	SME that uses AI to forecast crop yields, optimise tractor scheduling, and match farmers with tractor owners.
▶ Integrated Aerial Precision (IAPrecision)	Company that uses drone technology and data analytics for precision agriculture
▶ Ignitia	Deep tech SME that uses ML, satellites and predictive analytics to generate accurate weather forecasts and give farmers timely advice and warnings to optimise field performance via SMS.
▶ Kitovu	Startup that uses AI-driven data to help farmers determine soil needs, ensuring that they plant the right crops in suitable areas.
▶ Riwe Technologies	Startup leveraging AI and satellite-based precision solutions to empower farmers in Africa to increase their yields, reduce input costs and improve their livelihoods.
▶ ThriveAgric	SME that provides AI-enabled input financing, digital advisory and market intelligence to smallholder farmers.
▶ TradeBuza	Startup that digitises commodities sourcing, last-mile operations and trade for large agribusinesses who run out-grower schemes.

- ▶ **WFP** Non-profit organisation that utilises ML to estimate both current and future levels of insufficient food consumption, offering early warnings and enabling immediate responses.
- ▶ **Zenvus** Startup that uses electronic sensors and hyperspectral cameras to monitor soil needs and identify pests/diseases/droughts in crops early on; leverages IoT and cloud computing for data analytics.

Energy

- ▶ **Arnergy** SME that uses AI and ML to optimise energy storage and distribution from their solar solutions.
- ▶ **Azuri Technologies** SME that uses advanced AI algorithms in its solar home systems to enable real-time analysis of user power consumption patterns.
- ▶ **Beacon Power Services** SME that developed an AI-enabled grid management platform that offers energy providers and utilities real-time visibility on network performance and allows them to distribute electricity more efficiently.
- ▶ **Fraym** Data analytics company that uses ML to identify patterns and predict future energy needs across different regions, enabling more targeted and efficient energy distribution efforts.
- ▶ **Husk Power Systems** Company that uses AI to streamline mini-grid operations and scale up installations, and to forecast supply and demand, optimising electricity delivery and minimising costs for customers.
- ▶ **ICE Solar** SME that leverages AI-driven analysis of hyperlocal geospatial and demographic data, optimising the deployment of IoT-enabled solar microgrids.
- ▶ **Inq** Company that uses installed smart meters that leverage IoT to generate data on energy usage and transmission lines to minimise losses.
- ▶ **Koolboks** Uses AI for credit assessment, predictive maintenance of refrigerators and early detection of payment defaults.
- ▶ **Nithio** SME that provides a sustainable, risk-informed approach to finance aggregated receivables for the off-grid solar sector and uses AI and blended finance to make receivables financing more accessible.
- ▶ **Odyssey Energy** SME that provides end-to-end investment and an asset management platform to enable funders, governments, regulators and project developers to partner on mini-grid projects.

▶ Omdena	SME that uses satellite imagery to identify areas with low electricity far from the national electricity grid and uses ML-driven heatmaps to identify suitable sites for solar panel installation.
▶ OneWattSolar	Uses intelligent energy management systems that rely on blockchain and IoT to deliver tokenised digital services/products and support access to energy.
▶ VIDA	Uses satellite imagery and big data to estimate optimal locations for mini-grid deployments

Climate action

▶ Chemotronix	Startup that uses emerging technologies (AI, IoT, Blockchain) to measure, report and verify emissions and provide carbon credits.
▶ Google Floods	Big Tech company that developed AI models to forecast floods to alert people before a disaster strikes, limiting damage and loss of life.

Annex 3: List of organisations consulted

Nigeria

AI in Nigeria	Fraym
Autogon AI	Gwin Technologies
Awarri	Itana
Chevron	Koolboks
CoAmana	Lagos Business School
Cold Hubs	NITDA
Crop2Cash	REAN (Renewable Energy Association of Nigeria)
Data Science Nigeria	Rise Networks
FarmSpeak	Riwe Technologies
Farmz2u	Tech Hive Advisory
Federal Ministry of Communication, Innovation and Digital Economy	ThriveAgric
Fedironics	University of Lagos
	Wootlab Foundation

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