GSMA

AI for Africa: Use cases delivering impact

South Africa deep dive

August 2024

GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at www.gsma.com

Follow the GSMA on Twitter/X: @GSMA

UK International Development
Partnership | Progress | Prosperity

This initiative has been funded by UK Aid from the UK Government and is supported by the GSMA and its members. The views expressed do not necessarily reflect the UK Government's official policies.

GSMA Central Insights Unit

The Central Insights Unit (CIU) sits at the core of GSMA Mobile for Development (M4D) and produces in-depth research on the role and impact of mobile and digital technologies in advancing sustainable and inclusive development. The CIU engages with public and private sector practitioners to generate unique insights and analysis on emerging innovations in technology for development. Through our insights, we support international donors to build expertise and capacity as they seek to implement digitisation initiatives in low- and middle-income countries through partnerships within the digital ecosystem.

Contact us by email: centralinsights@gsma.com

AXUM

Axum is an Afrocentric impact company dedicated to fostering climate-positive, digitally innovative, inclusive growth across Africa, the Middle East and around the world. The company works with locally and globally influential leaders that seek to drive sustainable development, inclusion and prosperity.

Through strategic leadership and the ability to transform ideas into reality, Axum partners with diverse stakeholders to drive positive change. Boasting over 150 years of collective leadership experience, and a team of nearly 100 across 10 offices in Africa and the Middle East, Axum leverages a wealth of multisectoral and multicultural expertise to help clients navigate pressing global challenges and realise Africa and the Middle East's immense potential.

Author and contributors

Author: Tanvi Deshpande

Contributors: Eugénie Humeau and Daniele Tricarico

Acknowledgements
This report draws on research conducted for the GSMA by Axum. We would like to thank Gathoni Kang'ethe, Jamila Raji, Jonathan Munge, Salma Ait Hssayene, Isis Nyong'o Madison and Robin Miller for their contribution.

We would also like to thank the many individuals and organisations that contributed to the research. A list of organisations consulted for the research in South Africa is listed in Annex 3. We are particularly grateful to Dr Amandine Robin (Innovation Matters/AI in Africa), Brian Makaiba (Veluka Platform), Chido Dzinotyiwei (Vambo.ai), Dr Emmanuel Migabo (Tshwane University of Technology), Lavina Ramkissoon (African Union), Pria Chetty (Genesis Analytics), Dr Prosper Zanu Sotenga (Tshwane University of Technology), Tiyani Nghonyama (Geekulcha), Dr Unene Gregory (Institute for the Future of Work), and Zinhle Mncube (22 on Sloane) for their participation in our focus group discussion in Johannesburg.

Contents

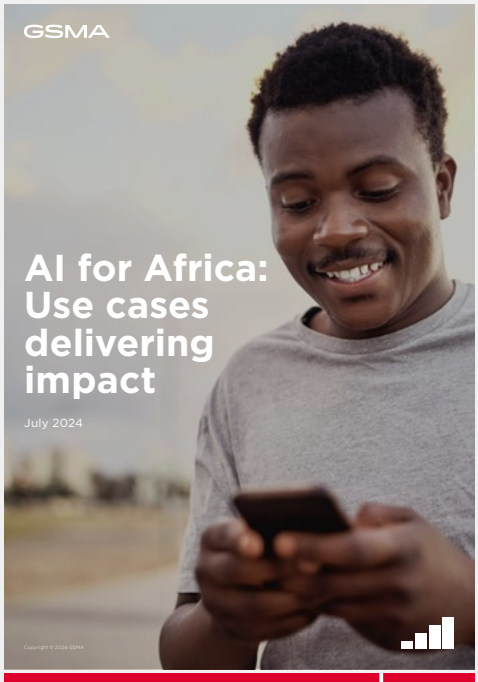
1. Introduction

South Africa is an upper-middle income country with a population of 59.8 million and a GDP of $405.3 billion.[1] It is considered a regional superpower on the African continent, based on its industrialisation, diversified economy, international trade and human capital. However, South Africa's economy has faced several challenges after the COVID-19 pandemic, with increased unemployment rates, especially among the youth, stagnating GDP growth and high rates of retail inflation. Despite these challenges, South Africa has become a thriving technology and innovation hub, enabled by the presence of startups, Big Tech players, strong academic and research institutions, investors, incubators and accelerators.[2] Startups in South Africa raised $548 million in 2023, holding the highest share in Africa.[3] The country has approximately 80 active tech hubs, second only to Nigeria, as well as two dedicated AI hubs.[4,5]

With its developed technology ecosystem and mature education ecosystem, South Africa has become one of Africa's leaders in exploring the potential of artificial intelligence (AI) in its economic growth and development. The AI market in South Africa is estimated to be worth $3.18 billion in 2024 and is expected to grow to $8.74 billion by 2030.[6] AI has the potential to be an economic enabler for the country by improving the productivity of South Africa's core industries and creating new jobs in emerging fields like data analysis, graphic design and computer engineering.[7] In addition, South Africa's smartphone adoption accounted for 69% of its total cellular connections in 2022, and is projected to increase to 94% by 2030.[8] With advanced smartphone and internet penetration, in addition to its investments in digital and compute, South Africa is well poised to fulfil the opportunity of AI.

The South African government has prioritised leveraging the Fourth Industrial Revolution (4IR)[9] to boost innovation and economic competitiveness.[10] For the benefits of 4IR to be enjoyed by all sections of the population, it is important to explore the potential of technologies like AI to address South Africa's development challenges, particularly in sectors like agriculture, energy, climate action, and healthcare. Integrating AI into tech-for-good solutions can significantly enhance their impact and expand their reach to all segments of the population, particularly disenfranchised communities at the last mile.

This report showcases existing and emerging AI-enabled use cases and solutions that can address development challenges related to agriculture and food security, energy, climate action and healthcare in South Africa. 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.



Download here

1 The World Bank Database: South Africa.
2 Artificial Intelligence Institute of South Africa.
3 TechCrunch. (2024). How African startups raised funding in 2023.
4 Tech hubs are defined as organisations based in the location, offering their facilities and financial or in-kind support to technology entrepreneurs.
5 Briter Bridges. 618 Active Tech Hubs in Africa.
6 Statista market intelligence. Artificial Intelligence – South Africa.
7 TRT Afrika. (2023). How artificial intelligence will affect jobs in Africa.
8 GSMA. (2023). The Mobile Economy Sub-Saharan Africa 2023.
9 Refers to changes brought about by emerging technological advances, including artificial intelligence, robotics, manufacturing, communication and automation, across the world.
10 Republic of South Africa. (2023). New investments to propel our digital economy forward.

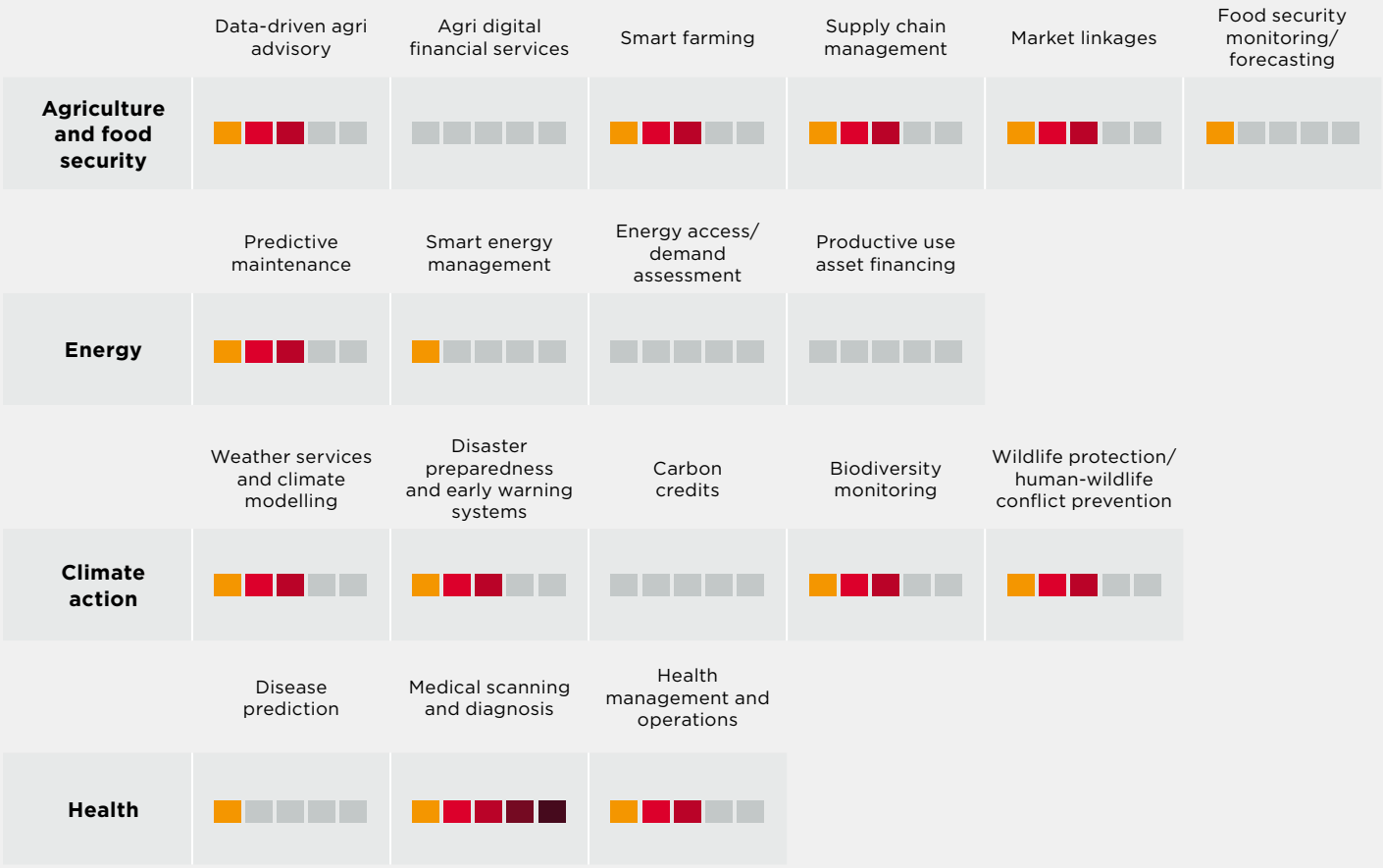
2. Use cases delivering impact

South Africa's National Development Plan aims to eradicate poverty, reduce inequality and align with the global Sustainable Development Goals (SDGs). The plan emphasises the improvement of healthcare systems to ensure a healthier, more productive population. It champions sustainable agricultural practices and technological innovation to enhance food security and support economic growth through agribusiness. It also prioritises reforms in the energy sector to ensure a reliable supply, promote renewable sources and contribute to a greener economy, while also addressing the urgent challenges posed by climate change. The plan envisages a nation that is resilient to environmental impacts with a diversified, low-carbon economy.[11] To promote a healthy population, the plan also identifies access to quality healthcare and wellbeing as a key priority for the country in the next decade.

AI can be transformative in advancing sustainable development efforts in South Africa. The technology is already being used to develop solutions across many sectors and use cases. This section explores the potential of AI in agriculture and food security, energy, climate action and healthcare in South Africa. Additional use cases are provided in Annex 1 and the full list of use case applications considered in South Africa is provided in Annex 2.

Figure 1

Heatmap of AI use cases in South Africa



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

11 Republic of South Africa. (2014). National Development Plan 2030: Our future- make it work.

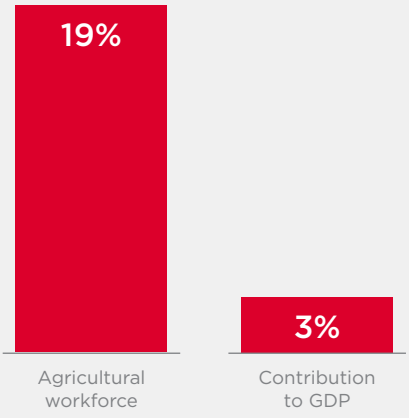
Agriculture and food security

South Africa has a relatively advanced agricultural sector, employing less than 20% of the population and comprising a mix of developed commercial players and subsistence farmers.[12] Challenges facing the agriculture sector in South Africa include low productivity, limited access to loans, land tenure and lack of market access in remote areas. The increasing occurrence of extreme climate events and unpredictable weather patterns has also adversely impacted crop yields, resulting in higher risk and lower returns for farmers, and rising food prices, which disproportionately impact people living in rural areas. The adverse effects of climate change are particularly felt by subsistence farmers, who rely solely on rainfall for their crop production, rather than commercial farmers. Rising temperatures also pose a challenge in the rearing and management of livestock in South Africa, impacting milk production and cattle reproduction, especially during the hottest periods of the year.

Figure 2

Agricultural contribution to labour force and GDP in South Africa

(2022)



Source: World Bank

Challenges like low crop productivity and uncertain rainfall also lead to other issues such as food insecurity, which is a key barrier to development in South Africa. As of 2021, 11.6% of households faced a form of food insecurity.[13] South Africa's semi-arid land makes it vulnerable to crop failures and food insecurity, which is exacerbated by increasing variations in annual temperature levels. Natural disasters like droughts and flash floods are the main drivers of food insecurity in the country, as they result in crop damage, loss of livestock, migration and displacement, and disease outbreaks.

Table 1

Hunger assessment in South Africa

(2023)

	GHI score	GHI rank (out of 125 countries)	Severity scale
South Africa	13	58	Moderate
Sub-Saharan Africa	27	-	Serious

Source: Global Hunger Index

The role of digital and AI

There is a significant opportunity for digital agriculture technologies to be used in South Africa to improve resource efficiency, increase agricultural productivity and yields, enhance market access for farmers, and reduce inputs and crop wastage. Digital agriculture solutions like Precision Drone Services[14] and EOS Data Analytics[15] use drones and remote sensors to collect data on weather, soil nutrients, crop health and land use to provide farm insights. Platforms like Mezzanine,[16] in partnership with Vodafone, offer online agriculture extension services to smallholder farmers through mobile apps, SMS and USSD to help them access farm advisory, agricultural inputs, credit and markets. At the post-harvest stage, agritech startup Desert Green[17] provides an e-commerce platform for smallholder farmers which aggregates demand for their crops, providing them with access to markets as well as logistics solutions in the form of mobile cold storage containers.

12 The World Bank Database.
13 Republic of South Africa. (2021). Assessing food inadequacy and hunger in South Africa in 2021. Department of Statistics South Africa.
14 Precision Drone Servies.
15 EOS Data Analytics.
16 Mezzanine.
17 Desert Green.

AI solutions can build on existing digital technologies by automating and enhancing decision-making processes on the field through data-driven insights, improving efficiency and scalability in the agriculture sector in South Africa. Aerobotics[18] utilises AI for pest and disease detection, analysis of drone imagery, orchard management and yield management (Spotlight 1). AI is also used in crop management and production for optimising the use of farm machinery. Hello Tractor, which also operates in Kenya and Nigeria, leverages AI to forecast crop yields, optimise tractor scheduling and connect farmers with tractor owners, thereby facilitating collaboration and enhancing productivity in the agriculture sector.[19] The Awareness Company[20] is another example of a startup, in collaboration with Microsoft, using AI to digitise farms and track data, including livestock health parameters, genealogy information, planting and rainfall schedules, and pest detection to provide valuable insights to farmers.

AI can also play a role in addressing food security challenges, by building upon existing knowledge to provide accurate predictions of events that trigger food insecurity in vulnerable regions. For example, the ITIKI project (Spotlight 2) incubated at the Central University of Technology (CUT) is a drought prediction system that combines the indigenous knowledge of farmers in South Africa with data modelling and AI.[21] Initiatives like ITIKI can be effective in linking traditional knowledge and local agricultural practices with digital and AI solutions, mitigating the impact of malnutrition and fostering food security for vulnerable populations.

Data-driven advisory

Spotlight 1
How Aerobotics uses drones for pest detection

Aerobotics, based in Cape Town, provides AI-driven insights for crop and orchard farmers through drone and satellite technology. Through their platform Aeroview, the company uses machine learning (ML) to analyse drone imagery data, detect pest and disease outbreaks and nutrient deficiencies in soil, and track water usage by crops, highlighting water-stressed regions. The company also provides insights on irrigation and fertilisation strategies, crop load and predicted yields.

Aerobotics' solution is particularly relevant in remote rural areas, where access to data may not be available and farmers can benefit from timely advisory to prevent over-usage of inputs and crop loss from pests and diseases. The company partners with Amazon Web Services (AWS) to leverage access to their cloud computing capabilities. Aerobotics' impacts include improved crop yields, reduction of water overuse and other inputs, and enhanced sustainability through optimised farm management.

18 Aerobotics.
19 Hello Tractor: Atlas AI case study.
20 Microsoft. (2021). Harnessing the power of agritech to help SA's smallholder farmers.
21 AfricaLive (2024). AI meets indigenous knowledge to predict droughts.

Food security monitoring/forecasting

Spotlight 2
The ITIKI project combines AI with indigenous knowledge to predict droughts

The ITIKI project is a drought prediction tool that delivers timely weather and drought forecasts along with actionable insights to farmers. Farmers can then act upon these insights to adjust their agricultural practices to mitigate the impact of droughts and reduce crop wastage.

ITIKI's drought prediction system uses various kinds of environmental data collected from sensors, including soil moisture levels, temperature, along with indigenous knowledge such as the key indicators for certain weather events, e.g. the blooming patterns of indigenous flowers being linked to an early start to the rainy season. These sources of information are then combined using advanced AI algorithms, transforming raw data into actionable insights. For example, a forecast might warn about low levels of rainfall in a particular season and suggest that farmers plant a crop requiring less water to grow over a water-intensive crop. The forecasts are delivered via SMS, ensuring that the solution is accessible to farmers who own feature phones but not smartphones.

Since being launched in 2019, the ITIKI project is now operational in South Africa, Kenya and Mozambique. The ITIKI tool can now predict droughts up to four years in advance with an accuracy of 70%, and up to 19 months in advance with an accuracy of 98%.[22] The solution underlines the importance of human expertise and local knowledge in developing practical and useful AI solutions in rural areas.

22 AfricaLive (2024). AI meets indigenous knowledge to predict droughts.

Key takeaways and considerations for AI deployment

The key challenges to expanding the adoption of AI innovations in agriculture are the availability of data and devices like smartphones and sensors, as well as unreliable connectivity. Smartphone penetration is relatively advanced in South Africa, but mobile data can be costly.[23] In addition, the country suffers from a lack of adequate digital skills, especially among end users, i.e. smallholder farmers, agribusinesses and input companies, and lack of access to digital devices. Low-tech delivery channels such as SMS and USSD must be developed along with digital agriculture services in South Africa, especially considering issues around accessibility, affordability and digital skills.

Most of the identified use case applications are around data-driven advisory services, where data is synthesised using various sources and AI models are applied to provide tailored agriculture advisory, facilitate market linkages, and derive insights on crop and livestock health. In addition to Aerobotics and the Awareness Company, organisations like South African Agri Initiative are using channels like WhatsApp to provide advice to farmers using existing agricultural data.[24] Offering accessible delivery channels that do not require a lot of mobile data will be critical to ensure adoption across smallholder farmers, as well as marginalised groups including women farmers.

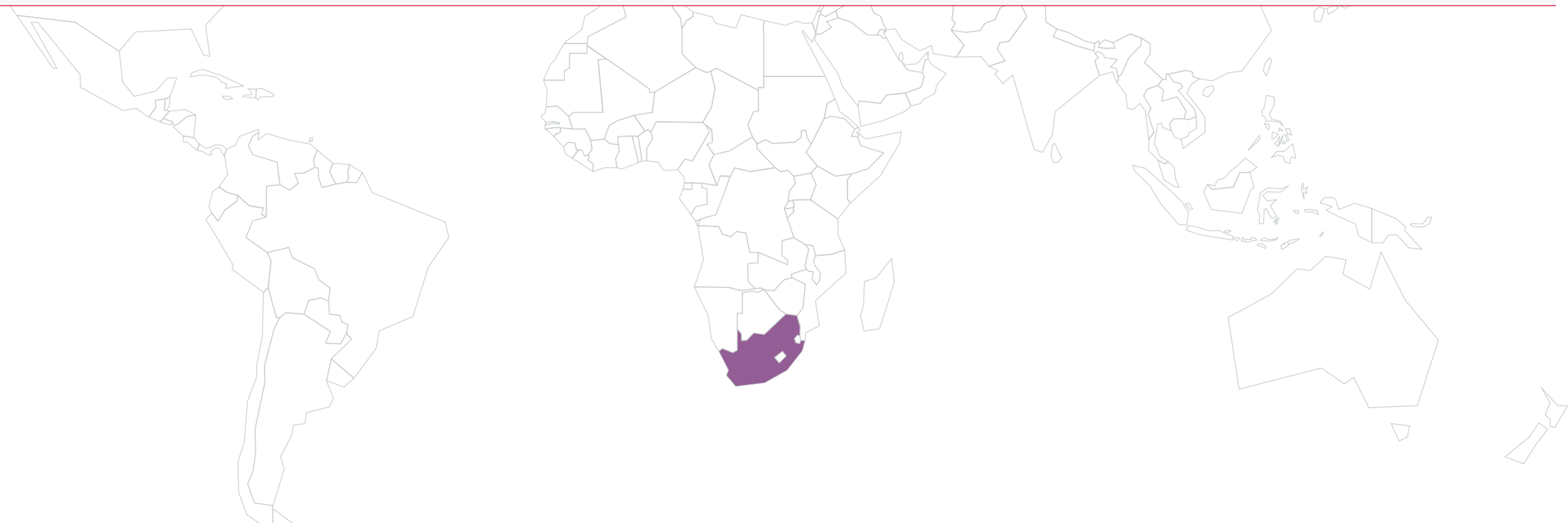
23 Competition Commission South Africa. (2019). Data prices are too high in South Africa - final findings and recommendations for data services market inquiry.

24 Saai. (2023). Saai launches artificial intelligence platform for family farmers.

Table 2

Mapping of use cases in agriculture and food security in South Africa

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Data-driven agri advisory	Customised advisory for climate-smart agricultural practices at the farm level (i.e. precision agriculture)	Weather data, historical climate data, remote sensing data, agronomic data, environmental data, domain-specific data, local language data	Smallholder farmers, extension agents, farmers cooperatives	Mobile apps, SMS alerts, face-to-face	Informed decision making, optimised resource allocation, increased yields, improved livelihoods and resilience to climate change	Aerobotics, Donkerhoek Data, Southern African Agri Initiative
Smart farming	Crop and livestock management and mechanisation equipment	Weather patterns, crop types, agricultural activity, socioeconomic data	Farmers, community-based agents	Digital marketplaces	Optimised use of farm inputs, increase in productivity and incomes	Hello Tractor
Market linkages	Digital marketplaces and analysis of market trends, demand-supply dynamics and price fluctuations	Production data, market demand and supply data, market price data, geospatial data, logistics and inventory data	Smallholder farmers, farmer cooperatives, agribusinesses	Mobile apps, feature phones	Supply chain optimisation, market and price transparency	KHULA!, The Awareness Company
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	Central University of Technology (ITIKI)



Energy

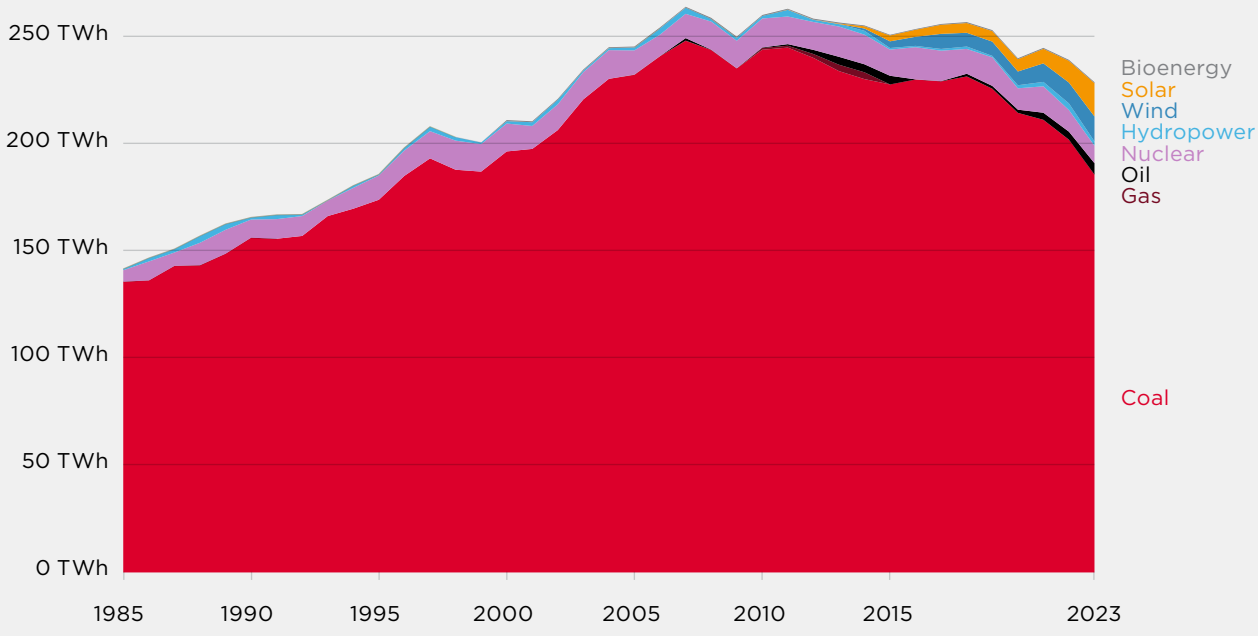
South Africa's energy sector grapples with challenges that include aging infrastructure, a reliance on coal, and the need to ensure reliable and sustainable energy access to all citizens. Although the country has better grid connectivity than most other African countries, issues around the reliability of the grid persist. South Africa faces significant power outages and has a heavy national utility debt of $21 billion as of 2023.[25] The lack of regular energy supply disproportionately impacts consumers and small businesses in rural areas where grid connectivity is sparse. It also impacts data centres with computing resources, and research and academic institutions, since the cost of back-up power supply can significantly increase their operating costs.[26] Irregularities in energy access also impact the operations of mobile network operators (MNOs) in the country, disrupting their ability to provide reliable network services. MNOs like Vodacom and MTN have subsequently partnered with the government to contribute renewable energy to the national grid[27] and increase investments in generators to address energy access issues.[28]

Eskom is a state-owned power company in South Africa, generating approximately 95% of the electricity used in South Africa,[29] 85% of which is generated through coal, oil and gas. South Africa is one of the most energy-intensive economies in Africa, accounting for 30% of the continent's electricity demand.[30] South Africa's draft Integrated Resource Plan 2023 for the development of the energy sector estimates a 29,500 MW increase in electricity capacity by 2030, mainly led by renewable energy sources including photovoltaic and wind power. To meet this demand, the government is keen to develop the domestic manufacturing industry by partnering with multinational energy companies and participating in their supply chain. To reduce reliance on public utilities and the usage of coal, the government is also liberalising the power generation sector, allowing off-grid renewable power suppliers to contribute to the electricity grid.[31]

Figure 3

Electricity production by source in South Africa

(Terawatt-hours, 1985-2023)



Note: electricity is just one component of total energy consumption – the other two being transport and heating. The electricity mix should not be misinterpreted as the breakdown of the total energy mix.
Source: Energy Institute

25 International Trade Administration. (2024). South Africa – Country Commercial Guide.
26 Financial Times. (2021). Cabling Africa: the great data race to serve the 'last billion'.
27 GSMA. (2023). Energy Challenges for Mobile Networks in Sub-Saharan Africa: The need for clean and reliable energy for universal connectivity and digital transformation.
28 Developing Telecoms. (2024). Power issues spur further investment from South Africa's MTN.
29 International Trade Administration. (2024). South Africa – Country Commercial Guide.
30 International Energy Agency. (2021). E4 Country Profile: Energy Efficiency in South Africa.
31 African Business. (2023). Are independent power producers delivering for South Africa?

The role of digital and AI

AI can play a critical role in ensuring reliable and uninterrupted electricity supply in South Africa by improving grid access and capacity and optimising existing operations and maintenance processes. The use of AI in the energy sector in South Africa is however still nascent. AI has been used to improve the efficiency of on-grid energy generation and transmission by Enel Green Power, which employs a digital assistant powered by ML algorithms to support control room operators by analysing data from wind turbines and providing insights to optimise management (Spotlight 3). In an effort to reduce the impact of loadshedding on households and businesses, the City of Cape Town has joined a pilot programme where non-essential uses like swimming pool pumps and air conditioning are sequentially switched off to conserve energy for households, based on AI-driven inputs from smart meters.[32] There are other opportunities for AI to be used with IoT technologies, such as in the case of Kenya's power entity KenGen, which has installed IoT devices to improve operations and maintenance processes at one of its thermal power stations.[33]

AI has also been applied to a limited extent to improve the effectiveness and reach of off-grid renewable energy solutions. For instance, to reach populations that do not have access to the national grid, Sun Exchange uses AI and big data analytics to optimise solar project development, operations and financing.[34] AI and digital technologies, along with tools like geospatial mapping can be leveraged to identify areas that are not connected to the national grid and may benefit from off-grid solutions like solar home systems (SHS). Companies like Sun King and M-KOPA in Kenya and Husk Power in Nigeria are using AI to identify and provide access to PAYG SHS in energy-scarce regions. As this sector develops in South Africa, there is huge potential for private sector companies to leverage AI and help to tackle South Africa's electricity supply crisis.

An additional consideration in the deployment of AI solutions in the energy sector is the availability of AI-enabled hardware such as IoT sensors and smart meters. However, such technologies have barriers of affordability which leads to limitations in developing AI-driven solutions. As South Africa looks to strengthen its position as a regional leader in AI compute, there is an opportunity to leverage the growing demand for IoT-enabled devices by investing in domestic manufacturing capabilities.[35] The IoT market in South Africa is projected to grow from $4.98 billion in 2022 to $31.5 billion by 2028.

Smart energy management

Spotlight 3
Enel Green Power optimises renewable energy production with AI

Enel Green Power focuses on developing and managing renewable energy generation in South Africa. The company currently operates 12 power plants in South Africa, with a total installed capacity of 1,236 MW in solar and wind energy. Enel uses AI in smart energy management to optimise renewable energy production, distribution and consumption. By leveraging ML and data analytics, they predict energy demand, enhance grid stability and increase the efficiency of renewable resources like wind and solar. AI also supports predictive maintenance, reducing downtime and extending the lifespan of energy assets.

32 WESGRO. (2023). AI could be the mighty ally in SA's energy battle – shaping a greener and resilient future.
33 CIO Africa. (2022). KenGen Installs IoT Technology at Olkaria Power Station.
34 Sun Exchange.
35 Investment Monitor. (2022). Will Africa's poor power supply hold back its AI and automation charge?

Key takeaways and considerations for AI deployment

There is a plethora of digital and AI solutions available to enhance electricity supply and introduce smart energy management systems, but few are aimed towards improving energy efficiency in rural areas and for marginalised groups. While nearly 90% of the population is connected to the national electricity grid, the state-owned power company Eskom is facing several operational and financial challenges, such as aging infrastructure as well as issues with sabotage and corruption, leading to unprecedented hours of load shedding in South Africa.[36]

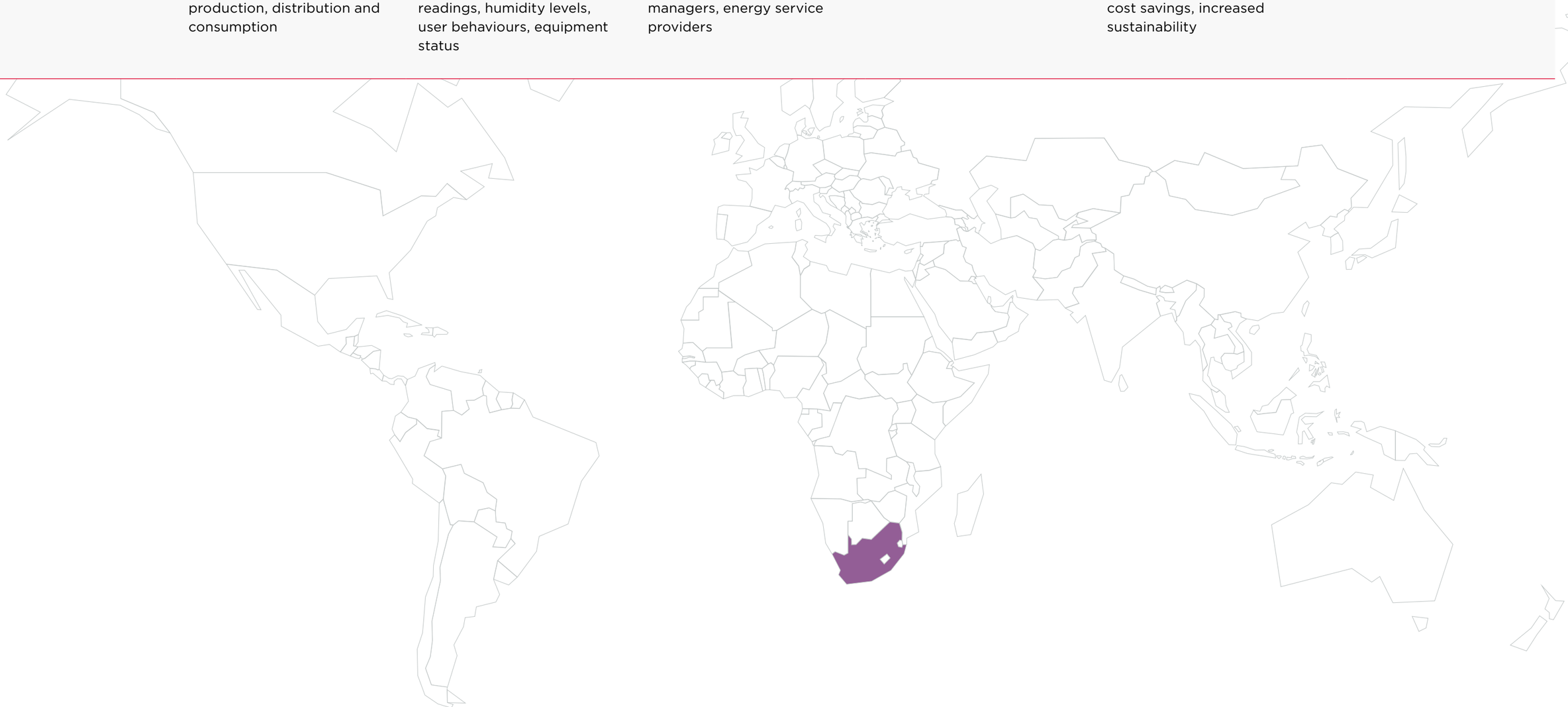
More capital will be needed to improve the grid infrastructure, not only for initial technology deployment but also for ongoing infrastructure maintenance and monitoring. Where grid infrastructure is lacking, there is an opportunity to focus on renewable and off-grid solutions. Government incentives to reduce the costs associated with installing solar PV and batteries can help accelerate deployment and promote public-private partnerships to improve energy access and reliability, especially in rural areas.

36 BBC. (2023). South Africa load-shedding: The roots of Eskom's power problem.

Table 3

Mapping of use cases in agriculture and food security in South Africa

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	Eskom
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	Reduced energy waste, optimised energy consumption, cost savings, increased sustainability	Enel Green Power, Sun Exchange



Climate action

While South Africa has low greenhouse gas emissions, it is highly vulnerable to the impacts of climate change. The country accounts for 1.17% of global emissions[37] and is ranked 111 out of 188 countries in terms of its vulnerability to climate change.[38,39] Temperatures in South Africa are projected to continue rising by 2°C by the 2050s and approximately 4.2°C by the end of the century.

South Africa's landscape comprises of extensive central grasslands, surrounding mountain ranges, and a low-lying coastline. The country is vulnerable to multiple climate hazards including heatwaves, droughts and floods, which can lead to biodiversity loss such as soil erosion, land degradation, desertification and depleted water resources. With half of the country classified as arid or semi-arid, South Africa is the fifth most water-scarce country in Sub-Saharan Africa.[40] Severe water scarcity has been further impacted by volatile rainfall patterns and increasing demand for resources. To arrest the impacts of climate change, the South African government has identified transitioning to sustainable agriculture practices and using renewable energy sources as key developmental priorities in its National Plan for 2030.

Table 4

Vulnerability to climate change and readiness to improve resilience

(Rank out of 185 countries, 2021)

	Country Index Rank	Vulnerability Rank	Readiness Rank
South Africa	95	111	120

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

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	**+0.5 to +1.7** (+1.2°C)	**+1.4 to +2.9** (+2.0°C)	**+2.4 to +4.4** (+3.2°C)	**+3.3 to +6.0** (+4.2°C)
Annual Precipitation Anomaly (mm)	**-16.2 to +14.0** (-1.6 mm)	**-21.4 to +11.9** (-3.7 mm)	**-22.2 to +13.2** (-4.3 mm)	**-26.1 to +12.4** (-5.9 mm)

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

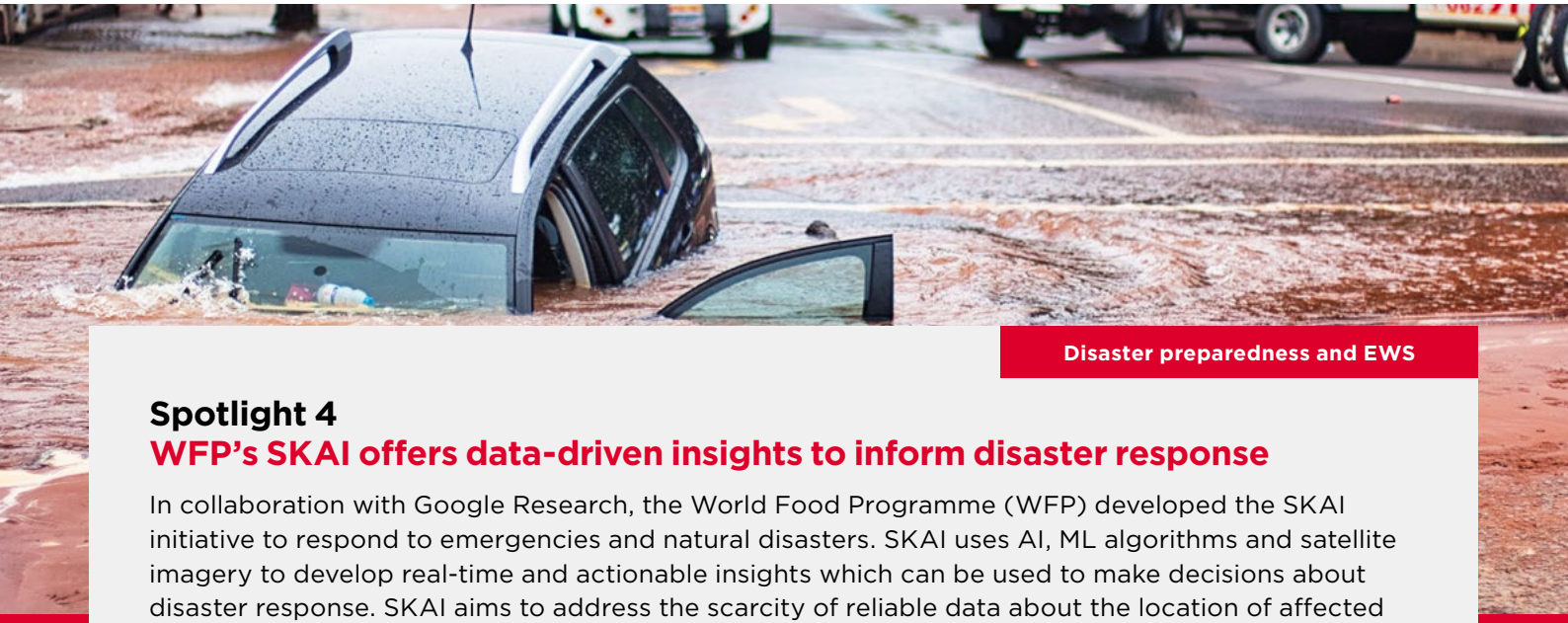
37 International Energy Agency, Energy systems of South Africa.
38 World Bank. (2021). Climate Risk Country Profile South Africa.
39 A lower ranking means greater vulnerability. The Notre Dame Global Adaptation Initiative Country Index summarises a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. See: https://gain.nd.edu/our-work/country-index/rankings/.
40 World Bank. (2021). Climate Risk Country Profile: South Africa.

The role of digital and AI

Digital innovations have the potential to mitigate the impacts of climate change and build climate resilience in South Africa, especially in rural areas and among local communities that are most affected by it. For example, mobile-based early warning systems (EWS) provide timely alerts for disasters and climate-related events such as heatwaves and flooding, based on weather data, mobile big data and demographic data to identify populations at risk. Weather and climate advisory services can support farmers to better adapt to the effects of climate change, informing them about planting and harvesting windows and optimal crop rotation cycles.

AI has the potential to enhance efforts around climate resilience and action through several use cases, building upon satellite or drone imagery, predictive analytics and sensor data. For example, the WFP uses satellite imagery and ML to support disaster response (Spotlight 4), while the IBM Green Horizons Initiative utilises AI for air quality prediction based on historical and real-time data on weather, air quality, topography and traffic reports. The South African National Space Agency (SANSA) has worked in collaboration with AWS and Zindi to develop an AI-based tool to detect informal settlements using SANSA's satellite data.[41] The tool can be used to ensure that government services reach all residents during emergencies.

AI can also be used to optimise natural resource management and support wildlife conservation to take climate action. For instance, FruitPunch AI, a community-driven organisation in South Africa, has used AI to conserve wildlife by detecting illegal poaching. They built AI models directly on devices in low-resource environments, using edge computing to enable real-time wildlife monitoring without needing cloud connectivity. Organisations like Rainforest Connection[42] and Connected Conservation Foundation are leveraging tools to collect and analyse data for ecosystem conservation and to protect wildlife and prevent human-wildlife conflict (HWC). By using satellite imagery and sensor data and monitoring footage from thermal cameras, they can track and predict changes in biodiversity and detect human activity in wildlife hotspots to prevent poaching activities.



Disaster preparedness and EWS

Spotlight 4
WFP's SKAI offers data-driven insights to inform disaster response

In collaboration with Google Research, the World Food Programme (WFP) developed the SKAI initiative to respond to emergencies and natural disasters. SKAI uses AI, ML algorithms and satellite imagery to develop real-time and actionable insights which can be used to make decisions about disaster response. SKAI aims to address the scarcity of reliable data about the location of affected populations during humanitarian and climate crises.

During the flash floods in Durban in 2022, SKAI analysed nine areas in the region to identify buildings that were damaged, aiding in the response and recovery efforts. SKAI also developed building and infrastructure-level assessment maps, identifying impacted wards, and aiding in quantifying the impact of the floods. This data was shared with local authorities to facilitate informed decision-making during and after the floods.

41 SANSA. (2020). African data scientists harness AI to find informal settlements in SANSA's satellite imagery.
42 Atlas of the Future. Saving the rainforests with AI: Rainforest Connection.

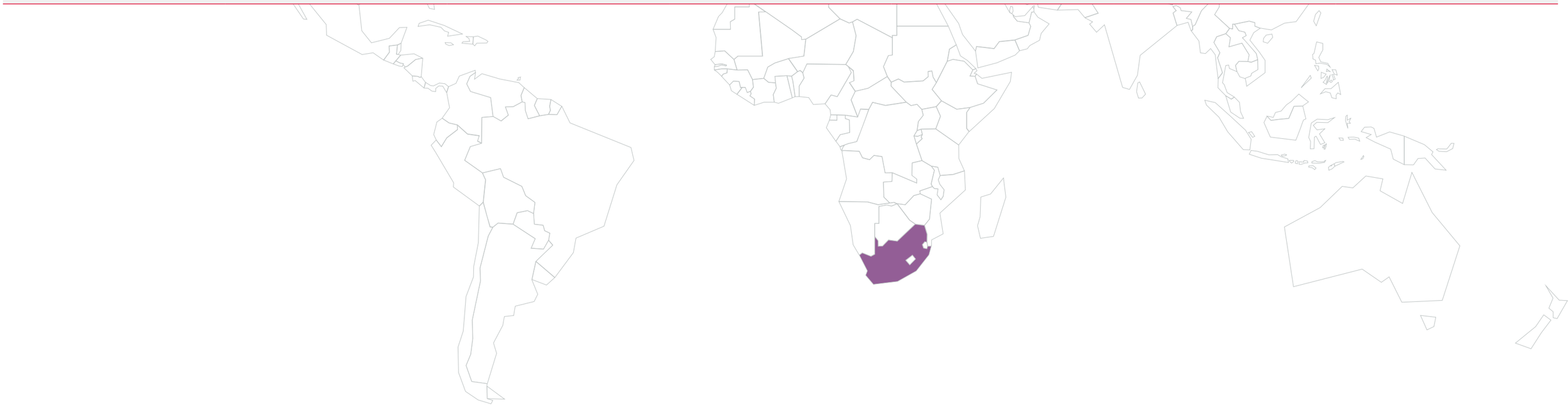
Key takeaways and considerations for AI deployment

The increasing availability and accessibility of satellite imagery has supported a range of weather and climate advisory, and biodiversity and wildlife preservation use cases. The climate action use case applications in South Africa are primarily led by philanthropic or not-for-profit organisations, followed by local organisations including academic institutions like the Tshwane University of Technology. As many of these use cases follow a B2G or B2B approach, especially those focusing on natural resource management, there is an opportunity for government agencies to play a role in working with local communities. It is particularly crucial to integrate local and indigenous communities in project design and implementation and ensure that solutions being implemented in their regions are inclusive, effective, and sustainable. Examples like the ITIKI project highlighted under food security monitoring and forecasting show how AI solutions can effectively combine local and indigenous knowledge with data analytics. Further, most of the climate action related use cases explored are in the form of projects and pilots, and there is a need to increase collaborative efforts between ecosystem actors, particularly government agencies, data and device providers, and private sector companies to develop and deploy the identified solutions at scale.

Table 6

Mapping of use cases in climate action in South Africa

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Weather services and climate modelling	Hyperlocal weather forecasts and climate modelling for climate change anticipation and adaptation	Weather data, historical climate data, remote sensing data	Smallholder farmers, agricultural communities, environmental organisations, government agencies	USSD, SMS, mobile apps, data visualisation dashboards	Enhanced resilience and adaptation to climate change	Microsoft/eThekwini Municipality, IBM, SpekTech, Tshwane Institute of Technology
Disaster preparedness and EWS	Predictive analytics and real-time disaster assessment and monitoring to mitigate impacts	Historical disaster data, environmental data, geospatial and remote sensing data, sensor data, social media and crowdsourced data, infrastructure data, population and demographic data, MNO data	Local communities, disaster response agencies, humanitarian organisations	Online platforms, mobile applications, feature phone alerts, radio	Enhanced preparedness and response to climate disasters, timely and targeted interventions to reduce loss of life	World Food Programme's SKAI initiative
Biodiversity monitoring	Assessment and tracking of changes in ecosystems, species distribution and habitat health	Geospatial and remote sensing data, habitat health indicators, historical data, climate data, species distribution data	Environmental agencies, conservation organisations, government bodies	Interactive maps, web-based platforms, community workshops	Conservation of biodiversity hotspots, sustainable land management, ecosystem restoration	Connected Conservation Foundation
Wildlife protection/ human-wildlife conflict prevention	Monitoring of wildlife habitats, detection of illegal activities (e.g. poaching) and support towards conservation efforts	Camera data, sensor and acoustic data, remote sensing data, population and species distribution data	Wildlife conservationists, park rangers, environmental researchers	SMS alerts, online dashboards	Reduced illegal wildlife trade, preserving endangered species habitats	FruitPunch AI, Rainforest Connection



Healthcare

The delivery and management of good quality and accessible healthcare is one of the critical development challenges in South Africa. The sector faces significant challenges, including a high chronic disease rate, inadequate diagnostic facilities and unequal access to affordable private healthcare services.[43] Healthcare in South Africa is largely publicly funded, with 70% of the population relying on free healthcare services provided by the government.[44] For instance, in 2022, the country's doctor-to-patient ratio was 1:3198, which is considerably lower than other developing countries like India, Brazil and Mexico.[45] Such challenges disproportionately impact people living in rural areas, where access to healthcare services is not easily available.

Inequalities in the healthcare sector are exacerbated by several systemic challenges, such as inefficient healthcare delivery systems, a shortage of qualified staff, and lack of uniformity in skillsets between healthcare providers in rural and urban areas.[46] While the government funds public health services including primary health clinics, community health centres and district hospitals, the system is overburdened owing to high levels of poverty and unemployment. There is a lack of equality between the public and private health sectors as a result of these issues.

The role of digital and AI

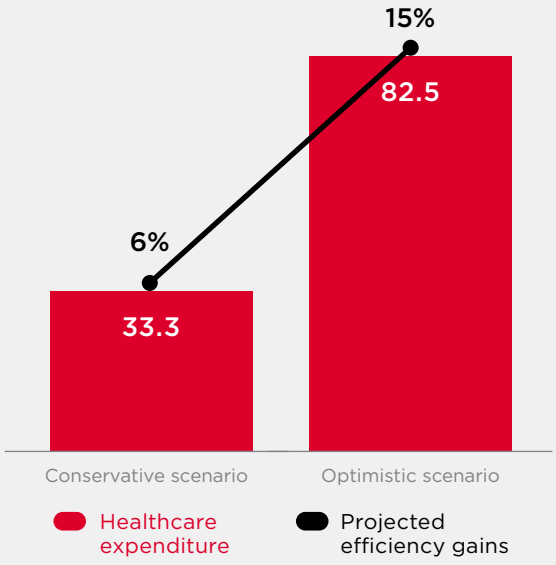
Digital technologies can help to address these issues and reduce inequalities in access to healthcare. Solutions such as mobile health apps offering teleconsultations, digitised patient and clinical records, remote monitoring devices to monitor conditions like diabetes, and healthcare logistics systems are some examples of digital tools being deployed in South Africa. These solutions can help to reduce the burden faced by the public health sector, contributing towards improving the quality of care.

Mobile big data has also shown some potential as a useful tool in digital health by aiding in the mapping of disease-affected areas, issuing health advisories during emergencies like the COVID-19 pandemic, and predicting the spread of infections across populations. Vodafone South Africa launched a digital health solution called SmartPatient in partnership with the Northern Cape Department of Health in 2023, which allows people to request medical assistance through an app, triggering an emergency services dispatch system.[47] In partnership with AXA Assurance, Orange acquired a majority stake in DabaDoc, a Moroccan digital healthcare management company, to help expand their services to Sub-Saharan Africa.[48] However efforts need to be taken to ensure that these digital tools are accessible for people in rural areas and from lower income groups. Investing in increasing the adoption of digital health solutions can help reduce South Africa's expenditure by as much as 15% by 2030.[49]

Figure 4

Potential efficiency gains from the adoption of digital health solutions in South Africa in 2030

(Healthcare expenditure in $ bn)



Note: The conservative scenario assumes the continuation of current trends in implementation and adoption on digital health tools, and lower-bound efficiency gains. The optimistic scenario assumes accelerated growth in implementation and adoption of digital health tools, and higher-bound efficiency gains.

Source: McKinsey & Company

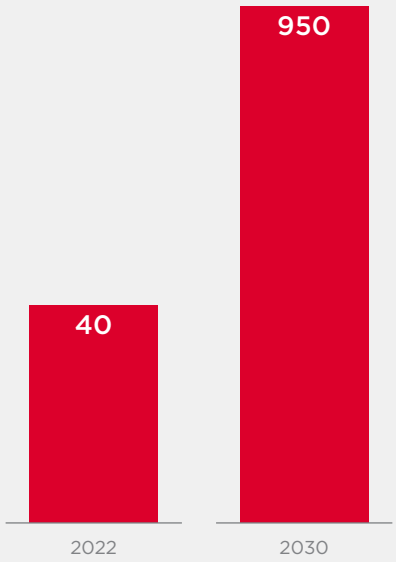
43 Behara, K. et al., (2022). Artificial intelligence in medical diagnostics: A review from a South African context. Scientific African, Vol 17.
44 Boston Consulting Group. (2023). South Africa and Artificial Intelligence.
45 Juta Medical Brief. (2022). SA's doctor shortage has worsened substantially in the past 3 years.
46 de Villiers, K. Bridging the health inequality gap: an examination of South Africa's social innovation in health landscape. Infect Dis Poverty 10, 19 (2021).
47 Vodafone. (2023). Delivering more accessible healthcare in South Africa.
48 Orange. (2021). Orange Middle East and Africa and AXA Assurance Maroc sign an agreement to acquire a majority stake in DabaDoc, the Moroccan health-tech company digitalizing access to healthcare in Africa.
49 McKinsey & Company. 2023. How digital tools could boost efficiency in African health systems.

AI can play a significant role in improving the efficiency and scaling existing digital solutions in healthcare. For example, administrative tasks like patient management, improving resource allocation, and addressing routine patient enquiries can be automated by using AI tools. Computer vision-based AI solutions can be used to improve the accuracy of medical imaging diagnostics, where precise and early detection of diseases can enhance healthcare response efforts. Other use cases include AI-powered telemedicine platforms, advanced medical imagery tools, and AI tools to forecast healthcare resource needs. Figure 5 shows the opportunity of using AI in the healthcare market in South Africa.[50]

Figure 5

Projected size of the AI in heathcare market in South Africa

($ million)

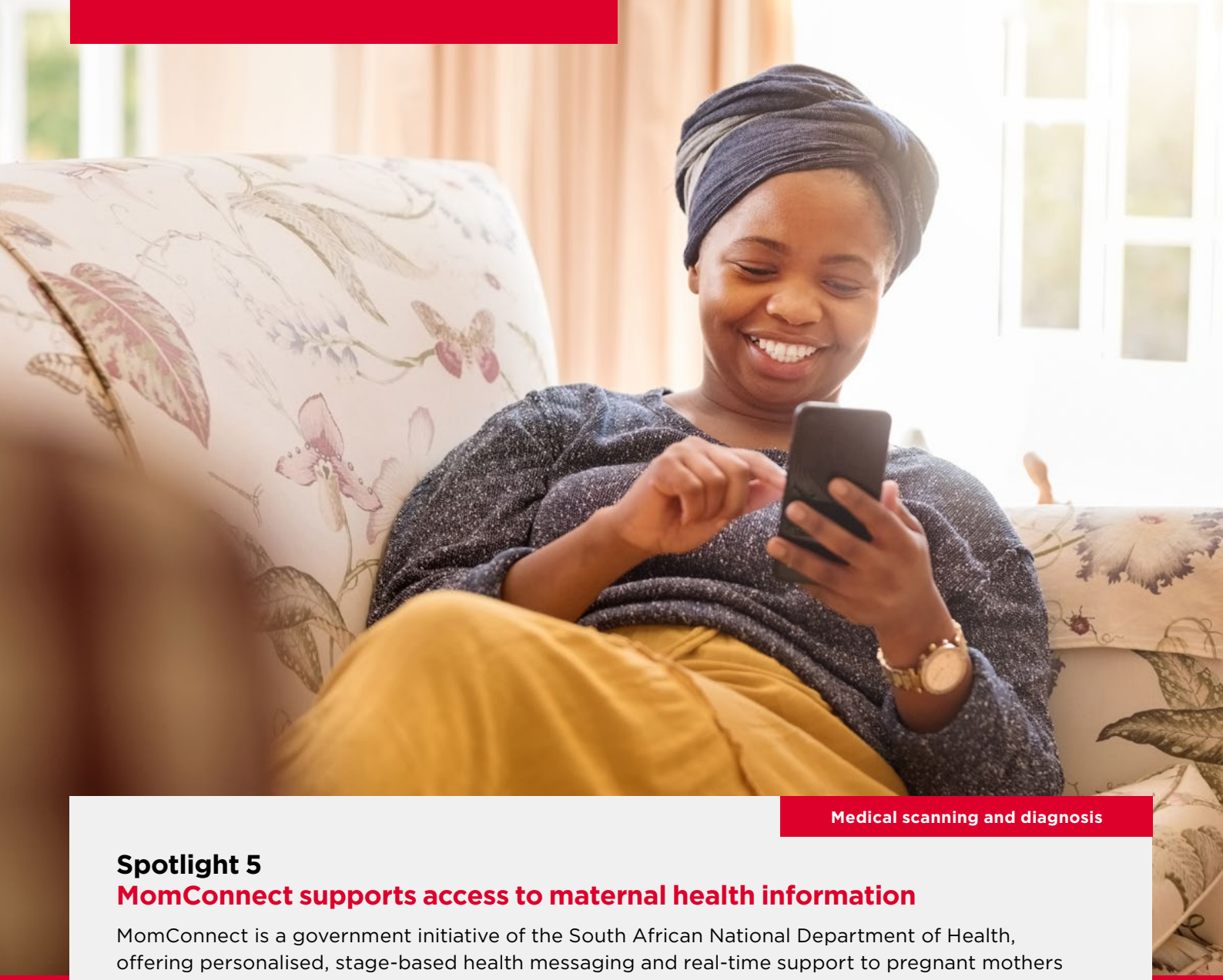


Source: Insights10

Startups like Envisionit Deep AI[51] and Quro Medical[52] are using AI to improve medical imaging and provide remote diagnosis. Quro Medical uses an AI-driven platform designed for remotely diagnosing, monitoring and supporting patients with chronic lung diseases. Another startup, MedSol AI Solutions,[53] utilises ML algorithms to power early and accurate diagnoses of breast cancer. Not-for-profit organisations like Jembi[54] have also developed AI-based healthcare solutions for efficient patient matching and health information system interoperability.

Initiatives by Big Tech players, such as the Microsoft Africa Research Institute (MARI), include a project to use ML for predicting the spread of infectious diseases.[55,56] The Phillips Foundation developed AI software to help triage and monitor COVID-19 patients via X-ray imaging, implementing this solution across 11 hospitals in South Africa. This solution may also have applications for similar diseases such as respiratory tract infections.

50 Upadhyay, V., (2023). South Africa Artificial Intelligence (AI) in Healthcare Market Analysis. Insights10.
51 Envisionit Deep AI.
52 Quro Medical.
53 MedSol AI Solutions.
54 Jembi.
55 Microsoft. (2022). A Prediction Model for Malaria using an Ensemble of Machine Learning & Hydrological Drought Indices.
56 MomConnect.



Medical scanning and diagnosis

Spotlight 5
MomConnect supports access to maternal health information

MomConnect is a government initiative of the South African National Department of Health, offering personalised, stage-based health messaging and real-time support to pregnant mothers in South Africa, including crucial information on breastfeeding to encourage positive behavioural changes and enhance the health of mother and child. MomConnect was set up in 2009 with initial donor funding from the National Department of Health, Reach Digital Health, Ada Health and the Rockefeller Foundation.

The MomConnect platform offers an AI-enabled virtual agent solution powered by Ada Health. Ada's AI-enabled symptom assessment technology uses natural language processing (NLP) to provide users with a thorough series of questions to understand their symptoms better. The technology provides health advice over WhatsApp and SMS and provides accurate assessments of maternal and paediatric symptoms and conditions.

Key takeaways and considerations for AI deployment

Most of the healthcare use case applications identified in South Africa fall under medical imaging and diagnosis (Table 7). This trend can be explained by the increasing digitisation of health records and the availability of historical clinical information and socioeconomic data online. Solutions that use AI to provide medical imagery using mobile phones and low-tech devices are mainly offered by healthcare startups and philanthropic organisations. Many of the use case applications are also focused on improving the efficiency of hospitals and patient management systems, mainly intended for hospital management and health insurance companies. There are few use cases that are focused on predicting the spread of diseases, although some results have been seen in predicting the spread of diseases like malaria and tuberculosis.

While the adoption of AI tools in healthcare is growing on the continent, healthcare providers and patients face some key barriers, such as insufficient technological infrastructure, a technical and domain knowledge skills deficit in the workforce, and regulatory considerations such as data privacy and consumer protection.[57] Given the sensitivity of health-related data, it is critical to ensure that the data used to train AI models in this sector is updated and complete. Further, AI tools for healthcare must appropriately represent the African reality, with its diversity of geography, languages and cultural norms. For instance, AI tools may not have the same efficacy across different countries and regions, owing to different colloquial names for illnesses or diseases, different ways of describing symptoms and different cultural or gender norms related to certain medical conditions.

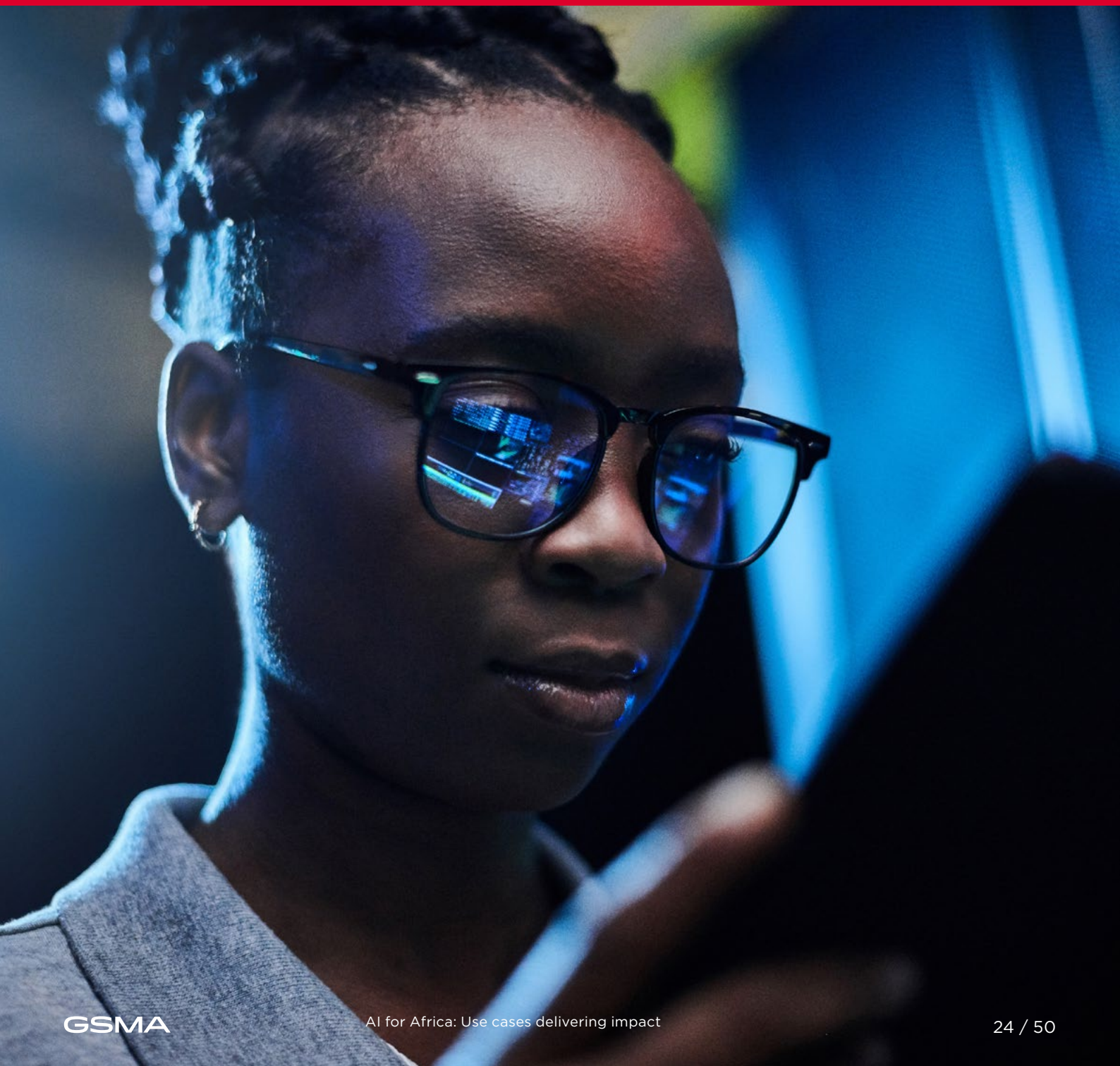
57 Townsend, B.A., et al, (2023). Mapping the regulatory landscape of AI in healthcare in Africa. Front Pharmacol, Vol 14.

Table 7

Mapping of use cases in healthcare in South Africa

Use case	Description	Data	End users	Delivery channels	Impact	Applications
Disease prediction	Early detection of diseases or prediction of conditions based on patient data	Disease incidence, prevalence, and transmission data, electronic health records, socioeconomic data, human mobility data, genomic data	Healthcare providers, public health agencies, emergency response agencies	Mobile apps, SMS, online platforms	Public health preparedness, prompt emergency response, evidence-based research studies, reduction in disease burden	Microsoft Africa Research Institute
Medical imaging and diagnosis	Mobile phones and low-tech devices to capture medical imagery, and improve accuracy of X-rays, CT scans and MRIs	Electronic health records, medical imagery, genomic data, historical clinical information, socioeconomic information	Healthcare providers, public health agencies, patients and caregivers, health insurance companies	SMS, mobile apps, smartphones	Data-driven decision-making, personalised health intervention, reduced load on hospitals and healthcare providers	Envisionit Deep AI, Quro Medical, MedSol AI Solutions, The Health Foundation, Philips Foundation, MomConnect
Hospital operations and patient management	Management of hospital operations, matching of patients with doctors, streamlining of patient health records	Patient health records, hospital operations data, socioeconomic and demographic data, customer service data	Hospital management, healthcare providers, health insurance companies, health policy makers, patients, caregivers	Online dashboards, mobile apps	Optimised hospital management, increased reach of healthcare providers, improved medicine supply chain	African Health Placements, Jembi, Vantage Health Technologies

3. Building a thriving AI ecosystem



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, capacity, skills 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 efforts. Figure 6 illustrates key actors involved in building and strengthening South Africa's tech and AI ecosystem along these enablers through various initiatives. This section explores existing gaps and opportunities to strengthen South Africa's ecosystem and unlock the potential of AI to support the SDGs.

Figure 6

Key ecosystem players in South Africa

Government agencies	science & innovation – Department: Science and Innovation, Republic of South Africa; the dtic – Department: Trade, Industry and Competition, Republic of South Africa; SANSA – South African National Space Agency
Development partners	UK International Development – Partnership | Progress | Prosperity; Artificial Intelligence for Development Africa; Tony Blair Institute for Global Change; giz – Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; African Union; Bill & Melinda Gates foundation
Digital infrastructure/ HPC providers	aws; Google; NICIS CHPC; Microsoft; NVIDIA
Data and NLP initiatives and organisations	Common Voice – mozilla; Lacuna Fund – Our voice in data; Lelapa AI; Fair Forward – Artificial Intelligence for all.; Vambo AI
Capacity building initiatives and organisations	GEEKULCHA/>; GEN 22 on Sloane; AI in Africa; UK South Africa Tech Hub
Academic and research institutions	University of Pennsylvania; Research ICT Africa; World Economic Forum; South Africa Centre for the Fourth Industrial Revolution; cair – Centre for Artificial Intelligence Research; HSRC – Human Sciences Research Council; IBM Research; Tshwane Institute of Technology
MNOs and industry associations	cell C; vodacom; MTN; Telkom; rain; SAAIA – South African Artificial Intelligence Association – The AI opportunity of tomorrow, today

AI fundamentals

Data

South Africa is a regional leader in data availability, with several initiatives from the public and private sectors focusing on building a data repository as a foundation of the country's AI ecosystem. Organisations working on generating and storing data include Open Data South Africa,[58] Stats SA,[59] and the South African Cities Open Data Almanac.[60] Open Data South Africa is a joint initiative between several key ecosystem actors, including the Department of Public Service and Administration (DPSA), OpenUp, Centre for Public Service Innovation, The Innovation Hub, Geekulcha, Open Cities Lab and the Human Sciences Research Council (HSRC). While the government owns large datasets including census data, household surveys and labour force data collected through the National Statistics Office, it faces challenges with data cleaning and integration across different ministries.

Limited access to high-quality and complete datasets is a key barrier to developing the AI ecosystem in South Africa. Inaccuracy of data is an additional constraint, especially for use cases that directly impact end users, such as health diagnoses or extreme weather forecasts. Concerted efforts are needed to build tools to clean and structure data into datasets that can be seamlessly integrated into AI models. Another key challenge is ensuring fairness and removing bias in data used to train foundational AI models as well as in the governance of these datasets.

The lack of local language datasets is a critical barrier to solving region-specific challenges using AI tools. In South Africa, several organisations and initiatives are working towards making local language datasets and NLP models accessible in the public domain. NLP models can be used by startups, tech companies and universities to feed into AI tools such as chatbots, virtual assistants and data translation and extraction services. An example is Lelapa.AI (Spotlight 6), an AI research lab working on building local language models in African languages at the regional level.

In building datasets that can be used by AI algorithms and models, it is important for the data to be locally relevant to South Africa. AI solutions based on data collected from local sources are more likely to create trust between end users and solution providers, and also help to mitigate biases and risks associated with building AI models. In addition to the local region, datasets must be contextualised to the provincial or regional context, language and culture as much as possible. Another consideration is for data collected and stored locally to adhere to local laws, such as the Protection of Personal Information Act in South Africa.[61]

58 Open Data South Africa.
59 Stats SA.
60 South African Cities Open Data Almanac.
61 Republic of South Africa. (2013). Protection of Personal Information Act (POPI Act).

Medical scanning and diagnosis

Spotlight 6

Lelapa.AI aims to bridge South Africa's local language data gap

Lelapa.AI is an Africa-centric AI research lab based in Johannesburg. Founded in 2022, the organisation is looking to address the challenge of local language data availability on the continent. Since existing language models do not recognise prompts in local languages, Lelapa.AI leverages ML to create AI tools that work for African languages.

Lelapa.AI launched its AI tool Vulavula in 2023, which converts voice to text and recognises the names of people and places in four different languages spoken in South Africa: isiZulu, Afrikaans, Sesotho and English. The tool can be used as a standalone model or integrated into existing tools like ChatGPT and other chatbots. Lelapa.AI is now expanding Vulavula's capabilities to other African languages, of which there are about 2,000 in total. Lelapa.AI collects data in local languages through online and offline avenues, working with linguists and local communities to gather, clean and label data, tagging it according to potential use cases. Lelapa.AI has raised $2.5 million through a seed venture capital round in 2023 and is planning its next funding round in 2025.

Compute and infrastructure

South Africa has emerged as a telecommunications leader on the African continent, owing to its extensive mobile network coverage and connectivity, as well as investments by the government and MNOs to build its digital infrastructure. The country is also considered a regional giant in AI compute, based on its high growth rate of servers, supercomputing capabilities and investments in quantum computing, cloud and data centres for AI.[62] South Africa's power grid connectivity, which is essential for data centres to operate, is about 97-98%, just short of the 99% standard for developed markets and better than most other African countries.[63]

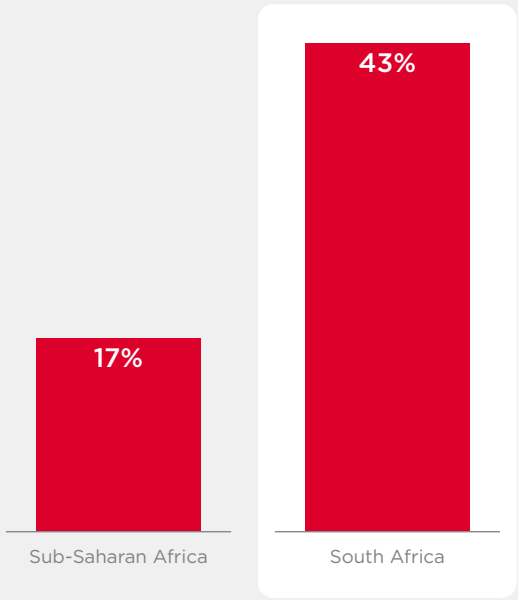
There are 32 data centres in South Africa as of 2023, with JHB2 Samrand Data Centre being regarded as the leading data centre in Africa.[64] Companies like AWS, Teraco, and Dimension Data have pledged investments of R21 billion ($1.1 billion) to build more data centres in South Africa.[65] The country also houses one of two supercomputers in Africa. The Lengau supercomputer,[66] launched in 2016, is hosted at the Centre for High Performance Computing (CHPC), an initiative of the South African government's Department of Science and Innovation (DSI) that offers high-performance computing (HPC) resources and specialised support to practitioners in the public and private sector.

MNOs also play a key role in supporting the AI compute and infrastructure ecosystem in South Africa. Key regional players include Vodacom, MTN and Telekom. In 2023, Vodacom announced that it would invest $3.3 billion (R60 billion) in the South African market over the next five years, with the objective to boost its connectivity and improve network resilience, especially in rural areas.[67] In 2018, Vodacom, MTN and Telkom had pledged investments of approximately R200 billion ($10 billion) over five years to develop the data and telecommunications infrastructure in South Africa. MTN has also announced plans to embed AI and APIs in its national strategy by monetising aggregated mobile big data. Further, as momentum for 5G grows across Sub-Saharan Africa, South Africa is set to lead in terms of accounting for nearly half of these connections by 2030. As consumers migrate to 4G, growth in 5G connections also will continue to grow, significantly adding to mobile data traffic over the next five years.[68]

Figure 7

Projected percentage of 5G connections in 2030

(% of connections)



Source: GSMA Intelligence

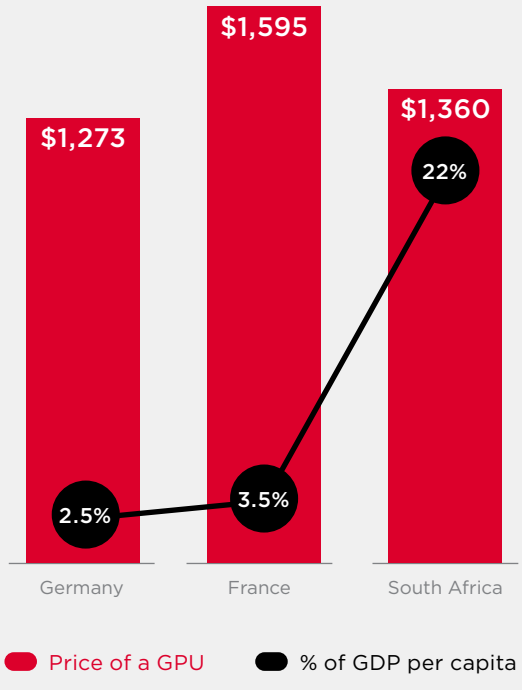
Given these projections, development of digital infrastructure to support AI solutions needs to be a key priority for South Africa. The country currently relies on importing components like graphics processing units (GPUs) and central processing units (CPUs) from external markets. Additionally, international ICT companies including NVIDIA, Intel, Google, Microsoft, IBM, Huawei and AMD have a strong presence in South Africa, and they account for most of the computing hardware and cloud computing capabilities in the country. In the absence of local manufacturers of computing hardware, startups and smaller technology companies are dependent on partnerships or AI programmes with Big Tech, which may constrain their ability to safeguard their intellectual property and data and keep it within the country.

62 Tony Blair Institute for Global Change. (2023). State of Compute Access: How to Bridge the New Digital Divide.
63 Financial Times. (2021). Cabling Africa: the great data race to serve the 'last billion'.
64 Data Center Map. South Africa data centers.
65 Republic of South Africa. (2023). New investments to propel our digital economy forward.
66 National Integrated Cyberinfrastructure System. Advancing High-Performance Computing in South Africa: The CHPC.
67 Developing Telecoms. (2023). Vodacom will pump $3.3bn into South African unit.
68 Okeleke, K., et al. (2023). The Mobile Economy Sub-Saharan Africa 2023. GSMA.

The cost of compute is a key barrier to developing local compute infrastructure capabilities in South Africa, as seen in Figure 8. The cost of compute, measured as the price of a GPU, is nine times that of a GPU in Germany, which is considered as a benchmark.[69] While this ratio is lower than other African countries like Kenya, the price of a GPU accounts for 22% of South Africa's per capita GDP, underlining its unaffordability. This impacts the ability of startups, technology innovators and AI practitioners—including students to a large extent—and limits them from engaging in complex AI and ML projects which require substantial computing power.[70]

Figure 8

Absolute and relative cost of compute in South Africa



Source: AI4D Africa

Another key challenge in building AI compute and infrastructure is access to a stable power supply. While grid connectivity in South Africa is high, an uninterrupted supply of power is a challenge for data centres, especially in non-urban regions. In 2022 alone, over 1,000 hours of load shedding were reported in the country.[71] When power supply is not seamless, data centres must rely on diesel-operated power backup generators, which are fuel-intensive and significantly add to their operating costs. To ensure the smooth operation and competitiveness of data centres in the regional market, access to uninterrupted power at the last mile must be a priority.[72] Load shedding and unreliable electricity supply also impacts the base stations of MNOs, in turn affecting their ability to provide high-quality connectivity and increasing their reliance on diesel as a source of fuel.

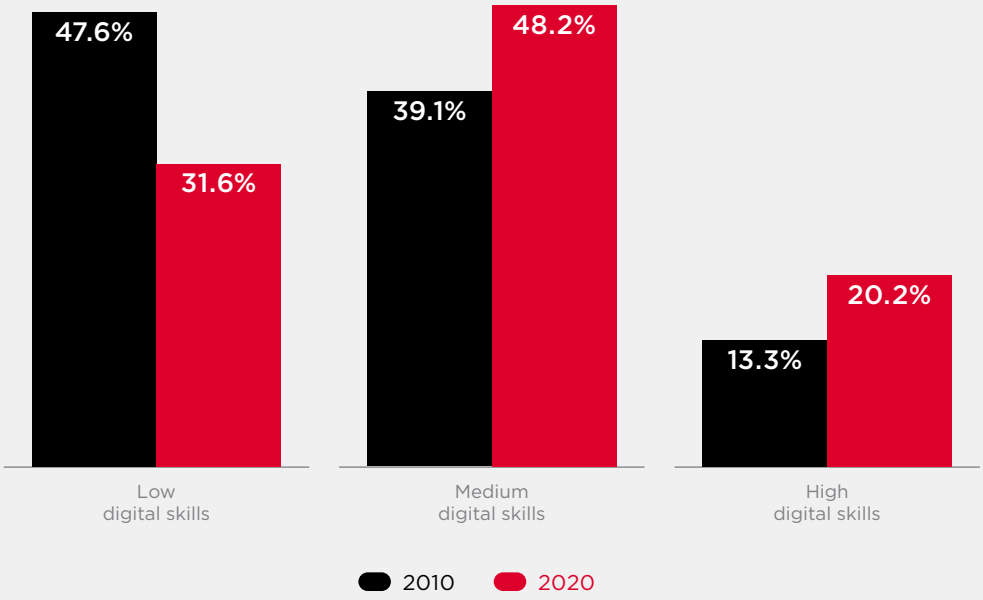
Skills

According to a study by Brookings, the proportion of occupations in South Africa that require a high or medium level of digital skills has grown significantly from 2010 to 2020.[73] Software development, considered as foundational for building AI models, has been identified as a scarce skill and is expected to grow by 22% by 2030.[74] However, despite the growing demand for workers with digital skills, unemployment levels in the country continue to be high, especially among the young. According to Stats SA from the Department of Statistics, youth unemployment was 44.3% at the end of 2023.[75] A key component to bridge the unemployment gap and enhance economic development in South Africa will be to build basic digital skills and advanced technical skills among the young.

69 Artificial Intelligence for Development Africa. (2024). "Compute - AI in Africa: The state and needs of the ecosystem".
70 Data Center Dynamics. (2022). Understanding Africa's data center challenge.
71 Republic of South Africa. (2023). Electricity: a vital resource for municipalities. Stats SA.
72 Financial Times. (2021). Cabling Africa: the great data race to serve the 'last billion'.
73 Africa Growth Initiative at Brookings. (2023). Digitalisation and Digital Skills Gap in Africa: An empirical profile.
74 Tech Financials. (2022). Digital Literacy Is The Foundation On Which South Africa Should Be Building Its Future.
75 Republic of South Africa. (2024). Quarterly Labour Force Survey – Q4: 2023, Stats SA, Department of Statistics.

Figure 9

Occupation shares by digital skills intensity in South Africa



Note: Computer programming and electrical engineering were the key occupations identified under high digital skills.
Source: Brookings

Developing a workforce skilled in building data algorithms and AI models within South Africa is an essential component of building an AI ecosystem in the country. There are several initiatives focused on building digital and AI skills in South Africa, led by academic and research institutions, local not-for-profit organisations, Big Tech, and incubators and accelerators. The government has allocated $50 million for AI-focused PhD training within the National Skills Fund, with the objective of building domestic capacity in AI research and development.[76] An additional $41 million has been allocated to digital skills development, focusing on building the necessary digital skills to ensure students are ready to join the workforce.[77]

Universities and their research institutions also play a significant role in building AI skills in South Africa. Key institutions, including the University of Johannesburg, University of Cape Town, Tshwane University of Technology, and University of Pretoria, offer post-graduate programmes in AI and data analytics-related subjects. For instance, the Data Science for Social Impact research group within the University of Pretoria provides courses on AI-related topics like big data science and NLP. In addition to universities, Technical and Vocational Education and Training (TVET) institutions and Sector Education and Training Authorities in South Africa incorporate technology programmes focused on 4IR.[78] Coding and robotics are also included in some school-age education curricula, reflecting a broader integration of technology education.[79]

However, a key challenge in building an AI-skilled workforce is the lack of a robust pipeline of opportunities available for AI talent in South Africa. There is a disconnect between the demand for jobs and the skills acquired as part of AI capacity building initiatives, mainly owing to rapid advances in AI and its applications across sectors. While Big Tech companies and other international players are absorbing some of the AI talent, there are instances of brain drain where highly skilled workers are either moving across African borders or to high-income countries for opportunities that align with the

76 Research Professional News. (2023). Cyril Ramaphosa unveils R1bn PhD initiative.
77 IT Web. (2024). R800m to fund workplace digital readiness upskilling.
78 Hanlin, R., and Mlilo, W.K., (2023). Enhancing South Africa's Emerging Digital Technologies' Innovation Ecosystem. UbuntuNet.
79 Huawei. (2022). ICT Talent Development for The Digital South Africa.

skills they offer. To address this gap, skill-building programmes must ensure that their courses are relevant from a jobs-demand and employability perspective.

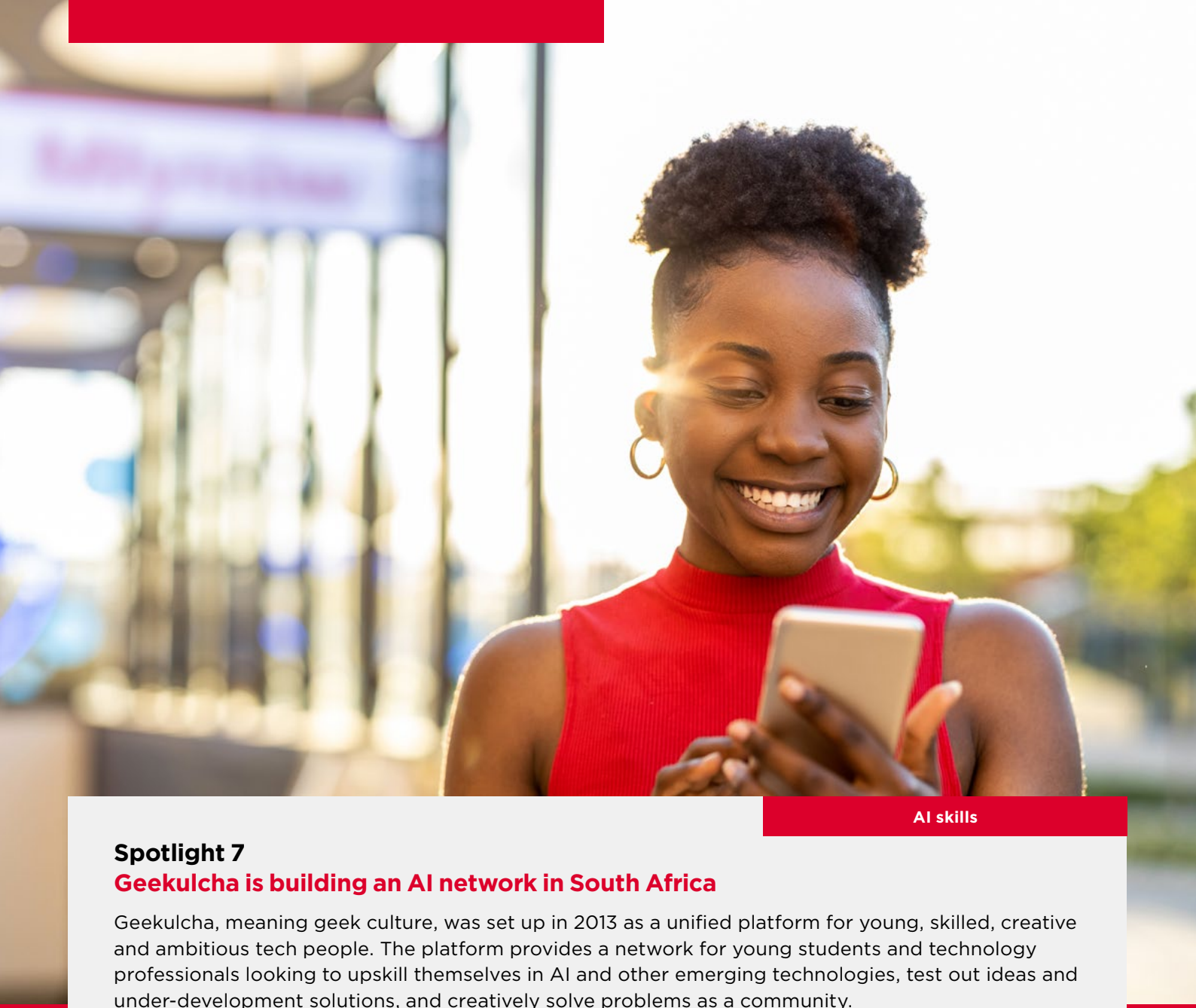
Big Tech players are also participating in the AI skills ecosystem in South Africa by conducting AI skilling events, developing coursework on digital and AI, and collaborating with local organisations that engage with young talent in the country. Through its SkillsBuild programme, IBM is working with universities and non-profit organisations involved in upskilling young people in South Africa.[80] While these programmes are effective in terms of raising interest and awareness of AI among younger people, private companies continue to face challenges with skills shortages, particularly in areas such as data science. There is a need for increased collaboration between government agencies and Big Tech to ensure that people with AI and technical skills are seamlessly absorbed into the jobs market. Other Big Tech players involved in providing AI skilling online include Microsoft, Google and Meta.[81,82] To deliver their skills programmes, Big Tech players are also partnering with local institutions, including MNOs. For example, Vodacom has partnered with Microsoft South Africa to provide educational content on topics including generative AI, entrepreneurship and cybersecurity through the Mzansi Digital Learning Platform.[83]

Local-level organisations such as incubators and accelerators, private companies, research institutions and networking platforms are also playing a key role in building awareness about AI and the skills required to build AI programmes. For example, AI for Africa aims to empower young people in Africa with AI skills and train them to develop innovative solutions to African challenges. Through their AI in Townships programme, the organisation sets up bootcamps in different localities in South Africa to introduce young people to AI, robotics and emerging technologies by partnering with technology companies like Microsoft and Fliptin.[84] To address the gender gap in digital skills, AI for Africa held a dedicated bootcamp on AI for girls in 2019, focused on introducing concepts like 4IR, AI and design thinking.[85]

However, it is difficult for interventions like these to continue creating impact for students after they leave school, owing to a lack of reliable internet connectivity and the high cost of data, which act as barriers to accessing online courses. In addition, these initiatives tend to be concentrated in urban areas, exacerbating the rural-urban digital and skills divide.[86]

In addition to providing AI skills to enable young people to build AI models on their own, there is value in building awareness about existing AI tools that are already available in the public domain. For instance, entrepreneurs can leverage generative AI tools like ChatGPT to gain strategic inputs into their business models and explore avenues to expand their footprint. The South Africa-based HSRC conducted an AI roadshow around Cape Town in 2023 to build AI skills among school students and entrepreneurs.[87] The roadshow included an introduction to AI and its potential, and guidance on using AI tools like ChatGPT and Google Gemini for tasks such as scoping out target market segments and developing business plans for new ventures. Initiatives like these have the potential to be scaled across the country through partnerships with local governments and skill-building organisations.

80 IBM SkillsBuild.
81 Google Cloud. Machine learning and artificial intelligence.
82 Meta. Resources and tools, for advancing AI, together.
83 Vodacom. (2024). Vodacom, Microsoft South Africa join forces to bolster digital skills for in-demand jobs.
84 Microsoft (2018). Soweto school girls solve social challenges using artificial intelligence.
85 AI in Africa.
86 University of Johannesburg. (2021). Artificial Intelligence in the 4IR: Short Learning Programme.
87 HSRC. (2023). Community engagement: Innovation and AI skills development in Philippi.



AI skills

Spotlight 7
Geekulcha is building an AI network in South Africa

Geekulcha, meaning geek culture, was set up in 2013 as a unified platform for young, skilled, creative and ambitious tech people. The platform provides a network for young students and technology professionals looking to upskill themselves in AI and other emerging technologies, test out ideas and under-development solutions, and creatively solve problems as a community.

With over 19,000 members, Geekulcha runs several initiatives which aim to introduce participants to tools and technology used in the industry, including programmes for high school students, university students, workforce joiners and entrepreneurs. The organisation is also currently collaborating with the University of South Africa to develop a national data science and AI programme.

Along with the government, the organisation consults with ecosystem actors including Big Tech players like IBM and Microsoft, technology startups and international development players like the British Council, GIZ and the FCDO to inform their technology skills interventions and test new programmes aimed at the youth.

Broader enabling environment

Partnerships

Given the complexity of building AI solutions tailored to local communities in different sectors, multistakeholder partnerships are key to leveraging technical, domain-specific and network strengths across the ecosystem. They can be useful in building the core pillars of data, skills and compute capabilities, pooling financial resources to invest in AI initiatives, and building synergies between stakeholder actors including government agencies and NGOs, startups, Big Tech, and international development organisations.

Stakeholders interviewed for this report mentioned a lack of synergy between stakeholders working on AI initiatives in South Africa, leading to duplication of efforts and limiting their impact. There are few examples of the government participating in building the AI ecosystem through partnerships. An example is Open Data South Africa, a collaborative initiative between the DPSA, OpenUp, the CPSI, The Innovation Hub, Geekulcha, Open Cities Lab, and the HSRC. The partnership works towards promoting the use of government data for social impact by running community engagements and developing open data resources and portals.[88]

There are also examples of organisations that create avenues for ecosystem actors to meet and promote the advancement of AI. For instance, the South African Artificial Intelligence Association (SAAIA) is an industry body that offers a platform, both online and offline, for collaboration and knowledge sharing among stakeholders in the AI space, including startups, private companies, governments, academic institutions and NGOs.[89] Other examples include the Just AI Centre by Research ICT Africa, contributing to policy research, workshops and AI ethics discussions, the Centre for AI Research (CAIR), engaged in AI-related technology development across five universities in South Africa, and the HSRC, which focuses on establishing an AI research programme in South Africa.

To develop the requisite foundational digital skills and AI-specific skills, private sector companies and academic institutions are playing a key role in South Africa. For instance, Microsoft South Africa has partnered with the Youth Employment Service (YES) programme, which aims to provide digital skills to 300,000 young people in South Africa.[90] The YES programme offers a one-year paid apprenticeship in a corporate job, and Microsoft has partnered with YES to provide AI skills designed across a range of expertise levels, from novice to experts. The programme aims to help reduce the high unemployment rate among South Africa's youth.

In addition to collaborative efforts to strengthen the AI fundamentals in South Africa, it is also critical to establish more partnerships at the use case level. Many of the existing use cases identified in this report are still at the pilot stage or in the form of short-term projects, and partnerships can play a key role in ensuring that these initiatives get the impetus to become commercially available. For AI startups and other private sector companies looking to integrate AI, partnerships with Big Tech players, government agencies, and academic institutions can provide much-required access to data systems, compute capacity, and AI talent aligned to their development needs.

88 Open Data South Africa Toolkit.
89 South African Artificial Intelligence Association.
90 Microsoft. (2023). AI training for 300,000 South African youth, an enabler for future career advancement.

Financing

In South Africa, venture capital (VC) funders, international development organisations, Big Tech and philanthropic organisations have taken on the role of funding AI initiatives. Prominent funders include the Bill and Melinda Gates Foundation (BMGF), Mozilla Foundation, the Lacuna Fund, Google and IBM. In 2023, AI startups in South Africa received $123 million in VC funding.[91] However, despite the potential of AI to create social and economic impact, investors are wary of making long-term investments in AI solutions owing to lack of evidence of their commercial potential. Startups and tech-for-good companies leveraging AI need patient financing that allows them to test the feasibility of AI-led solutions in the market, iterate them as needed, and launch them into the market to ensure that they are accessible and affordable to end users while also bringing in revenue.

Table 8

Venture capital investments in tech and AI in South Africa

($ millions, 2023)

Investment in tech startups	565
VC investments in AI	123

Source: Briter Bridges and OECD.AI

The government has also set up several sources of funding to promote the AI ecosystem, including the Department of Science and Innovation's National Research Fund and Innovation Hubs. At the local level, the Technology Innovation Agency (TIA) provides risk funding for early-stage technologies which are conceptualised through funds like the Seed Fund, the Technology Development Fund, and the Commercialisation Support Fund in South Africa.[92] Funding is also available through short-term programmes or events like hackathons and grant competitions, such as the Grand Challenges South Africa programme, a collaboration between the South African Medical Research Council (SAMRC), BMGF and Grand Challenges partners.[93] While these initiatives play a role in identifying and supporting early stage innovation around AI, a funding gap remains for startups and AI companies that are at the next stage of development, i.e. commercialisation. Stakeholders such as Big Tech and other private sector companies, as well as governments and utility companies including MNOs, can bridge this gap by forming strategic partnerships with innovative AI companies or including them in their supply chains.

Policy

South Africa is among the African countries at the forefront of developing national policies and strategies for AI. The country ranks second in the Sub-Saharan African region, after Mauritius, on the Government AI Readiness Index by Oxford Insights, and ranks 77 worldwide.[94] The South African government has begun to put in place foundational policies for AI, including policies around intellectual property, data privacy and data protection, electronic communications and transactions, cybersecurity and cybercrime and consumer protection.[95] These include initiatives such as the Presidential Commission on the Fourth Industrial Revolution (PC4IR), a Digital Economy Master Plan, a Draft National Policy on Data and Cloud, and the Consumer Protection Act (Table 9).[96]

Government departments leading AI initiatives include the Department of Science and Innovation, which concentrates on inclusive and responsible AI innovation, and the Department of Trade, Industry and Competition, which addresses regulatory aspects in the Digital Economy Master Plan. The Department of Communications and Digital Technologies is also mandated to develop ICT policies and legislation to support the growth of the ICT sector and bridge the digital divide by promoting ICT uptake.

In the private sector and civil society organisations, there are several organisations driving policy research and advocacy efforts on AI and its responsible use, such as the Data Economy and Policy Hub (DepHUB), GIZ Fair Forward, Research ICT Africa, Mozilla Foundation, and the OECD AI Policy Observatory, which focus on advocating for responsible AI governance and fair digital economies through national, provincial and municipal policies.

91 OECD.AI.
92 TIA.
93 Funds for NGOs (2023). Grand Challenges South Africa: Catalysing equitable AI use to improve global health.
94 Oxford Insights. (2023). Government AI Readiness Index 2023.
95 UNESCO. (2022). Landscape study of AI policies and use in Southern Africa: Research report.
96 Ibid.

Table 9
Digitalisation and AI: key policies and initiatives

Policy/Law/Initiative	Key features
Presidential Commission on the Fourth Industrial Revolution	Establish a National AI Institute Emphasis on digital skills, data availability, innovation and infrastructure development
Digital Economy Master Plan	Updated data sharing policies and competition regulations Focus on intergovernmental coordination, including on AI policies
Draft National Policy on Data and Cloud	Includes sections on data consolidation, e-government services and cloud services market competition Requires all data generated in South Africa to be stored within the country
Consumer Protection Act	Emphasises responsible and ethical AI use, prioritising privacy rights and disclosure of information

As a first step towards the creation of a National AI Policy, the South African government published the South Africa National Artificial Intelligence Policy Framework in August 2024.[97] These include digital skills and literacy, investments in research and innovation around data, and building domain-specific data to accelerate the adoption of AI. In line with trustworthy AI principles by the Mozilla Foundation, some other factors to consider are fairness, transparency of use, accountability and ease of accessibility. Stakeholders have also highlighted the need to ensure a participatory process of policymaking, bringing together stakeholders from the private sector and civil society organisations in addition to local and provincial governments.

Research and development

South Africa has strong research and development (R&D) capabilities compared to the rest of the region. It ranks 53 out of 132 economies for R&D on the Global Innovation Index 2023, and ranks 36 for university-industry R&D collaboration, a key strength for the country which marks it as a regional leader.[98] South Africa also leads in patents and publications among all African countries, highlighting its significant contributions to the advancement of AI research.[99] Despite these indicators, the government's spending on R&D remains low at just 0.7% of the country's GDP in 2023, compared to the world level of 2.63%, and much lower than developed countries, including the US, China, Japan and Korea.[100] Higher investments in R&D can encourage AI innovation and also help bridge the AI skills gap in South Africa.

Table 10
Country rankings for R&D capabilities
(rank out of 132 countries, 2023)

	R&D	University-Industry R&D collaboration
South Africa	53	36**

**indicates an area of strength relative to income group
Source: Global Innovation Index

Academic institutions play a key role in the development of R&D capabilities in South Africa. The Centre for Artificial Intelligence Research (CAIR) is a South African research network that spans across several major universities including the University of Cape Town, the University of Pretoria,

97 South Africa National Artificial Intelligence Policy Framework, August 2024. Note: The South African Department of Communications and Digital Technologies, which released the Policy Framework, is accepting feedback on the document from the ICT industry and other stakeholders.
98 WIPO. (2023). Global Innovation Index 2023.
99 Hanlin and Mlilo. (2023). Enhancing South Africa's Emerging Digital Technologies' Innovation Ecosystem. UbuntuNet.
100 WIPO. (2023). Global Innovation Index 2023.

and Stellenbosch University. Further, the University of Johannesburg, the University of the Witwatersrand, and the Tshwane Institute of Technology also have dedicated AI hubs, such as the AI Institute of South Africa[101] and the AI Africa Consortium,[102] that are focused on conducting research on AI applications and building solutions to address critical problems in South Africa. The AI hubs are also building partnerships with the private sector to scale the impact of their solutions. In addition to these initiatives, Big Tech companies like Microsoft, IBM and Google have research facilities focused on AI and its applications, such as MARI, IBM's Green Horizons Initiative and Google's AI accelerator. Local-level institutions like Deep Learning Indaba[103] and the HSRC[104] are also conducting research on emerging technologies and bringing together stakeholders to address development challenges collaboratively.

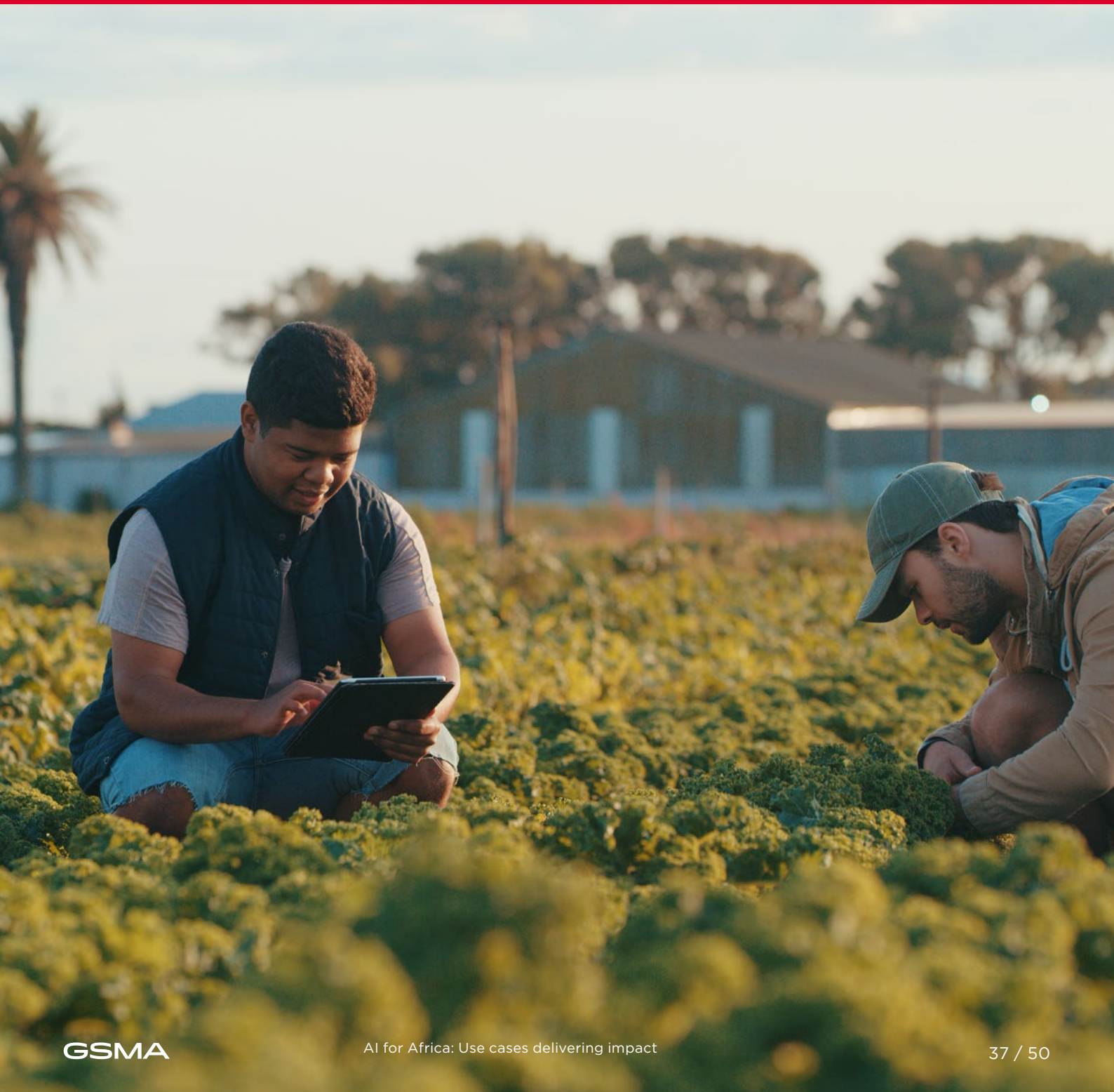
Some of the key challenges faced by AI practitioners and researchers in South Africa include securing funding for AI research, staying informed about rapid developments in the AI sector and accessing large datasets and compute resources. There is a need to invest in research to build local language and mixed language datasets in the country, given the linguistic diversity in the country. AI solutions tailored for local communities must be designed so that people can easily interact with their interface, removing barriers such as accessibility and explainability. To address the lack of local language datasets that can be used to build AI solutions contextualised to South Africa, an organisation called Masakhane brings together stakeholders working on NLP and African language datasets to interact and build solutions together.[105]

> "South Africa needs a strong private R&D, and we need to stop depending on global Western hubs for our research and talent needs. We need to consider things like local dialects and code switching among African languages when we build datasets. Dedicated research is required to build models that are flexible enough to change based on how people interact with these tools."
>
> **– Data scientist and professor, Johannesburg**

In its National Development Plan, the South African government has emphasised the urgent need to substantially increase investment in R&D to enhance the country's innovation landscape and support the development of its youth.[106] The Presidential Commission on the Fourth Industrial Revolution also recommended setting up the AI Institute of South Africa, in partnership with the Department of Communications and Digital Technologies, to generate a knowledge base around AI and its applications.

101 University of Johannesburg. (2023). UJ and TUT collaborate to launch TUT Hub of the AI Institute of South Africa.
102 AI Africa Consortium.
103 Deep Learning Indaba.
104 Human Sciences Research Council.
105 Masakhane.
106 IT Web. (2024). Scholarly initiative to boost SA's AI research.

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 collaborative actions to ensure that impactful AI innovations in South Africa can be developed and scaled. Table 11 presents some key findings and recommendations to support various components of the AI ecosystem, considering South Africa's areas of opportunities and challenges. These recommendations work in concert with those published in the primary report 'AI for Africa: Use cases delivering impact'.

Table 11

Key recommendations to support AI deployment and adoption in South Africa

Increase the availability and accessibility of high-quality data

- **Develop and strengthen initiatives building local language datasets:** Indigenous languages are not adequately represented in existing language datasets in South Africa. As LLMs become increasingly fundamental to building AI solutions, especially generative AI, it is crucial for datasets to be available in local languages to ensure that AI solutions are accessible to all. Some local initiatives are working to bridge this gap by bringing together researchers working on African languages to collect and digitise local and indigenous language data into formats compatible with AI models. These initiatives require long-term support, primarily funding and partnerships, to effectively scale and expand to other African languages. Development partners and donor organisations can play a key enabling role in this regard.

  Relevant stakeholders: Academic and research institutions (e.g. Data Science for Social Impact Research Group at University of Pretoria), NGOs and CSOs, development partners (FCDO, GIZ – FAIR Forward, Mozilla Foundation).

- **Streamline data handling and management processes:** South Africa has made strides in collecting data and building open-source datasets which can facilitate the creation of AI models, as illustrated by multi-stakeholder initiatives like Open Data South Africa. However, the quality and completeness of existing open-source datasets, and data cleaning, processing and updating processes remains a challenge. There is a need to develop a clear data management plan that addresses the smooth movement of data through its collection, storage, use, and secure disposal. The government can also identify an independent body to conduct regular data audits of existing datasets to maintain the integrity of data used for AI.

  Relevant stakeholders: Government agencies (e.g. Statistics South Africa, Department of Public Service and Administration), development partners (e.g. FCDO, GIZ – FAIR Forward), research and academic institutions (e.g. Tshwane Institute of Technology)

- **Invest in local-level 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. For example, existing IoT deployments have been implemented on a small scale, limiting the availability of hyper-local data. There is a need to leverage the growing demand for IoT sensors and other devices by investing in their domestic production, to enable the collection of local domain-specific data, including real-time data in key sectors such as energy and agriculture. Smart meters can optimise electricity supply and gather information on water usage and customer behaviour in real time.

  Relevant stakeholders: MNOs, government agencies (e.g. Department of Science and Innovation, domain-specific government departments), academic and research institutions (e.g. AI Hubs in universities), development partners (e.g. FCDO)

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

- **Create a dedicated roadmap to build AI infrastructure:** South Africa has taken the lead in building compute infrastructure for AI on the continent through numerous data centres and the Lengau supercomputer – one of just two on the continent. While Big Tech players and selected academic and research institutions have access to HPC, there is a need to ensure that this compute capacity can be effectively leveraged by all ecosystem actors, including academia and startups, NGOs, and local researchers. There is a need to establish a dedicated roadmap to build South Africa's AI infrastructure, bringing together efforts by various ecosystem actors and focusing on key priority areas such as investments in both physical hardware and cloud-based solutions, reducing the cost of compute by improving access to distributed edge computing and strengthening data management processes.

  Relevant stakeholders: Government agencies (e.g. State Information Technology Agency), hardware and device manufacturers, Big Tech players (e.g. Microsoft, AWS), MNOs

- **Explore PPPs to ensure reliable electricity supply:** South Africa is facing unprecedented amounts of load shedding, interrupting electricity supply for AI startups and technology companies and increasing reliance on diesel-operated generators. There is an urgent need to address the financial and operational challenges faced by the state-owned power utility company and upgrade the national power grid. Access to reliable electricity supply can help improve internet connectivity, ensure the smooth operations of data centres and the base stations of MNOs and reduce costs for AI startups and innovators. The government can explore partnerships with private sector companies to tap into renewable energy sources and reduce the burden on the national grid by bringing in independent power producers.

  Relevant stakeholders: Public utility companies (e.g. Eskom), DFIs (e.g. African Development Bank), private sector actors (e.g. Internet service providers, MNOs)

Foster the development of adequate skills for AI builders and users

- **Foster collaboration between industry and academia to build an AI workforce:** While South Africa is highly ranked in industry-academia collaboration compared to most African countries, more needs to be done to bring AI-related skills to the fore. There is a mismatch between existing courses and skills offered and those needed in the industry. The job market struggles to absorb even students with highly technical degrees. On the other hand, academic institutions must keep pace with the advancements around AI and emerging technologies in order to generate an employment-ready workforce. Universities should work towards establishing a direct link between academic research on AI and private sector needs, through initiatives such as jointly funded AI research hubs and internship programs with Big Tech players and local AI companies. The government can also help address the talent gap by incentivising global manufacturing and technology companies to set up bases in South Africa to absorb highly qualified talent that would otherwise contribute to brain drain.

  Relevant stakeholders: Universities and research institutions (e.g. Institute for the Future of Work, Tshwane Institute of Technology, Human Sciences Research Council), Big Tech players (e.g. Microsoft, IBM), AI startups, government agencies

- **Update curricula and skills courses on AI and 4IR:** A key reason for the talent mismatch in South Africa industry is a lack of connection between the offerings of existing AI and 4IR courses and the skills needed by technology companies leveraging AI. Universities and capacity building organisations must evolve their curricula to match the demands of the industry and include offerings such as domain-specific technical expertise, data processing and management and adequate exposure to real-world applications of AI. To effectively understand the talent needs of AI companies and create an effective jobs pipeline for graduates, universities and research institutions should bring in perspectives from AI and tech companies in designing post-graduate AI courses. Further, on-campus entrepreneurship hubs can be developed in collaboration with local incubators and accelerators to help students get exposure to solving real-world problems using AI and its applications. Development partners can also play a role by funding initiatives like AI labs where students receive mentorship and support to build market-ready AI solutions.

  Relevant stakeholders: Universities and research institutions, capacity building organisations and networks (e.g. Geekulcha, Deep Learning Indaba), incubators and accelerators, Big Tech players

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

- **Ensure a representative and inclusive policymaking process:** As South Africa begins its process of developing a national strategy for AI, it is important to design an inclusive and representative framework where perspectives from a range of ecosystem actors are captured. These include development partners, donors, Big Tech players as well as a wide range of local-level actors such as AI startups, capacity building organisations, research and academic institutions, NGOs and CSOs. It is crucial that underrepresented groups also participate in the policymaking process, including women, persons with disabilities, and elderly persons. To support its policymaking process, South Africa can adapt relevant examples from the ethical and responsible AI roadmaps laid out by regional organisations like the African Union as well as international development organisations.

  Relevant stakeholders: Government agencies (e.g. department of communications and digital technologies), policy research organisations, development partners (e.g. FCDO, IDRC, GIZ – FAIR Forward)

- **Establish a clear plan for AI strategy implementation:** For the effective implementation of the national AI strategy, the government should establish an independent body to create a roadmap for this purpose. The dedicated body can oversee aspects such as identifying key government agencies and establishing their roles and responsibilities, undertaking the capacity building of government, judicial, and policy representatives on the basics of AI, its underlying technology, and its applications, and ensuring that the needs and challenges of provincial governments and municipalities are considered in the implementation plan. Establishing such a dedicated body will also help the government understand the potential risks and pitfalls of implementing AI for all.

  Relevant stakeholders: National and provincial government agencies, municipalities, policy research organisations, NGOs and civil society organisations

- **Utilise blended finance models to mitigate investment risks in AI:** Investors in South Africa are risk-averse owing to previous economic instability as well as a lack of adequate understanding of AI and related technologies. Most investors also lack in-house expertise in AI to identify and bring in the financial and technical support needed by startups and technology companies looking to integrate AI, especially those building solutions intended for development impact. A blended finance approach where grant capital from donors and development finance institutions would be provided to startups in their early stages, followed by commercial capital once cash flows have been established, can help de-risk investments in AI. It can also pave the way for increased private investor participation in the AI for development ecosystem in South Africa.

  Relevant stakeholders: Development partners, impact investors, philanthropic organisations (e.g. BMGF, Mozilla Foundation), incubators and accelerators

- **Facilitate collaborative efforts towards building R&D capabilities:** South Africa has identified R&D on AI and 4IR as one of the key priority areas in its economic development plan and has set up various research labs and AI hubs dedicated to building domestic capacity in AI and its applications. To ensure that these initiatives are aligned with private sector efforts to advance R&D capabilities, the government can form collaborative partnerships with existing private sector AI labs and R&D projects. Such partnerships can leverage the shared compute resources of these organisations and focus on key aspects of R&D such as building evidence on the impact of AI across sectors, identifying local challenges that could be explored through research projects and understanding the risks associated with using AI models as well as principles for its ethical and responsible use.

  Relevant stakeholders: Big Tech players, development partners (e.g. FCDO, GIZ – Fair Forward, IDRC, SIDA), government agencies (e.g. TUT AI Hub, Institute for the future of work)

- **Increase government funding for building AI-related R&D capabilities:** South Africa's expenditure on R&D activities is low, and increased funding by the government will be a key enabler going forward. Funding should be directed towards building additional compute resources for students and researchers, testing proof of concepts of AI solutions and conducting pilot studies, and contributing towards growing South Africa's AI research output at a global level. It is also essential to support and invest in local academic and research institutions to attract and retain qualified talent to the AI space and prevent further brain drain from the country.

  Relevant stakeholders: Government agencies (e.g. department of science and innovation, department of trade and industry), research and academic institutions (e.g. centre for AI research, TUT AI Hub, Human Sciences Research Council)

- **Build connections with South African diaspora to explore opportunities in AI:** Brain drain has resulted in many of South Africa'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 South African tech startups, universities and capacity building organisations to accelerate R&D initiatives in the country.

  Relevant stakeholders: International development partners (e.g. FCDO, IDRC, USAID), capacity building organisations (e.g. Geekulcha, Masakhane), incubators and accelerators (e.g. frontier tech hubs), South African diaspora

5. Annexes

Annex 1: Additional spotlights

Data-driven agri advisory

Spotlight 8
Saai provides personalised agricultural advice to farmers with NLP solution

The Southern African Agri Initiative (Saai) is a nonprofit organisation dedicated to supporting and advocating for the interests of family farmers in Southern Africa through policy engagement, legal assistance and capacity building.

The Hi Saai WhatsApp-based AI platform utilises NLP to provide personalised agricultural advice and support to farmers. Through interactive conversations on WhatsApp, the platform employs NLP algorithms to understand farmers' queries and provide tailored recommendations on crop management, pest control and market information, enhancing access to agricultural knowledge and resources.

Natural resource management

Spotlight 9
TUT's work on AI for smart water management

The Tshwane University of Technology (TUT) in Pretoria is invested in research on the applications of AI and other emerging technologies to solve local challenges. The faculty and research team at TUT have developed a use case for AI smart water management that incorporates AI by developing an advanced algorithm that syncs a water leakage model with traditional water distribution network hydraulic modelling. The AI algorithm utilises predictive analytics and optimisation strategies to accurately estimate network leakages and pinpoint critical areas that need pressure adjustments. This enables the system to adapt and enhance its performance through the analysis of collected data and feedback, resulting in optimised water distribution efficiency and reduced water loss.

Biodiversity monitoring/wildlife protection

Spotlight 10
FruitPunch AI monitors wildlife in real-time

FruitPunch AI is a community-driven organisation focused on leveraging AI to solve global challenges in line with the United Nations Sustainable Development Goals. They organise challenges, educational programmes and collaborations aimed at applying AI for good, particularly in areas such as wildlife conservation, health and environmental sustainability.

FruitPunch AI utilises edge computing to run AI models directly on devices in remote locations, enabling real-time wildlife monitoring without needing cloud connectivity. Tiny ML is applied to minimise energy consumption and hardware requirements, crucial for devices like drones or camera traps in conservation areas. Computer vision technology is employed to detect and classify wildlife species, poachers and other elements of interest from images and video footage, contributing to biodiversity management and protection efforts with minimal environmental impact.

Medical scanning and diagnosis

Spotlight 11
Envisionit Deep AI's accurate medical imaging diagnosis

Envisionit Deep AI is a medical technology SME that uses AI to conduct medical imaging diagnosis. The company was formed to address challenges in access to doctors in South Africa, especially specialist doctors, and democratise access to healthcare in peri-urban and rural areas.

Envisionit Deep AI's products include RADIFY®, a solution to identify radiology images, RATify, a quality assurance tool to monitor and assess the deployment of AI solutions in real time, teleradiology, a platform for patients to connect with experienced radiologists across South Africa, and CAT, a web-based learning platform for students and medical consultants to upskill themselves. Envisionit Deep AI's use cases include detecting COVID-19-caused pneumonia from chest X-rays in under 25 milliseconds, launched during the global COVID-19 pandemic.

The company received $1.65 million in 2023 to expand their radiology and medical imaging offerings across African countries, especially for those with skewed patients to radiologist ratios.

Disease prediction

Spotlight 12
Microsoft Africa Research Institute using AI to detect the spread of malaria

The Microsoft Africa Research Institute (MARI) in partnership with the Central University of Technology (CUT) in South Africa has developed a model that uses AI and big climate data to predict the outbreak of malaria. The model uses two drought indices and historical incidents of malaria in Limpopo, South Africa to predict the outbreak of malaria, which is associated with extreme climate variations. The model had achieved 99% prediction accuracies as of 2022. Further research and data are needed to test its applicability to other infectious diseases.

Annex 2: List of South Africa-specific use case applications considered in the research

Agriculture and food security

Aerobotics	Uses AI to perform pest/disease detection, drone imagery services, orchard management and yield management.
Central University of Technology	Initiated project ITIKI, using AI in combination with indigenous environmental knowledge to predict droughts, providing alerts to farmers using mobile phones.
Donkerhoek Data	Uses AI in crop monitoring and management, analysing satellite imagery and drone data to monitor crop health, detect diseases and optimise irrigation and fertiliser application.
Hello Tractor	AI-based forecasts of crop yields, to optimise tractor scheduling and match farmers with tractor owners.
KHULA!	Uses AI to connect small-scale farmers with buyers in the food supply chain, providing a marketplace for farmers to sell their produce and thus improving their market access and distribution channels.
Southern African Agri Initiative	Developed Hi Saai, a WhatsApp-based AI platform for family farmers, providing answers to farm-related queries using data points from the internet.
The Awareness Company	Uses AI, data analytics and sensors to track livestock, detect perimeters and trigger alerts about suspicious activities, leading to increased productivity and reduced production costs through real-time insights.

Energy

Enel Green Power	Uses AI in their renewable energy operations for consumption efficiency.
Eskom	Exploring the use of AI for predictive maintenance and demand forecasting in power generation.
Sun Exchange	Uses AI and big data analytics to optimise solar project development, operations and financing.

Climate action

Connected Conservation Foundation	Uses AI and advanced analytics software to continuously monitor thermal camera footage to detect and generate automated alerts when human or wildlife activity is identified.
FruitPunch AI	Developed an autonomous drone/virtual flying ranger to detect poachers in wildlife reserves as one of their projects.
IBM	Launched the Green Horizons Initiative, under which ML and IoT are used for air quality prediction based on historical and real-time data about weather, air quality, topography, and traffic reports.
Microsoft/ eThekwini Municipality project	Initiative deploying an AI-enhanced water monitoring model for local municipalities.
Rainforest Connection	Uses AI to detect threats to wildlife such as illegal logging and poaching by relying on eco-acoustics data.
Spektech	Uses AI and satellite imagery to map carbon captured through restoration and offset carbon emissions of landowners, businesses and corporations.
Tshwane University of Technology	Project using AI algorithms to monitor water pipe leakage and conduct controlled irrigation to reduce water wastage.
WFP SKAI	Uses AI and satellite imagery to enable real-time insights and actionable intelligence for effective decision-making during disasters which impact food security.

Healthcare

Africa Health Placements	Employing ML to predict how long health workers might stay in public service.
Envisionit Deep AI	Uses AI to streamline and improve medical imaging (X-rays, CT scans, MRIs) diagnosis for radiologists.
Jembi	Developed AI-based system for efficient patient matching and health information system interoperability.
Microsoft Africa Research Institute (MARI)	Uses ML to predict infectious disease outbreaks by combining two drought indices with historical malaria incidents.
MedSol AI Solutions	Uses ML algorithms to power early and accurate diagnoses of breast cancer.
MomConnect	Developed an AI-powered symptom-checking service for maternal health and childcare in partnership with Ada Health and the National Department of Health.
Philips Foundation	Implemented AI software, developed by Delft Imaging, in 11 South African hospitals to help triage and monitor COVID-19 patients via X-ray imaging.
Quro Medical	Uses an AI-driven platform for remotely diagnosing, monitoring and supporting patients.
The Health Foundation	Initiative to train and test LLMs to extract recommendations from available clinical guidelines.
Vantage Health Technologies	Uses AI and cloud-based solutions to translate health data into solutions for health equity challenges.

Annex 3: List of organisations consulted

South Africa

22 on Sloane	Innovation Matters
African Union	Institute for the Future of Work
Data Economy Policy Hub	mDoc
Dimagi	MomConnect: Ada Health
Discovery Health	Mozilla Foundation
Geekulcha	Tshwane University of Technology
Genesis Analytics	University of Pretoria
GIZ Fair Forward	Vambo AI
Human Sciences Research Council	Veluka Platform
Innovate UK	

GSMA Head Office
1 Angel Lane
London
EC4R 3AB
United Kingdom
Tel: +44 (0)20 7356 0600