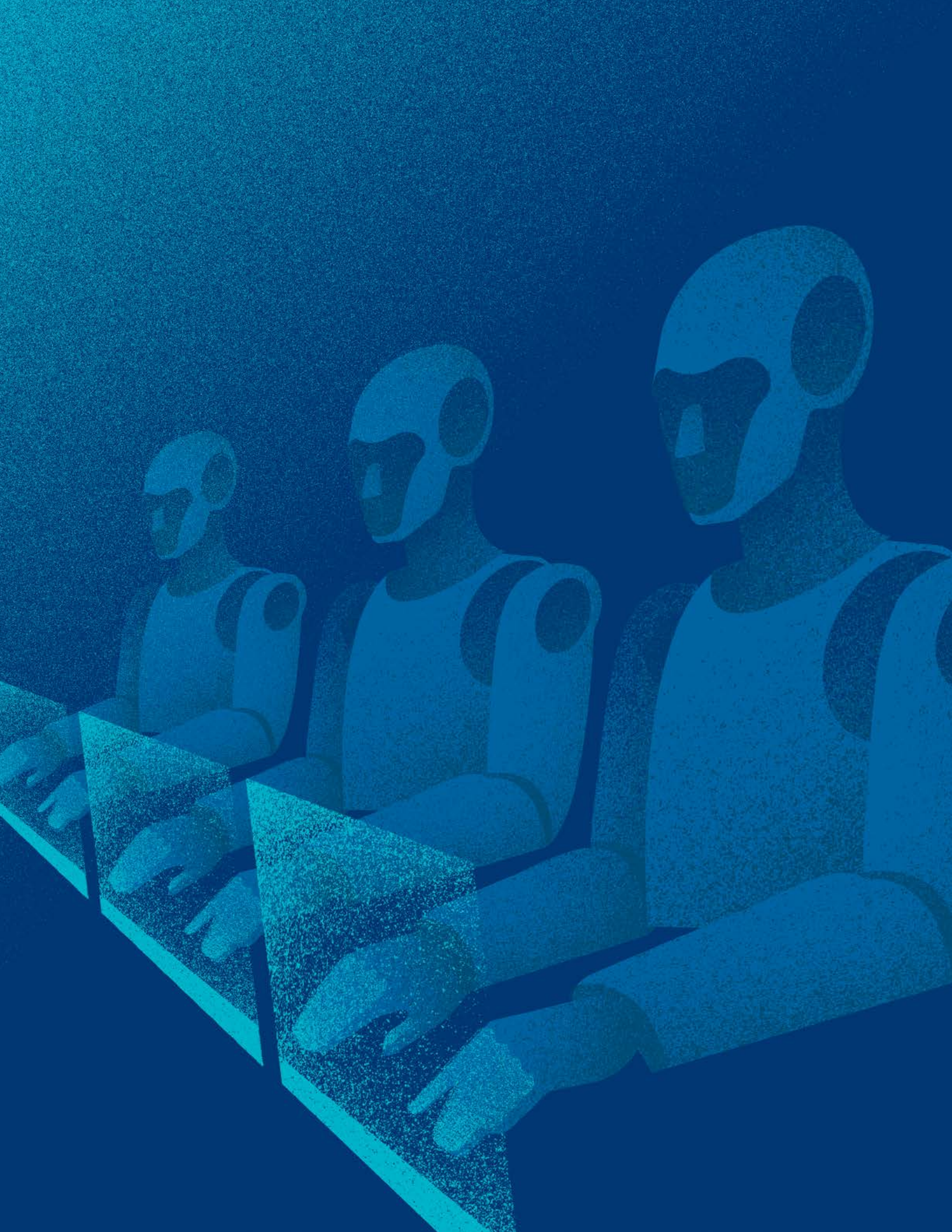

# 5

# AI and emerging technologies: Solving challenges and seizing opportunities

# Leveraging AI and emerging technologies to unlock Africa's potential

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## Introduction

Breakthroughs in the development and deployment of AI and emerging technologies, often referred to as hallmarks of the Fourth Industrial Revolution (4IR),[1] are making headlines and stirring both excitement and anxiety within the scientific and policy worlds. Yet only recently have there been attempts to systematically analyze how AI and emerging technologies might impact development goals and outcomes. With the latest projections estimating that Africa is on track to meet less than 6% of the UN Sustainable Development Goals (SDGs) by 2030,[2] the international development community and policymakers alike are looking for development accelerators that can maximize impact and ultimately deliver on the goals of Agenda 2063. It is clear that AI and emerging technologies can play a catalyzing role in achieving development outcomes, but there are important nuances to bear in mind regarding how and to what extent they may do so within different development areas. These technologies also carry potential pitfalls that must be examined. A recent study by Vinuesa et. al assessed the effect of AI on the achievement of the SDGs and found that overall, AI could enable 134 targets while inhibiting 59.[3] AI and emerging technologies' projected effects on a few key sectors of development outcomes—economic, social, environmental, and governance—are discussed in detail below.

**AI and emerging technologies can play a catalyzing role in achieving development outcomes, but there are important nuances to bear in mind regarding how and to what extent they may do so.**

## Economic outcomes

By 2035, AI could double the GDP rate of African countries.[4] According to Vineusa et al.'s assessment of the SDGs, AI could positively benefit 42 economic targets (70% of what the authors refer to as the "economic" SDG group) while negatively impacting 20 (33%).[5] The economic benefits of AI and other emerging technologies often stem from their impact on productivity, both through improving within-sector productivity and through structural

1 Landry Signé, *Africa's Fourth Industrial Revolution*, (Cambridge: Cambridge University Press, 2023).

2 "2024 Africa Sustainable Development Report" (Addis Ababa, Abidjan, New York, Addis Ababa: African Union; African Development Bank; United Nations Development Programme; United Nations Economic Commission for Africa, 2024), https://www.undp.org/africa/publications/2024-africa-sustainable-development-report.

3 Ricardo Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals," *Nature Communications* 11, no. 1 (January 13, 2020): 233, https://doi.org/10.1038/s41467-019-14108-y.

4 Tanvi Deshpande, "Understanding AI for Sustainable Development in Africa," *Mobile for Development* (blog), February 9, 2024, https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/understanding-ai-for-sustainable-development-in-africa/.

5 Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals."

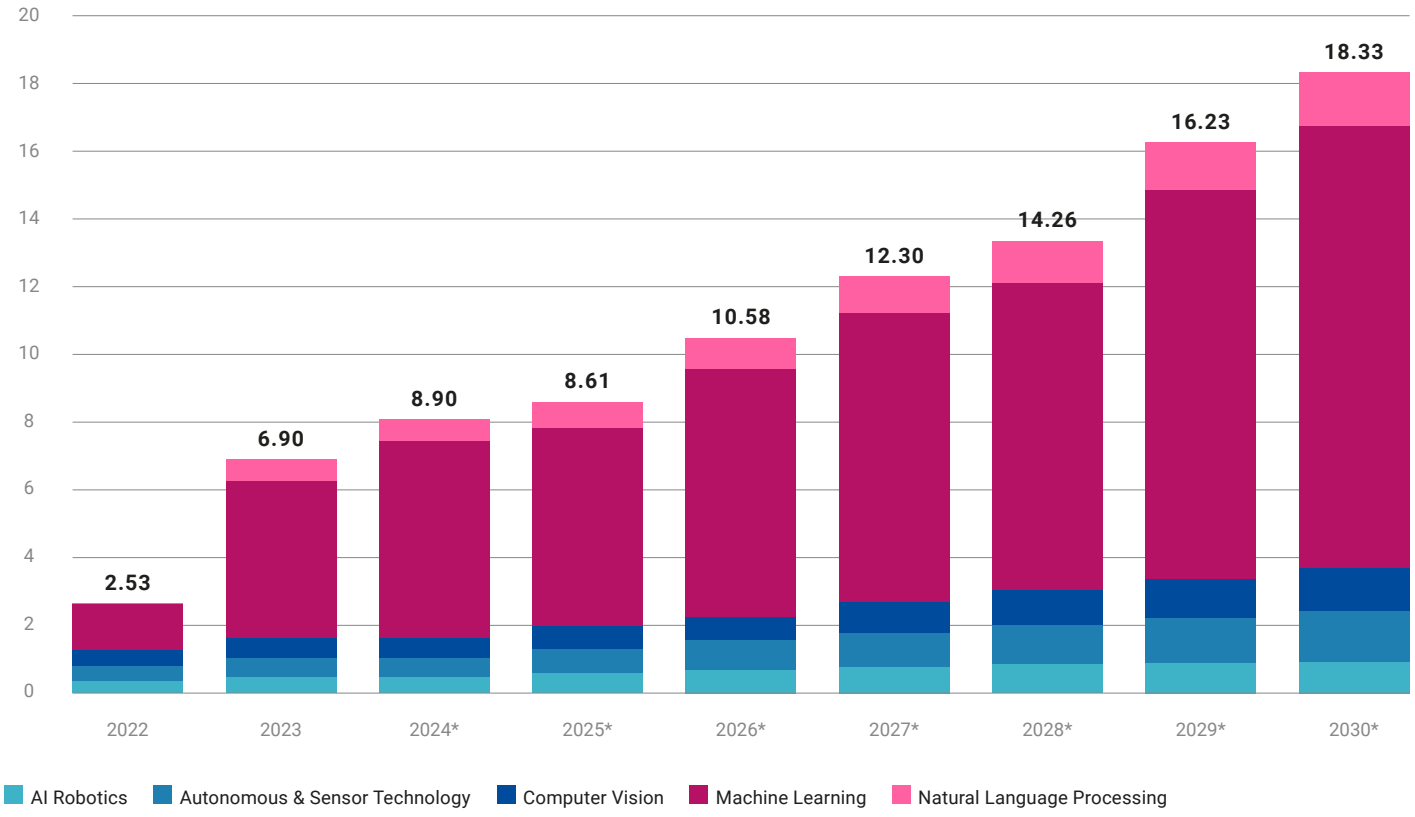
change.[6] In three of the main sectors of the economy—agriculture, industry, and services—4IR technologies can play a catalytic role in implementing public and private investment, regulation, and service delivery.[7]

However, inequality represents a major hurdle when it comes to the spread of emerging technologies, particularly, the challenge of ensuring that people are not left behind as jobs continue to change in the wake of new technology. Africa's demographic future—by 2063 it will be home to half of the world's total working-age population—makes this an extremely important challenge for the continent to overcome.[8]

**FIGURE 33**

## AI MARKET SIZE, AFRICA, 2020-2030

*Over the next five years, the use of machine learning will grow significantly across sectors in Africa*




Note: Market size in billions of USD. Years 2022-2023 are actual while 2024-2030 are forecasted (*).
Source: ITEdgeNews. "Unlocking Africa's AI Potential." ITEdgeNews, March 12, 2024. https://www.itedgenews.africa/unlocking-africas-ai-potential/.

6 Louise Fox and Landry Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, and the Future of Jobs," *Brookings Insitution: Africa Growth Initiative*, March 2022, 51, https://www.brookings.edu/wp-content/uploads/2022/03/4IR-and-Jobs_March-2022_Final.docx.pdf.

7 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, the Fourth Industrial Revolution, and the Future of Jobs."

8 Eric K. Ogunleye, "Leveraging Potentials of the Youth for Inclusive, Green and Sustainable Development in Africa," *African Development Bank*, https://www.afdb.org/sites/default/files/2023/08/11/setting_the_scene_presentation_for_g-cop_on_youth_s_.pdf.

## Social outcomes

Based on Vinuesa et. al's SDG assessment, AI has the potential to facilitate 67 targets (82%) within the "society" SDG group, including SDG 1 on no poverty, SDG 4 on quality education, SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy, and SDG 11 on sustainable cities.[9] AI can act as an enabler to achieving these goals primarily through its potential to improve the production, provision, and distribution of food, health, water, and energy services while also contributing toward a circular economy that steers resources most efficiently to minimize waste.

Under SDG 3, which concerns good health and well-being, 4IR technologies are already helping African countries achieve health care outcomes and overcome health crises in more efficient and effective ways.[10] For example, African AI startups are being deployed to monitor maternal health, produce diagnostic imaging, and develop AI-powered virtual clinic appointments.[11]

Within health care, Wang et. al are looking into how health care could benefit from a combination of smaller-scale, task-specific models and large-scale generic AIs which are currently less common in medicine.[12] They find that large-scale AI models can play a particularly helpful role within medical dialog and medical image analysis; however, these models require a far larger amount of data, which could lead to their development being concentrated in regions outside of Africa.

Despite this potential, AI may also negatively impact 31 SDG targets (38% of Vinusa et. al's "society" SDG group).[13] These consequences stem from the inequality that may increase if these technologies are not evenly distributed (for example, if African small-scale farmers are left behind, meanwhile larger agricultural production companies in other regions capture the market with technology-based solutions), or if AI increases or reinforces discrimination against women and minorities through biased algorithms or image recognition.

## Environmental outcomes

The relationship between AI/emerging technologies and the environment has been heavily researched, and the literature emphasizes contrasting impacts. There are important concerns to highlight regarding the environmental impact of AI and other advanced technologies, including resource depletion and carbon emissions if the high-energy needs of AI applications are met by non-carbon-neutral sources. On the other hand, AI has been identified as a tool

9 Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals."

10 Landry Signé, "Strategies for Effective Health Care for Africa in the Fourth Industrial Revolution" (Brookings Institution, October 2021), https://www.brookings.edu/articles/strategies-for-effective-health-care-for-africa-in-the-fourth-industrial-revolution/.

11 Laura Sallstrom, Olive Morris, and Halak Mehta, "Artificial Intelligence in Africa's Healthcare: Ethical Considerations," *ORF*, no. 312 (2019), https://www.orfonline.org/public/uploads/posts/pdf/20230914110452.pdf.

12 Ding-Qiao Wang et al., "Accelerating the Integration of ChatGPT and Other Large-Scale AI Models into Biomedical Research and Healthcare," *MedComm – Future Medicine* 2, no. 2 (2023): e43, https://doi.org/10.1002/mef2.43.

13 Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals."

that can help mitigate the effects of climate change through weather forecasting, early warning systems, land resource management, sustainable agriculture techniques, climate risk assessment, and more, as a GSMA study outlines.[14]

Vinusa et. al's evaluation of the SDGs found that AI could be an enabler for 25 targets (93% of the environmental SDG group) due to its ability to better model the impacts of climate change, identify oil spills, identify desertification trends, and other use cases.[15]

Machine learning has also been found to be an effective tool for combating climate change by providing demand forecasts, optimizing electricity systems, accelerating clean energy technology development, and deploying smart grids and disaster management, according to Rolnick et. al.[16] Combining machine learning with generative design and 3D printing can lead to a reduction in the need for carbon-intensive materials in construction and could even create a new "climate-friendly material."[17] Rane notes that generative AI could raise awareness of climate change, conservation, and adaptation for the public and professionals, including by providing assistance in tracking deforestation and wildlife, analyzing oceanic data, disseminating information about sustainable fishing practices, and more.[18]

According to Olatunde, Adelani, and Sikhakhane, AI, coupled with other emerging technologies such as cloud computing, the Internet of Things, and remote sensing, can help Africa optimize water management by reducing waste through leak detection systems, predicting equipment failures, and resolving contamination issues immediately, which is critical for environmental outcomes and has key spillovers to other development goals related to sanitation and agriculture.[19]

## Governance outcomes

AI can significantly help African governments deliver public services and strengthen African governance. In Togo, for example, the government successfully used AI to refine targeting for the second phase of its Novissi cash transfer program, allowing 57,000 recipients of social funds in 100 of the poorest towns to be identified without contact.[20]

14 Eugenie Humeau and Tanvi Deshpande, "AI for Africa: Use Cases Delivering Impact" (London: GSMA, July 2024), https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2024/07/AI-for-Africa-Use-cases-delivering-impact.pdf.

15 Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals."

16 David Rolnick et al., "Tackling Climate Change with Machine Learning," *ACM Computing Surveys* 55, no. 2 (February 28, 2023): 1–96, https://doi.org/10.1145/3485128.

17 Rolnick et al., "Tackling Climate Change with Machine Learning."

18 Nitin Rane, "Roles and Challenges of ChatGPT and Similar Generative Artificial Intelligence for Achieving the Sustainable Development Goals (SDGs)," *SSRN* (Rochester: Social Science Research Network, August 4, 2023), https://doi.org/10.2139/ssrn.4603244.

19 Tosin Michael Olatunde, Fatai Adeshina Adelani, and Zamathula Queen Sikhakhane, "A Review of Smart Water Management Systems from Africa and the United States," *Engineering Science & Technology Journal* 5, no. 4 (April 10, 2024): 1231–42, https://doi.org/10.51594/estj.v5i4.1014.

20 "Novissi Scheme: Togo Uses AI to Boost Economic Inclusion," *Togo First* (blog), May 6, 2021, https://www.togofirst.com/en/social/0605-7791-novissi-scheme-togo-uses-ai-to-boost-economic-inclusion.

Rane finds that generative AI can help professionals and citizens navigate legal proceedings, increasing the efficiency of judicial and law enforcement while also increasing trust, transparency, and justice between citizens and institutions.[21] Generative AI can also strengthen international cooperation and prevent cybercrimes by identifying potential threats. In Zambia, an AI-powered fact-checking tool called iVerify, which uses machine learning to detect hate speech and fact-check articles, was used during elections and garnered positive feedback.[22]

However, challenges arise within governance, as AI can also sow polarization and promote misinformation that can negatively impact social cohesion (thus negatively impacting SDG 10 on reduced inequalities) or could hinder access to justice if algorithms contain inherent biases.[23]

## Gaps and challenges

A literature review on the 4IR in Africa by Kibe, Kwanya, and Nyagowa found that 4IR technologies are already being deployed for education, health services, e-commerce, tourism, records integrity, and project management in Africa.[24] However, they find that African countries are held back from realizing the full potential of 4IR technologies for further development goals by a lack of 4IR skills, infrastructure, stakeholder involvement, and relevant policies. These gaps and challenges cluster around two issues: ethics and security and inequality.

### *Ethics and security*

While it is clear that AI and emerging technologies have incredible potential for positive change, they can also be leveraged for nefarious purposes. According to the Institute of Development Studies, as of 2023, African governments were spending over $1 billion on digital surveillance technologies, some of which are used without the proper legal protections in place.[25]

There are also concerns about the human labor powering AI algorithms, which has so far been outsourced to non-Western countries, including in East Africa, where workers are paid a fraction of the wages they would receive elsewhere.[26] In fact, in 2023, journalists described how OpenAI, the creator of ChatGPT, outsourced the human labor required to feed its

21 Rane, "Roles and Challenges of ChatGPT and Similar Generative Artificial Intelligence for Achieving the Sustainable Development Goals (SDGs)."

22 "AI-Powered Fact-Checking Tool iVerify, Piloted during Zambia Election, Shows Global Promise," *UNDP* (blog), November 17, 2021, https://www.undp.org/digital/stories/ai-powered-fact-checking-tool-iverify-piloted-during-zambia-election-shows-global-promise.

23 Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals."

24 Lucy Kibe, Tom Kwanya, and Hesbon Nyagowa, "Harnessing Fourth Industrial Revolution (4IR) Technologies for Sustainable Development in Africa: A Meta-Analysis," *Technological Sustainability* 2, no. 3 (March 16, 2023): 244–58, https://doi.org/10.1108/TECHS-01-2023-0004.

25 Tony Roberts et al., "Mapping the Supply of Surveillance Technologies to Africa: Case Studies from Nigeria, Ghana, Morocco, Malawi, and Zambia" (Brighton: Institute of Development Studies, September 27, 2023), https://www.ids.ac.uk/publications/mapping-the-supply-of-surveillance-technologies-to-africa-case-studies-from-nigeria-ghana-morocco-malawi-and-zambia/.

26 Niamh Rowe, "'It's Destroyed Me Completely': Kenyan Moderators Decry Toll of Training of AI Models," *The Guardian*, August 2, 2023, sec. Technology, https://www.theguardian.com/technology/2023/aug/02/ai-chatbot-training-human-toll-content-moderator-meta-openai.

algorithms to Kenyans who made less than $2 per hour.[27] These reports make it clear that it will be critically important to reflect on the types of jobs AI will create or replace.

There are also ethical and security risks that arise from a lack of African data powering AI models. These risks are particularly amplified in the health care sector, where implementing models that provide diagnostic assistance or advice based on data from other countries can be impacted by local bias which can lead to troubling implications on health outcomes.[28]

### *Inequality in data, infrastructure, digital skills, and research and development*

One of the main challenges facing African countries regarding AI and emerging technologies is the potential for increased inequality both within and between continents when it comes to data, infrastructure and connectivity, digital skills and human capital, and research and development.

#### Data

Because AI development relies on the availability of large amounts of data, there remain gaps and challenges in making sure that Africa is not left behind in terms of data production, quality, and accessibility. A variety of languages and local contexts are necessary to avoid bias, but trends in the proportions of local content on the internet are concerning. Only 0.02% of total internet content is in African languages (there is 2,650 times more English content), and as of 2023, only 2.5% of the global AI market comes from Africa.[29]

#### Infrastructure and connectivity

Many African countries still face a lack of electricity, internet, and broadband penetration, which ultimately constrains the deployment of advanced technologies.[30] The African Development Bank estimates that infrastructure needs per year are between $130 billion and $170 billion, leading to a gap of $68 billion to $100 billion in financing.[31] Sub-Saharan Africa has a 27% mobile internet connectivity rate, a 60% usage gap, and a 13% coverage gap, compared to the global averages of 57%, 39%, and 4%, respectively,[32] meaning that many are within reach of connectivity but not able to use it.

27 Billy Perrigo, "Exlusive: OpenAI Used Kenyan Workers on Less Than $2 Per Hour to Make ChatGPT Less Toxic," *TIME*, January 18, 2023, https://time.com/6247678/openai-chatgpt-kenya-workers/.

28 Bilal Mateen, "Can AI Improve Health Care Delivery in Africa? 5 Things You Should Know," *PATH* (blog), October 28, 2024, https://www.path.org/our-impact/articles/can-ai-improve-health-care-delivery-in-africa-5-things-you-should-know/.

29 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

30 Njuguna Ndung'u and Landry Signé, "The Fourth Industrial Revolution and Digitization Will Transform Africa into a Global Powerhouse," *Foresight Africa*; Brookings Institution: Africa Growth Initiative, 2020, https://www.brookings.edu/articles/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/; "Measuring the Information Society Report: Volume 1" (Geneva, Switzerland: ITU Publications, 2018), 978-92-61-27231-9, https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

31 "Public-Private Partnerships Needed to Bridge Africa's Infrastructure Development Gap," *African Development Bank Group* (blog) (Abidjan: African Development Bank Group, November 17, 2023), https://www.afdb.org/en/news-and-events/public-private-partnerships-needed-bridge-africas-infrastructure-development-gap-65936.

32 Matthew Shanahan and Kalvin Bahia, "The State of Mobile Internet Connectivity 2024" (London: GSMA, October 2024), https://www.gsma.com/r/wp-content/uploads/2024/10/The-State-of-Mobile-Internet-Connectivity-Report-2024.pdf.

### Digital skills and human capital

The usage gap points to another key hurdle in the full implementation of AI for development: digital skills and human capital. Universities are starting to offer AI courses, but there is often a lack of opportunity for hands-on learning. The multidisciplinary skills needed to translate AI applications into development use cases may also be lacking, due to an exclusive focus on machine learning skills or data science.[33]

These skill gaps are particularly stark between African men and women. According to an ImpactHER survey in 2024, 86% of women surveyed across 52 African countries lack basic AI proficiency, 60% have not had digital skills training, 50.2% do not have (or have poor quality) internet access (37 percentage points lower than African men), and 34.7% do not own a digital device (with a stark contrast between urban and rural women: 15.7% of urban respondents reported no digital device ownership compared to 84.3% of rural respondents).[34] The cost of AI training, information gaps in available programs, gender-based discrimination in access to digital skills training, and a lack of understanding of the benefits of digital skills were cited as challenges, alongside other factors such as cultural norms and time constraints.[35]

### Research and development

Currently, AI funding, researchers, and publications are concentrated in the West, with the United States alone home to 60% of the top-tier AI researchers and $250 billion in private funding.[36] Africa, South America, and most Asian countries have contributed less than 5% of peer-reviewed papers across AI subfields since 2014, while the U.S. and China have contributed 30% and 18% respectively.[37] This leads to disparities in data and talent availability and potential biases in AI systems. Resource constraints and weak infrastructure hinder some African countries' ability to rely on foundation models, let alone develop their own. Graphic processing units and cloud computing have high costs, which pose a challenge for researchers with limited resources.[38] So far, AI startups in Africa have relied on grant funding, as the private sector has yet to overcome its risk aversion in investing in startups that use high tech innovation in science and engineering, in turn amplifying concerns that AI algorithms are being developed without African context.[39] AI still represents only a small proportion of Africa's $4 billion in total funding for tech startups in 2023.[40]

33 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

34 Efe Ukala, "Bridging the Digital Divide: Empowering Women & Girls in Africa Through Digital Literacy and AI Education" (ImpactHer; African Union International Center for Girls & Women's Education in Africa, August 23, 2024), https://cieffa.au.int/index.php/en/documents/2024-08-23/bridging-digital-divide-empowering-women-girls-through-digital-literacy.

35 Efe Ukala, "Bridging the Digital Divide: Empowering Women & Girls in Africa Through Digital Literacy and AI Education" (Ouagadougou: ImpactHer; African Union International Center for Girls & Women's Education in Africa, August 23, 2024), https://cieffa.au.int/index.php/en/documents/2024-08-23/bridging-digital-divide-empowering-women-girls-through-digital-literacy.

36 David Thomas, "AI: The African Opportunity," *African Business*, April 4, 2024, https://african.business/2024/04/technology-information/ai-the-african-opportunity.

37 Hélène Draux, "Dimensions Data Reveals the Global Divides in Artificial Intelligence Capabilities," *Dimensions* (blog), March 13, 2024, https://www.dimensions.ai/blog/analysis-of-dimensions-data-reveals-the-global-divides-in-artificial-intelligence-capabilities/.

38 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

39 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

40 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

## Strategies to unlock the potential of AI and emerging tech

Despite these challenges, some African countries have already emerged as leaders in AI research and development, AI startups, tech hubs, research initiatives, and government strategies for emerging technologies. Kenya in particular is leading the way in terms of public interest and engagement in AI. The 2024 Standard AI Index found that 27% of Kenyans use OpenAI daily.[41] As African countries continue to face both the challenges and opportunities of AI, below are some key strategies to steer AI and emerging technologies toward maximum impact.

### *Implementing national, regional, and continental strategies*

Seven African countries have developed AI strategies while others are creating specific entities to tackle these issues—Kenya's Blockchain and AI Taskforce[42] and South Africa's Presidential Commission on the Fourth Industrial Revolution,[43] for example. In July 2024, the African Union Executive Council endorsed its inaugural Continental AI Strategy, which calls for strengthening regional and global cooperation and a commitment to "an Africa-centric, development-focused approach to AI, promoting ethical, responsible, and equitable practices across the continent."[44] As continental and national strategies take shape, it will be important to ensure inclusive and collaborative processes that include perspectives on the ethics of AI. Key to moving these strategies forward will be the establishment of accountability mechanisms as well as clear ownership of the roles and responsibilities of each stakeholder.[45]

### *Supporting partnerships and support for AI research*

Given the potential consequences of not being involved in the research and development of AI systems, Africa must prioritize partnerships between African universities, ministries, and private sector players with international players working in this space.[46] Already, African universities are forming partnerships, including in Ghana, Uganda, and South Africa, where universities have formed AI labs focused on social impact. AI startups are also helping contribute to African-led research. Examples include Intron Health, a Nigerian startup that is developing a natural language processing tool for African accents in clinical settings and iCog labs, an Ethiopian startup that is developing an Amharic-speaking robot.[47] As Asiegbu and Okolo point out, these innovations sprouted from local, grassroots communities who are training and spreading an AI research ecosystem.[48] As AI becomes more advanced, African

41 Nestor Maslej et al., "AI Index Report 2024 – Artificial Intelligence Index" (Stanford: Institute for Human-Centered AI: Stanford University, April 2024), https://aiindex.stanford.edu/report/.

42 "AI Strategies and Policies in Kenya," *OECD.AI Policy Observatory; GPAI,* accessed December 10, 2024, https://oecd.ai/en/dashboards/countries/Kenya.

43 Stella Ndabeni-Abrahams, "Report of the Presidential Commission on the 4th Industrial Revolution" (Johannesburg: Government of South Africa, January 2020), https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf.

44 Mahamat et al., "2024 Africa Sustainable Development Report."

45 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

46 Landry Signé, "Technological Innovations: Creating and Harnessing Tools for Improved Livelihoods," *Foresight Africa*; Brookings Institution: Africa Growth Initiative, 2022, https://www.brookings.edu/articles/technological-innovations-creating-and-harnessing-tools-for-improved-livelihoods/.

47 "Intron - Real-Time Speech-to-Text for 200+ African Accents," accessed December 30, 2024, https://www.intron.io/; "iCog Home - Enabling Ethiopia's Youth through Technology.," accessed December 30, 2024, https://icogacc.com.

48 Charles Asiegbu and Chinasa T Okolo, "How AI Is Impacting Policy Processes and Outcomes in Africa," *Brookings Institution* (blog), May 16, 2024, https://www.brookings.edu/articles/how-ai-is-impacting-policy-processes-and-outcomes-in-africa/.

governments and universities must continue to make it a priority to pursue public and private research and development initiatives.[49] More broadly, partnerships between the five key types of actors involved in AI (data holders, hardware/software providers, technical partners, domain experts, and financial partners) as identified by GSMA will be key for collaboration and synergy in order to implement positive AI use cases in Africa.[50]

Investing in data and AI research and development is a critical priority for African countries to help combat biases and reduce the potential for unequal development and deployment of these technologies and their benefits. Such investments include investing in local language data, in participatory approaches to data collection, and in access to existing data sources.[51] Especially critical is the need for data that represents different demographic groups (particularly gender) in order to combat tendencies for AI algorithms to mirror and embed existing social inequalities, as well as robust data privacy and protection laws and clear guidance for data-sharing.[52] Policies that promote publicly available datasets should also be prioritized so that local entrepreneurs can leverage AI to create local solutions.[53]

### *Expanding physical, digital, and energy infrastructure*

To close infrastructure gaps, African governments must expand internet access to grow networks and digital hubs with a special focus on affordable access in rural areas through public-private partnerships.[54] Financing gaps could be filled through a consortium-based approach driven by innovative financing mechanisms.[55]

### *Developing 4IR-ready human capital*

To maximize the widespread gains of AI and other emerging technologies, African countries need to close their skills gaps by investing in basic education and innovative approaches, including new financing models to be able to upgrade post-primary education and job training.[56] Integrating emerging technologies into future-ready curricula can offer the rising youth population hands-on learning opportunities including through distance learning.[57] Beyond reskilling, worker-centered programs should be explored to support productivity, workforce engagement, and holistic support, which will help shift mindsets from a fear-based focus on changing jobs and tasks to an opportunity mindset based on building capabilities and investing in people.[58]

49 Depieri de Souza and Samantha Msipa, "Artificial Intelligence in the Global South: Will AI Advancement Deepen Digital Divides and Inequalities?," *Portulans Institute, University of Oxford, Said School of Business*, October 18, 2023, https://networkreadinessindex.org/artificial-intelligence-in-the-global-south/.

50 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

51 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

52 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

53 de Souza and Msipa, "Artificial Intelligence in the Global South: Will AI Advancement Deepen Digital Divides and Inequalities?"

54 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, and the Future of Jobs"; Signé, "Technological Innovations."

55 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

56 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, and the Future of Jobs."

57 Signé, "Technological Innovations."

58 Landry Signé et al., "Future-Ready Leaders for the Fourth Industrial Revolution," *HRD* (blog), September 29, 2020, https://www.hrdconnect.com/2020/09/29/future-ready-leadership-for-the-fourth-industrial-revolution/.

### *Developing future-looking regulatory frameworks*

Enabling anticipatory regulatory frameworks and making investments must be prioritized by policymakers to foster a thriving marketplace for emerging technologies,[59] especially to address challenges such as inequality and ethics, and to purposefully steer technology toward uses for societal good.[60] So far, use cases on the continent have been concentrated in IT services, computer software, and management consulting, with less focus on addressing development goals.[61] Legal and regulatory frameworks along with incentives can help steer the focus toward local, inclusive, and sustainable AI solutions[62] while also mitigating risks and biases.[63] These frameworks should avoid blanket prohibitions, but rather should recognize that AI applications and use cases differ greatly from each other.[64] As Davis, Signé, and Esposito explain, leaders must be equipped with three tools: transparent and holistic policymaking approaches, renewed efforts to collaborate across jurisdictions, and a shift toward agile governance.[65]

### *Investing in robust cybersecurity*

Amid the rapid emergence and ever-evolving nature of these technologies, cybersecurity has become one of the most important investments.[66] Cybersecurity should be addressed at multiple levels including the systems level, firm level, and individual level.[67] Governments can be proactive in establishing cybersecurity agencies and adopting emergency response strategies,[68] while private companies can promote cybersecurity skills for their employees and practice cyber risk protection within their leadership and decisionmaking.[69] Awareness-raising and training will be key for citizens and for public, private, academic, and civil society organizations.[70]

### *Leveraging green technologies*

Africa faces unique opportunities to exploit the positive reinforcing relationship between renewable energy and AI. Many African countries have high potential for renewable energy development, which they can leverage to improve access to electricity and, therefore, the

59 Landry Signé and Stephen Almond, "A Blueprint for Technology Governance in the Post-Pandemic World," *Brookings Institution* (blog), February 17, 2021, https://www.brookings.edu/articles/a-blueprint-for-technology-governance-in-the-post-pandemic-world/; "Agile Regulation for the Fourth Industrial Revolution A Toolkit for Regulators" (Cologny/Geneva World Economic Forum, December 2020), https://www3.weforum.org/docs/WEF_Agile_Regulation_for_the_Fourth_Industrial_Revolution_2020.pdf.

60 Mateen, "Can AI Improve Health Care Delivery in Africa?"

61 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

62 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

63 de Souza and Msipa, "Artificial Intelligence in the Global South: Will AI Advancement Deepen Digital Divides and Inequalities?"

64 Sallstrom, Morris, and Mehta, "Artificial Intelligence in Africa's Healthcare: Ethical Considerations."

65 Nicholas Davis, Landry Signé, and Mark Esposito, "Interoperable, Agile, and Balanced: Rethinking Technology Policy and Governance for the 21st Century," Working Paper 165 (Washington, D.C.: Brookings institution, January 2022).

66 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, And the Future of Jobs"; Ndung'u and Signé, "The Fourth Industrial Revolution and Digitization Will Transform Africa into a Global Powerhouse."

67 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, And the Future of Jobs."

68 Fox and Signé, "From Subsistence to Disruptive Innovation: Africa, The Fourth Industrial Revolution, And the Future of Jobs."

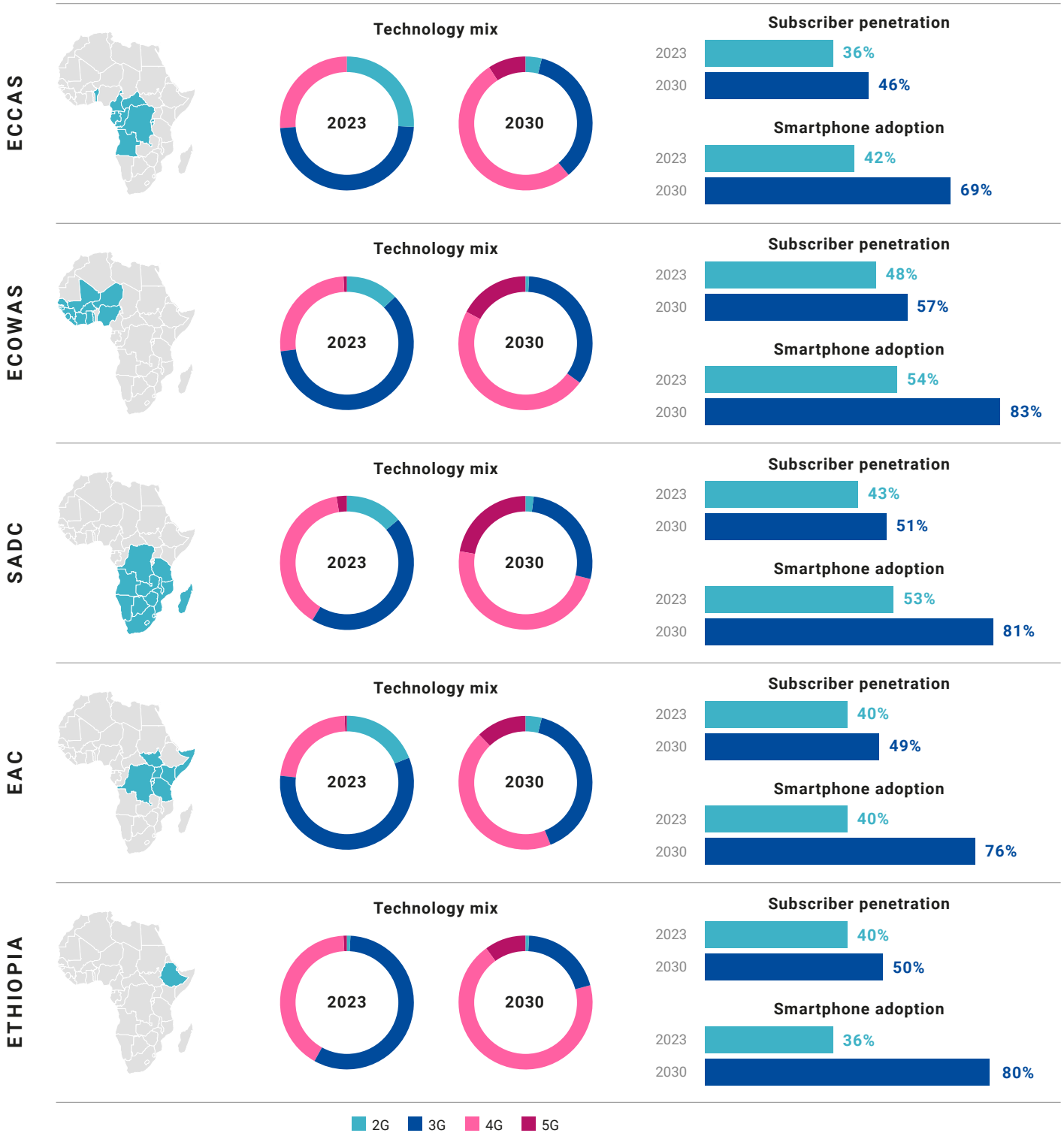
69 Ndung'u and Signé, "The Fourth Industrial Revolution and Digitization Will Transform Africa into a Global Powerhouse."

70 Landry Signé and Kevin Signé, "How African States Can Improve their Cybersecurity," *Brookings Institution* (blog), March 16, 2021, https://www.brookings.edu/articles/how-african-states-can-improve-their-cybersecurity/.

FIGURE 34

## REGIONAL SUBSCRIBER AND TECHNOLOGY TRENDS, 2023 AND 2030

*Africa is expected to make huge strides in upgrading mobile networks over the next five years with subscriber penetration and smartphone adoption ballooning across the continent*




Source: GSMA, 2024.

deployment of data centers that can develop sustainable computer technologies.[71] For now, AI use cases in energy in Africa are still in the nascent stage due to high initial investments, but with regulatory reforms that unlock private investment, African countries could become leaders in this area.[72]

## Conclusion

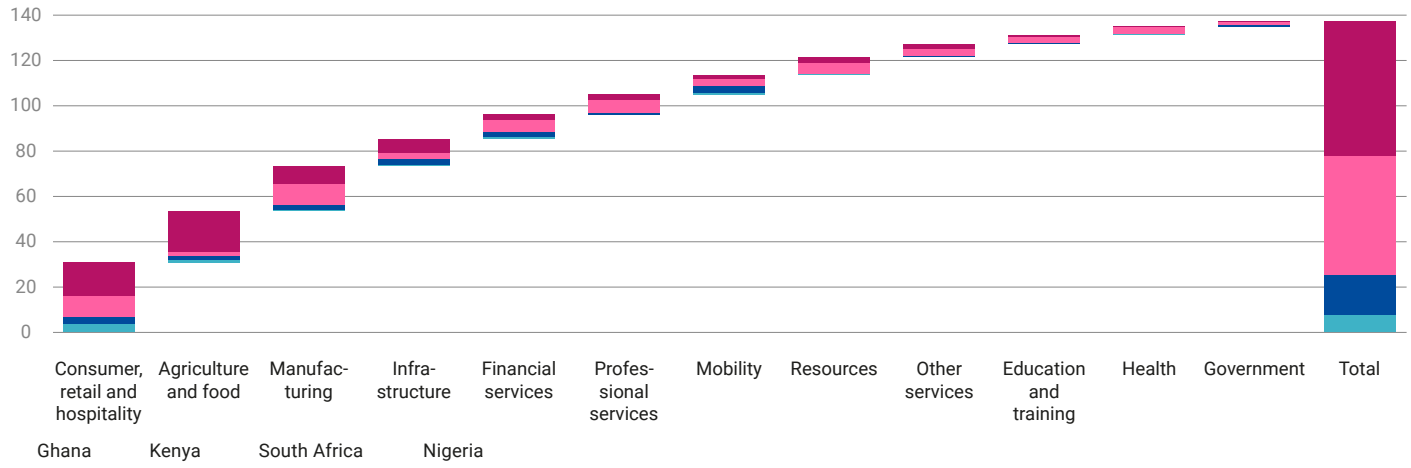
**African countries need investments in factors that enable 4IR technologies to thrive, such as infrastructure and digital skills, as well as nuanced and forward-looking regulatory frameworks.**

Enthusiasm and innovation among African entrepreneurs and end-users are helping Africa forge ahead with the 4IR and its technologies, offering new pathways to development. However, with only five years left until the 2030 SDG deadline, African policymakers, development practitioners, and technologists alike are looking at the potential for AI and emerging technologies to help accelerate progress and unlock new innovations. The benefits of 4IR technologies for economic, social, environmental, and governance goals include wide reachability, lower costs, higher productivity, and new techniques to meet these goals, while their challenges include ethical concerns and perpetuated inequality. To navigate these realities, policymakers should focus on leveraging Africa's strengths (entrepreneurship, youth population, etc.) when considering pathways forward. African countries need investments in factors that enable 4IR technologies to thrive, such as infrastructure and digital skills, as well as nuanced and forward-looking regulatory frameworks to encourage innovation while protecting citizens.

**FIGURE 35**

**POTENTIAL ECONOMIC BENEFITS FROM AI IN 2030**

*AI provides a huge opportunity for economic growth across many sectors of the African economy*




Note: USD billion, 2030. These estimates do not represent GDP or market size (revenue), but rather economic impact, including productivity gains, cost savings, time savings, and increased revenues. AI applications refers to two groups: (1) conventional applications of AI such as analytics-driven tools in marketing and sales or operational-centric efficiencies in manufacturing that could arise from predictive maintenance and improved manufacutring yields from optimization: and (2) generative AI, which involves the use of applications that are built upon foundation models and neural networks, which include capabilities to process and model outputs such as images, video, audio, and computer code. These are preliminary estimates. Numbers may not sum due to rounding.
Source: Access Partnership.

71 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

72 Humeau and Deshpande, "AI for Africa: Use Cases Delivering Impact."

# Bridging the digital divide in Africa: Enhancing technology adoption for economic growth

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The adoption of digital technologies by firms is a critical driver of productivity and economic growth for developing economies. While there have been notable advancements in digitalization—particularly in mobile payments—the overall use of digital technologies among businesses in Africa remains low.[1]

Despite the proliferation of mobile phones and increasing internet connectivity, many African firms do not fully leverage digital technologies for core business functions. Recent International Finance Corporation (IFC) research indicates that less than one-third of firms that have adopted digital technologies use them intensively for their most productive purposes such as business administration, planning, and sales.[2] Our analysis shows that 600,000 formally registered firms and 40 million microbusinesses in Africa could benefit from digital upgrades.

Several factors explain the disparities in technology adoption:

1. High costs of hardware and software: Digital devices, machinery, and software are significantly more expensive in sub-Saharan Africa compared to other regions. For example, the cost of digitally enabled machinery and equipment, including software, is approximately one-third higher than in the United States, even before adjusting for the lower purchasing power in Africa (Figure 36).

2. Limited digital infrastructure: A lack of reliable infrastructure impedes digital adoption. Approximately 600 million Africans—about half of the continent's population—do not have access to electricity. A comparable number lacks 4G mobile coverage. Without these fundamental services, businesses cannot effectively utilize digital technologies (Figure 37).

**Less than one-third of firms that have adopted digital technologies use them intensively for their most productive purposes.**

3. Expensive data plans and connectivity: The cost of internet connectivity remains prohibitively high for many African firms and individuals. Fixed broadband internet in sub-Saharan Africa averages around 20% of per capita gross national income, compared to less than 6% in other developing regions and 1% in North America.

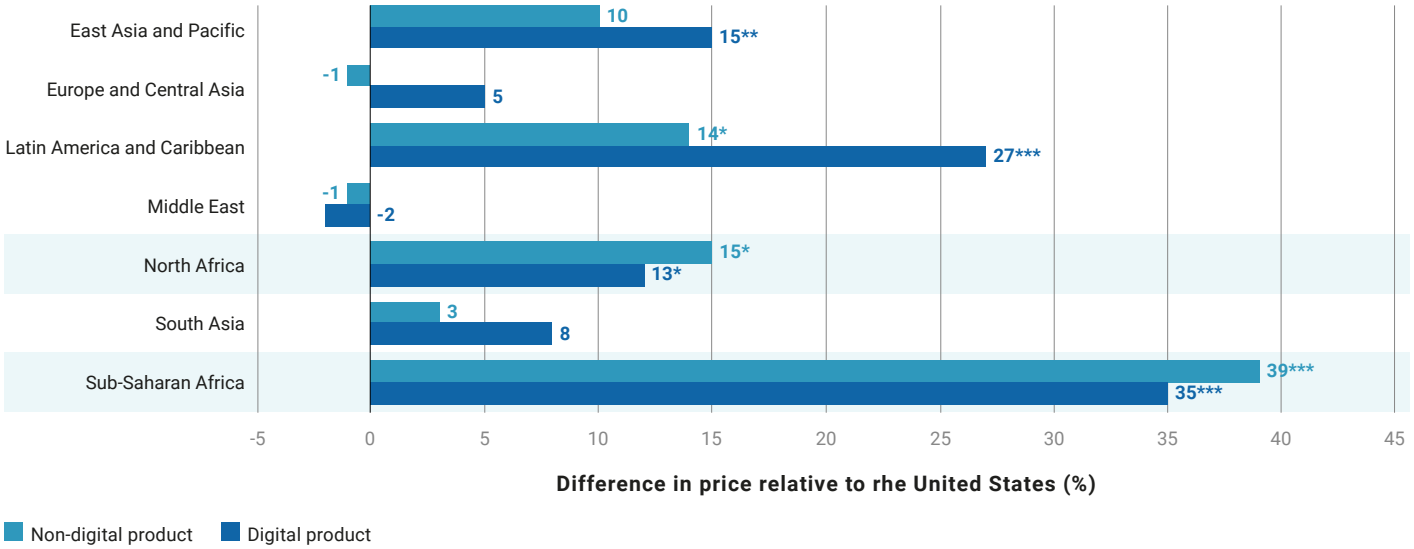
1 Digital Opportunities in African Businesses," International Finance Corporation Research Series, (Washington D.C.: The World Bank Group, 2024), https://openknowledge.worldbank.org/server/api/core/bitstreams/0bd11c26-2cac-4629-ad7f-d28fb390da60/content.

2 Digital Opportunities in African Businesses.

## FIGURE 36

### PRICES OF DIGITAL AND NONDIGITAL PRODUCTS, BY REGION, RELATIVE TO THE UNITED STATES

*Technology is significantly more expensive in Africa, even before adjusting for purchasing power*




Note: *Significant at the 10% level, **Significant at the 5% level, ***Significant at the 1% level.
Source: Cruz, Marcio, ed. 2024. "Digital Opportunities in African Businesses." Washington, D.C: World Bank. https://openknowledge.worldbank.org/server/api/core/bitstreams/0bd11c26-2cac-4629-ad7f-d28fb390da60/content.

Addressing these challenges will require the following:

- Investing in digital infrastructure: Enhancing middle- and last-mile digital infrastructure to improve internet access and reduce connectivity costs. The planned expansion of submarine fiber-optic cables is projected to increase international internet bandwidth sixfold by 2027. This expansion could lower broadband prices and stimulate up to $32 billion in investment over the next five years.

- Promoting competition among service providers: Increasing competition in the telecommunications and internet service sectors to reduce prices and improve services.

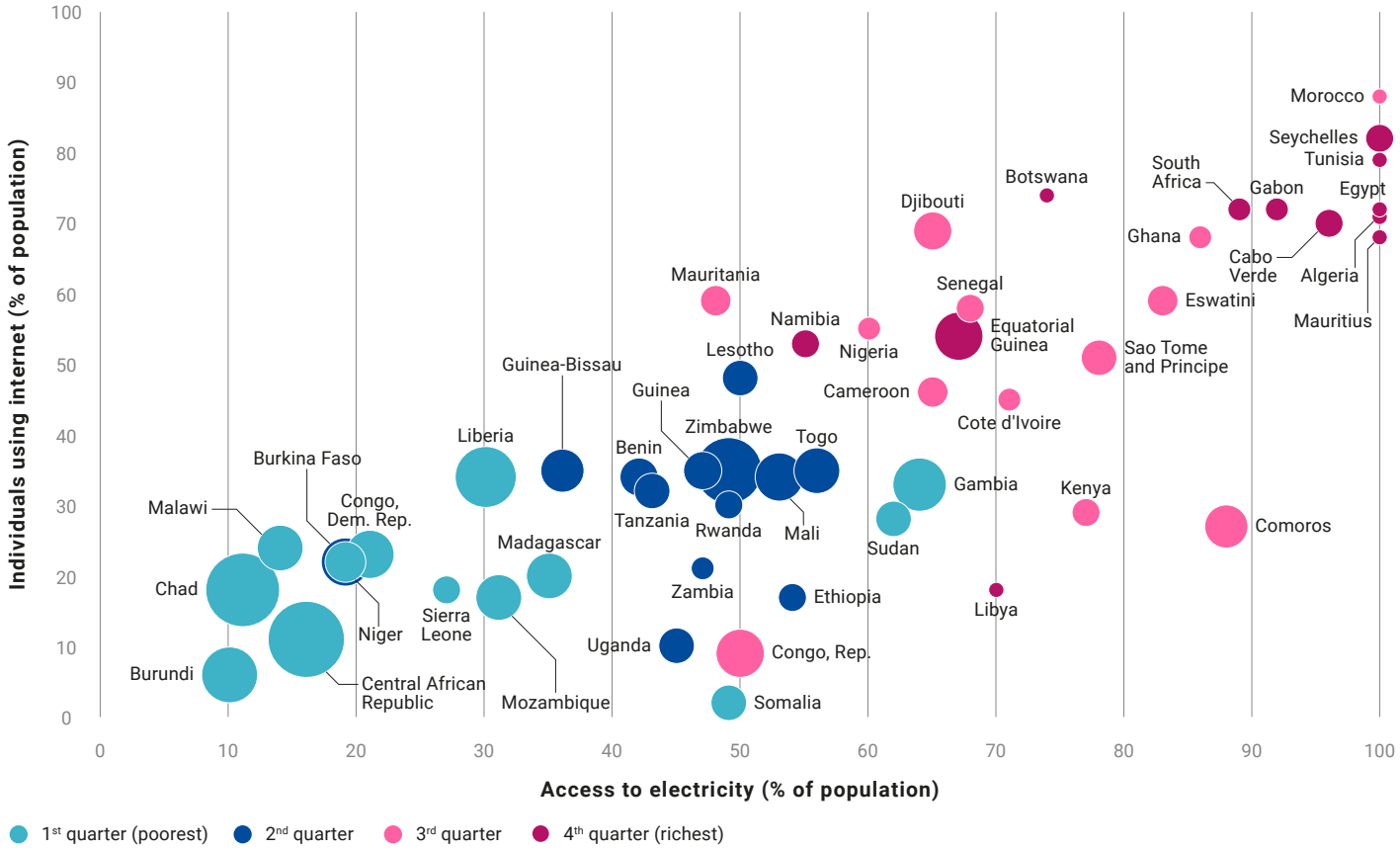
- Supporting innovative tech startups: Encouraging the growth of startups that offer affordable and user-friendly digital solutions to facilitate technology adoption among firms. Africa's startup ecosystem is expanding rapidly, with the number of tech hubs tripling between 2016 and 2021. Providing these startups with access to finance—particularly those incorporating disruptive technologies in sectors like agriculture, health, and education—can help overcome financial barriers and promote widespread digital integration.

3 Digital Opportunities in African Businesses.

## FIGURE 37

### INTERNET USE AND ACCESS TO ELECTRICITY IN AFRICA

*The relevance for digitalization of access to electricity, still limited in many African countries, and the cost of mobile broadband, generally higher in poorer countries, is corroborated by patterns in the data*




Note: Circle sizes represent the price of a data-only mobile broadband basket that provides at least 2 gigabytes of monthly data, with larger circles indicating higher broadband prices. The four circle colors represent four groups of African countries ranked by per capita gross national income, from the lowest (light blue) to the highest (dark pink).

Source: "Digital Opportunities in African Businesses," *International Finance Corporation Research Series*, (Washington, D.C.: The World Bank Group, 2024), https://openknowledge.worldbank.org/entities/publication/cadfc37b-e2ff-4ff9-a79b-b8b7245a296c.

Closing the digital gap has significant implications for Africa's economic prosperity. IFC's research demonstrates a strong positive association between increased digitalization and higher levels of firm productivity. Firms that intensively use digital technologies can enhance operational efficiency, access new markets, and integrate into global value chains. By investing in the infrastructure, innovation, and inclusivity needed to bridge the digital divide, Africa has the potential not only to transform its economies but also to redefine its place in the global digital economy.

# Shaping Africa's inclusive and trustworthy digital future: How Kenya is reimagining technology leadership

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Kenya has emerged as a thought leader in technology and artificial intelligence (AI), with its trajectory reflecting deliberate strategies at national, continental, and global levels.[2] This approach underscores a key principle: Africa must move from being merely a user to a creator of technology.[3] Kenya has integrated AI into key industries at the national level in an effort to meet the Sustainable Development Goals (SDGs) by 2030. On the continental level, Africa is working to convene stakeholders to share experiences and devise innovative solutions to shared problems. Additionally, Kenya's leadership in global forums—including its role in the United Nations resolution "Seizing the Opportunities of Artificial Intelligence for Sustainable Development" and its contributions to the Global Digital Compact negotiations—demonstrates how emerging economies can shape critical global discussions.[3] While Kenya has made substantial progress toward digital transformation, there is much work still to be done.

At the national level, Kenya's strategy combines infrastructure development with human capital investment. The Kenya Kwanza manifesto outlines plans to lay 100,000 kilometers of fiber optic cable to improve broadband access, with a focus on underserved regions.[4] This effort is bolstered by investments in undersea cables, such as the Umoja cable by Google connecting Africa directly to Australia via Kenya, enhancing the country's position as a digital hub.[5] However, internet penetration remains difficult, with access at approximately 40.8%, particularly in rural areas.[6] Infrastructure issues, high costs of technology, digital illiteracy, and cultural norms that disproportionately affect women's opportunities to engage with digital platforms all hinder the ability to bridge this gap quickly.[7] Addressing these issues will be crucial for achieving widespread digital inclusion.

**Africa must move from being merely a user to a creator of technology.**

1 We extend our gratitude to Nichole Grossman, research analyst at Brookings Africa Growth Initiative, for her outstanding research and editorial support.

2 "The Plan: Bottom-Up Economic Transformation Agenda 2022–2027," *The Kenya Kwanza Plan*, 2022, https://africacheck.org/sites/default/files/media/documents/2022-08/Kenya%20Kwanza%20UDA%20Manifesto%202022.pdf.

3 "Digital Economy Blueprint: Powering Kenya's Transformation," *Kenya Digital Economy* (Kigali, Rwanda: Smart Africa; Republic of Kenya, n.d.), https://smartafrica.org/knowledge/digital-economy/#:~:text=POWERING%20KENYA'S%20TRANSFORMATION&text=The%20Blueprint%20defines%20the%20digital,other%20technologies%E2%80%9D%20irrespective%20of%20industry.

4 "The Plan: Bottom-Up Economic Transformation Agenda 2022–2027."

5 Hilary Kimuyu, "Google Announces New Undersea Fibre Optic Cable to Link Kenya with Australia," *Nairobi News*, May 25, 2024, https://nairobinews.nation.africa/google-announces-new-undersea-fibre-optic-cable-to-link-kenya-with-australia/.

6 "Kenya - Individuals Using The Internet (% Of Population) - 2024 Data 2025 Forecast 1990-2022 Historical," *Trading Economics*, accessed December 11, 2024, https://tradingeconomics.com/kenya/individuals-using-the-internet-percent-of-population-wb-data.html.

7 Frederick Okello, "Bridging Kenya's Digital Divide: Context, Barriers and Strategies," *Centre for International Governance Innovation*, Digital policy Hub, Fall 2023, https://www.cigionline.org/publications/bridging-kenyas-digital-divide-context-barriers-and-strategies/.

In an effort to meet these goals, Kenya has begun to implement practical AI applications to address socioeconomic disparities. In agriculture, the Third Eye Project uses AI-powered drones to monitor soil conditions, detect pests, and identify crop diseases early, helping farmers reduce losses and improve productivity.[8] The agricultural sector accounts for 33% of Kenya's GDP with an additional 27% of GDP coming from linkages between agriculture and other sectors of the economy.[9] Better agricultural outputs help ease hunger across the country while the industry creates jobs leading to economic growth. In health care, Tambua Health employs machine learning to diagnose cardiopulmonary diseases by analyzing lung and heart sounds, making diagnoses more efficient and accessible.[10] Thirteen percent of all deaths and 25% of all hospital admissions in the country are due to cardiovascular diseases, making this initiative critical.[11] In finance, AI-driven Digital Lending Apps assess borrowers' behavioral data to extend credit to underserved populations, enabling financial inclusion.[12] Despite the noticeable increase in Kenyans' access to mobile money and lending accounts, most Kenyans still lack access to formal financial products such as savings, pensions, or insurance.[13]

Kenya's renewable energy leadership also offers a unique lens on how sustainability can intersect with technological progress. With 93% of its electricity generated from renewable sources, including geothermal, wind, and solar, Kenya provides a low-carbon energy base for powering AI infrastructure.[14] The integration of renewable energy into the Africa Green Industrialization Initiative exemplifies how Kenya is promoting climate-resilient technological development while fostering global partnerships.[15] However, grid stability and flexibility issues remain, making it difficult for Kenya to become a hub for energy-intensive operations such as data centers and AI model training until a solution is found.[16]

While there are still hurdles to overcome in Kenya's digital transformation, its many successes have allowed Kenya to play an instrumental role in shaping the digital economy across the continent. For example, as a contributor to Smart Africa's Digital Economy Blueprint, Kenya has helped create a framework for member states to harness digital technologies for inclusive socioeconomic growth.[17] Globally, Kenya has established itself as a key player in AI

8 Jackline Akello, "Artificial Intelligence in Kenya," ed. Ekai Nabenyo, *Paradigm Initiative*, Paradigm Initiative, January 2022, https://paradigmhq.org/wp-content/uploads/2022/02/Artificial-Inteligence-in-Kenya-1.pdf.

9 "Kenya at a Glance | FAO in Kenya," *Food and Agriculture Organization of the United Nations*, accessed December 17, 2024, https://www.fao.org/kenya/fao-in-kenya/kenya-at-a-glance/en/.

10 Akello, "Artificial Intelligence in Kenya."

11 "Advancing Heart Health in Kenya," *World Heart Federation* (blog), accessed December 17, 2024, https://world-heart-federation.org/news/advancing-heart-health-in-kenya/.

12 Akello, "Artificial Intelligence in Kenya."

13 "Measuring Kenya's Financial Inclusion Journey," *FinAccess Deep-Dives* (Nairobi: Financial Sector Deepening Kenya, September 2023), https://www.fsdkenya.org/wp-content/uploads/2023/11/Measuring-Kenyas-financial-inclusion-journey.pdf.

14 "Integrated Annual Report and Driving Value and Sustainability: Financial Statements for the Year Ended 30 June 2024" (Nairobi, Kenya: KenGen, n.d.), Integrated Annual Report and Driving Value and Sustainability Financial Statements for the Year Ended 30 June 2024.

15 "At COP28, Kenya's President Ruto Convenes African Leaders to Launch Green Industrialization Initiative, Capitalizing on UAE's Clean Energy Pipeline in Africa," *UAE Concensus*, December 2, 2023, https://www.cop28.com/en/news/2023/12/At-COP28-Kenyas-President-Ruto-convenes-African-Leaders-to-launch-the-Africa-Green-Industrialization.

16 "Project Spotlight: Kenya's Path to 100% Clean Power | CIF News," *Climate Investment Fund* (blog), September 5, 2024, https://www.cif.org/news/project-spotlight-final-stretch-100-clean-power-kenya-leads-learns-and-clears-few-hurdles.

17 "Digital Economy Blueprint: Powering Kenya's Transformation."

governance and safety. As the sole African member of the International Network of AI Safety Institutes, Kenya is shaping global standards to ensure AI systems remain ethical, inclusive, and trustworthy.[18] Its co-convening of a ministerial side event during the 2023 United Nations General Assembly, focusing on AI's potential to accelerate the SDGs, exemplifies how nations should address shared challenges such as climate change, health care, and economic inequality and work together toward sustainable solutions.[19]

Underlying Kenya's approach is a principle deeply rooted in African culture: trust. Trust fosters cooperation and mutual respect. Recognizing the growing importance of trust in the technological era, President William Ruto has proposed a Global Trust Summit in 2025. This summit aims to convene governments, technology leaders, and civil society to explore how fairness, inclusivity, and sustainability can anchor the next phase of AI development. By focusing on these values, the summit seeks to create a global AI ecosystem where technology enhances trust among people and communities.[20]

Kenya's successes in the digital realm are to be celebrated while maintaining focus on the obstacles not yet addressed. Through strategic investments, inclusive policies, and global partnerships, AI and technology can serve as transformative tools for sustainable development. Kenya's experiences in this space can guide other African nations seeking to achieve the SDGs with the help of advanced technologies. Moving forward, Africa should make the following recommendations a priority:

1. Digital public infrastructure needs substantial investment to create connectivity that is affordable. This includes provision of publicly accessible internet and centers for accessing the internet for communities without device capability.[21]

2. Africa can ease the cost of doing business by creating an open society with democratic freedoms and business-friendly policies that enable the private sector's ease of doing business. Companies like IBM And Microsoft have already established regional hubs in Nairobi due to the friendly business environment and push for increased democratic protections.[22]

3. Education is key. Investing in technology for the classroom provides for high quality education that prepares students for a career in the digital economy. Kenya's focus on improving technology in the classroom for students at all levels, including in vocational programs, and the significant number of edtech companies that have entered the arena in recent years have created a more inclusive learning environment and taught skills necessary for the workforce.[23]

18 "Ambassador Thigo Leads Kenya's Participation in Historic AI Safety Network Launch in the US," *Kenya News Agency*, November 24, 2024, https://www.kenyanews.go.ke/ambassador-thigo-leads-kenyas-participation-in-historic-ai-safety-network-launch-in-the-us/.

19 "Artificial Intelligence for Accelerating Progress on the Sustainable Development Goals: Addressing Society's Greatest Challenges," *United States Department of State*, September 18, 2023, https://www.state.gov/artificial-intelligence-for-accelerating-progress-on-the-sustainable-development-goals/.

20 "President Ruto Announces Kenya as the Host of the 2026 Global Data Festival," *Global Partnership for Sustainable Development Data*, September 26, 2024, https://www.data4sdgs.org/news/press-release-president-ruto-announces-kenya-host-2026-global-data-festival.

21 "Kenya Digital Economy Acceleration Project," Environmental and Social Commitment Plan (Nairobi: ICT Authority, February 2023), https://cms.icta.go.ke/sites/default/files/2023-02/P170941%20KDEAP_ESCP%20Feb%2023%202023%20Final.pdf.

22 Akello, "Artificial Intelligence in Kenya."

23 "Technology in Kenyan Classrooms," *Kenya Society UK*, June 24, 2024, https://www.kenyasociety.org/news/tech-in-kenyan-classrooms.

# Accelerating digital inclusion in Africa

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**@wef**

Digital technologies have significant potential to address many of Africa's pressing challenges, but their adoption and impact face several obstacles that need to be overcome to ensure that nobody is left behind.

Technologies such as the Internet of Things and big data analytics have incredible potential to drive Africa's economic growth, contributing up to $1.5 trillion in GDP by 2030 by increasing productivity and efficiency across industries,[1] creating new jobs and business opportunities, especially for youth, and empowering citizens through increased access to information, thereby creating intelligent economies.[2]

By taking a strategic, inclusive approach, African countries can harness digital technologies to foster intelligent economies that are sustainable and transformative. However, African countries must address several key challenges related to digital inclusion for an intelligent economy to emerge.

## Accelerating digital access

**By taking a strategic, inclusive approach, African countries can harness digital technologies to foster intelligent economies that are sustainable and transformative.**

As of 2023, approximately 37% of the African population used the internet, with high costs of internet cited as the main barriers to usage, especially in low-income and rural areas.[3] Notably, Africa's fixed broadband access rates are the highest globally, averaging 14.8% of gross national income, far exceeding International Telecommunication Union's recommended 2%.[4] As a result, mobile connectivity is the primary means of accessing the internet in Africa. As of 2023, mobile penetration in sub-Saharan Africa was 44% and mobile internet penetration was 27%.[5] Key barriers to mobile internet adoption include affordability (smartphones can cost up to 95% of monthly income for the poorest 20%),[6] lack of digital skills, limited locally relevant content, and language barriers. Given that smartphone penetration is expected to reach 88% by 2030, mobile-based digital tech

1 "Artificial Intelligence in African Economic Development Potential and Challenges to Overcome" (Addis Ababa: United Nations Economic Commission for Africa, 2024), https://repository.uneca.org/handle/10855/50180.

2 An intelligent economy, also known as a smart economy, is an advanced economic model characterized by the integration of cutting-edge technologies, innovation, and sustainable practices to drive growth and improve societal well-being.

3 "Measuring Digital Development: Facts and Figures 2023" (Geneva: ITU, 2023), https://www.itu.int/hub/publication/d-ind-ict_mdd-2023-1/.

4 "Assessing the Progress of Internet Activity in Africa," *Telecom Review Africa* (blog), April 18, 2024, https://www.telecomreviewafrica.com/articles/features/4206-assessing-the-progress-of-internet-activity-in-africa/

5 "The Mobile Economy sub-Saharan Africa 2023" (London: GSMA, 2024), https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/sub-saharan-africa/.

6 Matt Shanahan, "Despite Improvements, sub-Saharan Africa Has the Widest Usage and Coverage Gaps Worldwide," *Mobile for Development* (blog), April 8, 2024, https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/blog/despite-improvements-sub-saharan-africa-has-the-widest-usage-and-coverage-gaps-worldwide/.

solutions may offer a practical way to tap into and expand digital technology capabilities in Africa.[7]

The most pressing issue, however, is access to electricity. Only about 43% of Africans have a reliable supply of electricity.[8] Digital technologies significantly impact energy and electricity consumption, particularly through the rapid growth of data centers and increased computing demands. Generative AI systems already use around 33 times more energy to complete a task than task-specific software.[9]

Estimates suggest $400 billion is needed for electricity transmission and distribution improvements by 2050.[10] Without this investment, most countries in the region will not have the necessary baseload electricity to benefit from digital technologies.

## Addressing Africa's digital infrastructure

Africa accounts for less than 1% of total available global data center capacity, despite being home to 18% of the world's population.[11] There are currently around 150 data centers across Africa, with most concentrated in South Africa, Nigeria, and Kenya. Analysts suggest that Africa needs at least 700 new data centers to meet its connectivity and data storage requirements over the medium term.[12]

Furthermore, the continent will need to make significant investments in high-performance supercomputers that can power deep learning models, train and run complex AI models efficiently, and analyze vast amounts of data quickly, all of which are essential for extracting meaningful insights from large datasets.

Africa currently has only a few supercomputers: "Toubkal" in Morocco—currently Africa's most powerful supercomputer,[13] "Lengau" in South Africa — the next fastest,[14] and CHPC —

7 Eugénie Humeau and Tanvi Deshpande, "AI for Africa: Use Cases Delivering Impact" (London: GSMA, July 2024), https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2024/07/AI-for-Africa-Use-cases-delivering-impact.pdf.

8 "Key Findings – Africa Energy Outlook 2022 – Analysis," *IEA*, accessed December 16, 2024, https://www.iea.org/reports/africa-energy-outlook-2022/key-findings.

9 Eleni Kemene, Bart Valkhof, and Thapelo Tladi, "AI and Energy: Will AI Help Reduce Emissions or Increase Demand? Here's What to Know," *World Economic Forum*, July 22, 2024, https://www.weforum.org/stories/2024/07/generative-ai-energy-emissions/.

10 César Augier et al., "Green Energy in Africa Presents Significant Investment Opportunities" (McKinsey & Company, October 17, 2023), https://www.mckinsey.com/capabilities/sustainability/our-insights/green-energy-in-africa-presents-significant-investment-opportunities.

11 "Tackling a Critical Need for Data Center Infrastructure across Africa," *U.S. International Development Finance Corporation*, accessed November 19, 2024, https://www.dfc.gov/investment-story/tackling-critical-need-data-center-infrastructure-across-africa.

12 Samuel Carvalhoay, "Data Centers - Just One Part of the African Digital Infrastructure Investment Equation," *Data Center Dynamics*, June 4, 2024, https://www.datacenterdynamics.com/en/opinions/data-centers-just-one-part-of-the-african-digital-infrastructure-investment-equation/.

13 Wagdy Sawahel, "Africa Launches Powerful Supercomputer," *University World News*, March 1, 2021, https://www.universityworldnews.com/post.php?story=20210228193908881.

14 Admire Moyo, "SA Unleashes Africa's Fastest Supercomputer" *ITWeb News*, June 8, 2016, https://www.itweb.co.za/article/sa-unleashes-africas-fastest-supercomputer/Wdgp45Ma4KP7X9l8.

FIGURE 38

## THE MOBILE ECONOMY OF SUB-SAHARAN AFRICA

*By 2030, Africa's mobile economy will change substantially with more access to mobile netwroks and smartphones*

### UNIQUE MOBILE SUBSCRIBERS

2023 **527m**
44% penetration rate*

2030 **751m**
53% penetration rate*

CAGR 2023-2030 **4.5%**

### MOBILE INTERNET USERS

2023 **320m**
27% penetration rate*

2030 **518m**
37% penetration rate*

CAGR 2023-2030 **6.2%**

### SIM CONNECTIONS

(excluding licensed cellular IoT)

2023 **1.0bn**
88% penetration rate*

2030 **1.4bn**
103% penetration rate*

CAGR 2023-2030 **4.1%**

**4G** Percentage of connections (excluding licensed cellular IoT)

2023 **31%** 2030 **50%** ↑

**5G** Percentage of connections (excluding licensed cellular IoT)

2023 **1.2%** 2030 **17%** ↑

### SMARTPHONES

Percentage of connections

2023 **51%**

2030 **81%** ↑

### LICENSED CELLULAR IoT CONNECTIONS

2023 **27m**

2030 **51m**

### MOBILE'S CONTRIBUTION TO GDP

2023 **$140bn**
7% of GDP

2030 **$170bn**

### PUBLIC FUNDING

2023 **$20bn**

Mobile ecosystem contribution to public funding (before regulatory and spectrum fees)

### OPERATOR REVENUES AND INVESTMENT

2023 **$38bn**
Total revenues

2030 **$61bn**
Total revenues

OPERATOR CAPEX FOR THE PERIOD 2023-2030 **$62bn**

### EMPLOYMENT

2023 **1.5m jobs**
Directly supported by the mobile ecosystem

PLUS **2.2m indirect jobs**

Note: Percentage of population.
Source: GSMA

also in South Africa.[15] Given Africa's size, population, and diverse needs, the continent needs multiple supercomputing centers strategically located in different regions to serve various countries, research communities, and entrepreneurs.

## Mitigating risks and biases related to digital technologies through effective regulation

While regulation related to digital technologies in Africa is still in its early stages, there are growing efforts at both the national and continental levels to develop appropriate strategies and frameworks for ethical development of digital technologies. Still, many African countries lack robust regulatory frameworks and policies to address the ethical and societal implications, which can leave vulnerable populations exposed to potential harms and exploitation from uncontrolled AI deployment. Digital technologies have the potential to exacerbate existing inequalities and widen the digital divide. For example, AI systems are trained on historical data, which often reflect societal biases and inequalities, and, if not carefully designed and monitored, can perpetuate and amplify these biases leading to discriminatory outcomes.[16]

Africa's path to developing an intelligent economy must focus on ensuring digital inclusion by addressing these challenges related to digital access, digital infrastructure, and robust regulatory reform. If successful, Africa has the potential to drive significant socioeconomic change and emerge as a key player in the global digital landscape.

15 "Advancing High-Performance Computing in South Africa: The CHPC," *NICIS*, accessed December 16, 2024, https://www.nicis.ac.za/chpc/.

16 Nicol Turner Lee et al., "Algorithmic Bias Detection and Mitigation: Best Practices and Policies to Reduce Consumer Harms," *Brookings Institution*, May 22, 2019, https://www.brookings.edu/articles/algorithmic-bias-detection-and-mitigation-best-practices-and-policies-to-reduce-consumer-harms/.

# Digital solutions in agriculture drive meaningful livelihood improvements for African smallholder farmers

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Africa's agricultural sector faces compounding pressures, with climate change, degraded soil, and rapid population growth straining its ability to provide sufficient food. Today, 282 million Africans go hungry every day, a situation projected to worsen as climate-related challenges intensify.[1] By 2030, nearly 118 million people in Africa could face droughts, floods, and extreme temperatures, further heightening food insecurity and underscoring the urgent need for agricultural innovation.[2]

In many sectors, technology and innovation drive development, yet agriculture remains one of the least digitized sectors. This lack of digital integration limits smallholder farmers' capacity to respond effectively to changing environmental and market conditions. Attempts have been made to remedy this; the African Union established a Digital Transformation Strategy which included provisions for improving the efficiency and effectiveness of the African agricultural system to make it more resilient to climate change and environmentally sustainable by 2030.[3] The strategy seeks to contribute to the Comprehensive African Agricultural Development Program's vision of eliminating hunger and reducing poverty by raising economic growth through agriculture-led development and promoting increased national budget provision to the agriculture sector.[4]

The Fourth Industrial Revolution (4IR) also has the potential to transform Africa's agricultural sector, supporting the continent's progress toward the 2030 Sustainable Development Goals (SDGs) by enhancing food security, resilience, and sustainability.[5] Technologies such as artificial intelligence (AI), blockchain, and the Internet of Things are beginning to address age-old challenges in agriculture such as low productivity and market inefficiencies in the face of climate change.[6] Through data-driven insights and automated tools, digital innovation

1 "Alarm Bells Ignored as Africa Continues to Face Deepening Food Crisis," *Food and Agriculture Organization of the United Nations*, July 12, 2023, https://www.fao.org/newsroom/detail/alarm-bells-ignored-as-africa-continues-to-face-deepening-food-crisis/en; Emily Barone, "What Climate Change Means For Africa's Food Crisis," *TIME*, October 5, 2022, https://time.com/6220057/climate-change-africa-food-crisis/.

2 "Africa Faces Disproportionate Burden from Climate Change and Adaptation Costs," *World Meteorological Association*, September 2, 2024, https://wmo.int/news/media-centre/africa-faces-disproportionate-burden-from-climate-change-and-adaptation-costs.

3 "The Digital Transformation Strategy for Africa (2020-2030)" (African Union, n.d.), https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf.

4 "Comprehensive Africa Agricultural Development Programme," CAADP, accessed December 16, 2024, https://caadp.org/.

5 Francie Sadeski et al., "Potential of the Fourth Industrial Revolution in Africa" (Abidjan: African Development Bank Group; Korea-Africa Economic Cooperation, October 2019), https://www.technopolis-group.com/wp-content/uploads/2020/02/Potential-of-the-fourth-industrial-revolution-in-Africa.pdf.

6 Rambod Abiri et al., "Application of Digital Technologies for Ensuring Agricultural Productivity," *Heliyon* 9, no. 12 (December 1, 2023): e22601, https://doi.org/10.1016/j.heliyon.2023.e22601.

enables improved decisionmaking, precision targeting, and resource efficiency, which are essential to bolstering Africa's agricultural productivity and ensuring food security for its growing population.[7]

The impact of 4IR technologies on African agriculture is evident, with CGIAR playing a pivotal role in this transformation.[8] CGIAR has been leading the use of 4IR tools to address agricultural challenges, introducing innovations such as digital soil mapping and AI-powered crop disease detection systems. These technologies have enabled farmers to identify and treat diseases early, resulting in higher yields and reduced crop loss. For example, IITA's Cassava Disease Surveillance platform in Nigeria,[9] the Cassava Seed Tracker,[10] and the Plant Village Nuru AI app help smallholders diagnose and manage cassava diseases rapidly,[11] resulting in higher yields and minimized losses.

Several examples of AI applications in agriculture illustrate how AI is already making a tangible impact on agriculture in Africa, improving efficiency, productivity, and sustainability. Hello Tractor, often referred to as the "Uber for farmers,"[12] uses AI to connect tractor owners with farmers in need of plowing services, enhancing access to farm machinery and boosting productivity. PlantVillage leverages AI to help farmers detect plant diseases early, significantly improving agricultural resilience.[13] The Malawi Digital Plant Health Service is a countrywide initiative for coordinating internationally developed digital systems.[14] It bundles complementary digital tools developed across the world such as PlantVillage (Penn State University, U.S.), VIPS (NIBO, Norway),[15] FIA (IITA, Benin), and Prise and PlantWise (CABI, U.K.) to support smallholder farmers in pest and disease management.[16]

**Several examples of AI applications in agriculture illustrate how AI is already making a tangible impact on agriculture in Africa, improving efficiency, productivity, and sustainability.**

Additionally, AI technologies are used in precision agriculture for soil monitoring, including soil fertility and overfertilization, as well as for automated irrigation and pest, disease, and weed prediction. Ujuzi Kilimo builds sensors and farm data analytics tools to collect, analyze,

7 "Fertile Ground for Digitalisation: Adopting Digital Technologies to Improve Farming and Food Security in Africa," *AUDA-NEPAD* (blog), July 19, 2023, https://www.nepad.org/blog/fertile-ground-digitalisation-adopting-digital-technologies-improve-farming-and-food-security.

8 "CGIAR: Science for Humanity's Greatest Challenges," CGIAR, accessed December 16, 2024, https://www.cgiar.org/.

9 "IITA and NAQS Pilot Digital Cassava Disease Surveillance Platform," *IITA* (blog), accessed December 16, 2024, http://www.iita.org/news-item/iita-naqs-pilot-digital-cassava-disease-surveillance-platform/.

10 "Cassava Seed Tracker," accessed December 16, 2024, https://seedtracker.org/cassava/.

11 James Legg, "Nuru Mobile Phone App is Being Scaled out to Help Farmers in sub-Saharan Africa Identify and Manage Cassava Diseases," *MEL*, April 20, 2020, https://mel.cgiar.org/projects/-15/210/nuru-mobile-phone-app-is-being-scaled-out-to-help-farmers-in-sub-saharan-africa-identify-and-manage-cassava-diseases.

12 romainsame, "AI and Sustainable Agriculture in Africa: Utopia or Imminent Reality?," *Africa Hub*, November 8, 2023, https://www.aiafricahub.org/en/blog-en/social-environmental-impact/ai-sustainable-agriculture-africa/.

13 "PlantVillage Nuru: Pest and Disease Monitoring Using AI," CGIAR Platform for Big Data in Agriculture, accessed December 16, 2024, https://bigdata.cgiar.org/digital-intervention/plantvillage-nuru-pest-and-disease-monitoring-using-ai/.

14 "About Malawi Digital Plant Health Service (MaDiPHS)," MaDiPHS, accessed December 16, 2024, https://madiphs.org/malawi-digital-plant-health-service-madiphs/.

15 "VIPS - Nibio," Nibio, accessed December 16, 2024, https://www.nibio.no/en/services/vips.

16 "PRISE: A Pest Risk Information Service," *CABI* (blog), accessed December 16, 2024, https://www.cabi.org/projects/prise-a-pest-risk-information-service/; "Plantwise: Helping Farmers Loses Less and Feed More," *CABI* (blog), accessed December 16, 2024, https://www.cabi.org/projects/plantwise/.

and make sense of agricultural data for the world's smallholder farmers.[17] The Project FARM platform uses AI to determine farming patterns through big data, generating insights from the data to make recommendations and using machine learning to scale the platform by connecting it with cellphones.[18]

CGIAR has also developed precision agriculture tools such as smart irrigation and climate forecasting, optimizing water usage and helping farmers prepare for adverse weather patterns. Digital agronomy tools like RiceAdvice and NextGen Agroadvisory provide location-specific fertilizer and planting recommendations, resulting in 25% yield increases for wheat and rice and improved profitability for smallholder farmers in Ethiopia, Nigeria, and Mali.[19] CGIAR has been extensively using big data and cutting-edge digital technologies in research for development to accelerate the generation of nutritious, climate-resilient, high-yield crop varieties that are suitable for diverse market segments and end-user profiles through modern breeding methods and genome editing technologies.[20] Remote sensing technologies and AI are being used for mapping crops using satellite for disease surveillance,[21] AI mobile apps for disease detection, and information and communication technologies for disease management in farmers' fields.[22] These tools help smallholder farmers optimize input use and improve profitability.

In West Africa and the Sahel, a consortium of stakeholders has established a regional hub for fertilizer and soil health to help improve soil health status in the region, enhance soil fertility, and promote sustainable land management practices using digital soil mapping and other 4IR technologies.[23] Additionally, CGIAR has enhanced market access through digital platforms and blockchain systems, enabling transparent supply chains, reducing the influence of middlemen, and allowing farmers to connect directly with buyers. These advancements lower input costs and improve profit margins, making agriculture more

17 "Ujuzi Kilimo," accessed December 16, 2024, https://www.ujuzikilimo.com/.

18 Laura Foster et al., "Smart Farming and Artificial Intelligence in East Africa: Addressing Indigeneity, Plants, and Gender," *Smart Agricultural Technology* 3 (February 1, 2023): 100132, https://doi.org/10.1016/j.atech.2022.100132; "Project FARM – An Intelligent Data Platform to Resolve Global Food Shortages," *Capgemini* (blog), December 6, 2019, https://www.capgemini.com/news/client-stories/project-farm-an-intelligent-data-platform-to-resolve-global-food-shortages/; "Ujuzi Kilimo."

19 "AfricaRice | RiceAdvice," AfricaRice, accessed December 16, 2024, https://www.africarice.org/riceadvice; "Smallholder Farmers in Ethiopia Utilizing NextGen Agro-Climate Advisory Increased Wheat Yield by 25%," *CGIAR* (blog), 2022, https://www.cgiar.org/initiative-result/smallholder-farmers-in-ethiopia-utilizing-nextgen-agro-climate-advisory-increased-wheat-yield-by-25/.

20 "Reflections on Workshop: Adaptive Co-Design of Research for Development (R4D) Evaluations – the Need for Engagement, Learning and Ongoing Reflection," May 19, 2023, https://iaes.cgiar.org/evaluation/news/reflections-workshop-adaptive-co-design-research-development-r4d-evaluations-need; "New Project Aims to Modernize Rice Breeding in Africa," Excellenceinbreeding, accessed December 16, 2024, https://excellenceinbreeding.org/news/new-project-aims-modernize-rice-breeding-africa; Leena Tripathi et al., "Genome Editing for Sustainable Agriculture in Africa," *Frontiers in Genome Editing* 4 (May 12, 2022), https://doi.org/10.3389/fgeed.2022.876697.

21 "Africa: Remote-Sensing Models to Combat Banana Bunchy Top Virus," *Global Plant Protection News*, January 17, 2023, https://iapps2010.wordpress.com/2023/01/16/africa-remote-sensing-models-to-combat-banana-bunchy-top-virus/.

22 "Combating Banana Disease through Digital Innovation," ICT4BXW, accessed December 16, 2024, https://www.ict4bxw.com/; Mariette McCampbell et al., "Are Farmers Ready to Use Phone-Based Digital Tools for Agronomic Advice? Ex-Ante User Readiness Assessment Using the Case of Rwandan Banana Farmers," *The Journal of Agricultural Education and Extension* 29, no. 1 (January 1, 2023): 29–51, https://doi.org/10.1080/1389224X.2021.1984955.

23 Evans Samuel, "New Partnership to Deliver Improved Farm Productivity from Soil Health and Fertility," *IITA* (blog), accessed December 16, 2024, http://www.iita.org/news-item/new-partnership-to-deliver-improved-farm-productivity-from-soil-health-and-fertility/.

**To maximize the transformative potential of 4IR in agriculture, African governments and stakeholders must prioritize enabling policies, ethical technology use, and equitable access.**

sustainable and attractive for smallholder farmers across the continent. A good example is the Technologies for African Agricultural Transformation,[24] launched by the African Development Bank and implemented by CGIAR,[25] which has already delivered climate-smart seeds to 12 million farmers in 27 countries in just three years. The Technologies for African Agricultural Transformation program has been using digital tools to promote validated technologies through an e-catalogue which allows stakeholders to select appropriate technologies for adoption.[26]

Despite these successes, challenges persist in the adoption of 4IR tools due to uneven access and low digital literacy.[27] The risk of job displacement due to automation, especially for low-skilled labor in rural areas, is a pressing concern, requiring investments in reskilling programs to equip workers for more technical roles.[28] Furthermore, the digital divide continues to limit access to technology while limited internet connectivity, particularly in rural areas, further impedes the widespread adoption of digital solutions.[29] Data privacy and security issues also need to be addressed through robust governance frameworks to ensure that farmers maintain control over their data while benefiting from digital advancements.[30] While fintech solutions like mobile money and digital loans have improved financial inclusion, infrastructure limitations still prevent many smallholders from fully realizing the benefits of these technologies.[31]

To maximize the transformative potential of 4IR in agriculture, African governments and stakeholders must prioritize enabling policies, ethical technology use, and equitable access. This involves establishing data governance policies that protect farmers' rights, creating digital literacy programs, and fostering public-private partnerships to drive innovation. To support these goals, CGIAR, through initiatives like the Digital Transformation Accelerator Program, partners with African national programs to promote data governance frameworks that protect smallholder farmers' data rights.[32] This initiative backs policies that enhance digital literacy, data security, and equitable technology access, ensuring the full participation of smallholder farmers in the digital transformation of agriculture.

24 "Global Partnerships and Investments, Crucial to Leveraging Technologies for Food Systems Transformation – AfDB, CGIAR and Stakeholders," *Taat Africa*, June 3, 2024, https://taat-africa.org/news/global-partnerships-and-investments-crucial-to-leveraging-technologies-for-food-systems-transformation-afdb-cgiar-and-stakeholders/.

25 "African Development Bank Group," African Development Bank Group, accessed December 16, 2024, https://www.afdb.org/en.

26 "TAAT Africa E-Catalogs," Taat Africa, accessed December 16, 2024, https://e-catalogs.taat-africa.org.

27 Rik Moors, "Reimagining TVET for 4IR Jobs in Africa," *ACET* (blog), August 14, 2023, https://acetforafrica.org/research-and-analysis/insights-ideas/articles/reimagining-tvet-for-4ir-jobs-in-africa/.

28 Holzer, "Understanding the Impact of Automation on Workers, Jobs, and Wages," *Brookings Institution* (blog), January 19, 2022, https://www.brookings.edu/articles/understanding-the-impact-of-automation-on-workers-jobs-and-wages/.

29 "Widening Digital Gap between Developed, Developing States Threatening to Exclude World's Poorest from Next Industrial Revolution, Speakers Tell Second Committee," *United Nations*, October 6, 2023, https://press.un.org/en/2023/gaef3587.doc.htm.

30 Jasmin Kaur et al., "Protecting Farmers' Data Privacy and Confidentiality: Recommendations and Considerations," *Frontiers in Sustainable Food Systems* 6 (October 19, 2022), https://doi.org/10.3389/fsufs.2022.903230.

31 Ellis L. C. Osabutey and Terence Jackson, "Mobile Money and Financial Inclusion in Africa: Emerging Themes, Challenges and Policy Implications," *Technological Forecasting and Social Change 202* (May 1, 2024): 123339, https://doi.org/10.1016/j.techfore.2024.123339.

32 "Digital Transformation Accelerator: Full Design Document" (CGIAR, November 15, 2024), https://cgspace.cgiar.org/server/api/core/bitstreams/491533ae-f36f-49f9-80d0-ea7512fe3bad/content; "Digital Transformation," CIGAR Accelerator on Digital Transformation, accessed December 16, 2024.

Regional and international collaboration is also crucial, as it enables knowledge sharing and the scaling of solutions tailored to Africa's diverse agricultural contexts. Equipping young people and women with digital skills fosters entrepreneurship and creates new job opportunities, addressing social inequalities and boosting rural economies. Initiatives in this space include the GIZ Digital Transition Center program,[33] which, in collaboration with the public and private sectors, research, and academia, works with several African governments to foster the digitalization of micro, small, and medium enterprises, including agribusiness, and improve the innovation ecosystem. This approach creates jobs for youth and benefits economies. Several youth-led initiatives also use digital technologies to promote entrepreneurial skills, create employment opportunities, provide loans for startups, and help create market linkages.[34]

Investing in 4IR infrastructure is crucial for transforming African agriculture. 4IR innovations can enhance agriculture in several ways — enhancing the productivity of seed and soil, putting food on the table, providing opportunities for marketing and financing, developing innovations, building infrastructure and networks, and informing policy-making.

With these strategies, Africa's agricultural sector can harness 4IR technologies to address urgent food security challenges, driving sustainable development and resilience in agri-food systems across the continent.

33 "Digital Tranformation Center Nigeria," DTC Nigeria, accessed December 16, 2024, https://dtcnigeria.ng/.

34 "I-Youth Project – Agribusiness Trainings | Gender Inclusion | Decent Employment | Youth Inclusion | Agric-Clubs | Mindset Change," I-Youth, accessed December 16, 2024, https://iyouth.iita.org/.

# Prospects for climate adaptation finance for Africa: A glass less than half full

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Financing for climate adaptation action in Africa needs to increase seven to eightfold. Climate adaptation finance flows in Africa, according to the State and Trends in Adaptation 2023 report from the Global Center for Adaptation (GCA), reached only $11 billion annually in 2019-2020, and $13.9 billion in 2021-2022.[1] Africa may need more than $100 billion per year for adaptation.[2]

The end of 2024 brought some positive news and prospects regarding possible increases to climate adaptation finance for Africa: The commitment to triple climate finance at COP29 in Baku,[3] and the announcement to replenish the funds of the World Bank's International Development Association (IDA) to $100 billion, are encouraging signs.[4] Unfortunately, when these numbers are looked at more closely, it is clear that they will not close the gap for climate adaptation action in Africa.

The agreement to increase climate finance at the COP29 meeting (the New Collective Quantified Goal on Climate Finance) was a welcome step forward, though not without controversy. This agreement sets a goal for developed countries to mobilize at least $300 billion per year by 2035 for developing countries' climate action from a wide variety of sources—public and private, bilateral and multilateral—and for both mitigation and adaptation.[5]

**The agreement to increase climate finance at the COP29 meeting ... was a welcome step forward, though not without controversy.**

Many stakeholders were dissatisfied with this agreement for four reasons. First, the developing countries were looking for much higher levels of commitment, well beyond $1 trillion per year, based on the rapidly growing adaptation needs estimates.[6] The agreement has only one concrete action item ensuring an increase in climate financing, called the Baku to Belem Roadmap to 1.3T initiative, although a specific number or method

1 "Landscape of Climate Finance in Africa 2024" (Climate Policy Initiative, 2024), https://www.climatepolicyinitiative.org/publication/landscape-of-climate-finance-in-africa-2024/.

2 Dharshan Wignarajah et al., "State and Trends in Adaptation Report 2023," (Rotterdam and Abidjian: Global Center on Adaptation, 2022), https://gca.org/reports/sta23/.

3 "COP29 UN Climate Conference Agrees to Triple Finance to Developing Countries, Protecting Lives and Livelihoods," UN Climate Change, November 24, 2024, https://unfccc.int/news/cop29-un-climate-conference-agrees-to-triple-finance-to-developing-countries-protecting-lives-and.

4 "World Bank Group Announces Record $100 Billion IDA Replenishment," *World Bank*, December 5, 2024, https://www.worldbank.org/en/news/press-release/2024/12/05/donors-and-world-bank-group-boost-IDA-development.

5 "COP29 UN Climate Conference Agrees to Triple Finance to Developing Countries, Protecting Lives and Livelihoods | UNFCCC," United Nations, November 24, 2024, https://unfccc.int/news/cop29-un-climate-conference-agrees-to-triple-finance-to-developing-countries-protecting-lives-and.

6 "G77, China Rejects Framework for Draft Text on New Climate Finance Goal," *The Economic Times*, November 12, 2024, https://economictimes.indiatimes.com/news/international/world-news/g77-china-rejects-framework-for-draft-text-on-new-climate-finance-goal/articleshow/115226352.cms?from=mdr.

for upscaling was not finalized.[7] Second, the developed countries had hoped to bring into the contribution commitment some of the high-middle-income economies, such as China.[8] The final agreement only encourages them to make contributions, including through South-South cooperation, on a voluntary basis. Third, the developing countries were hoping for an increase and a clear target in grant funding, especially for adaptation.[9] Fourth, the agreement recognizes the need to dramatically scale up adaptation finance, but it does not set a target for the allocation between mitigation and adaptation. The latest calculations on global climate finance show that adaptation receives around 5% of total climate finance flows ($76 billion out of $1.5 trillion).[10]

While the COP29 commitment promises to triple climate finance flows, it will be disbursed over 10 years. Unless the percentage of climate finance directed to adaptation and the portion of climate finance that comes to Africa are substantially scaled up, the $300 billion target of COP29 will be insufficient. The glass is less than half full.

Climate impacts and debt are compounding the burden on Africa. According to the African Development Bank, Africa will spend $163 billion on debt service payments in 2024, far exceeding the $61 billion spent in 2010.[11] This is a substantial weight on Africa's prospects for development. While Africa's historical and current contributions to greenhouse gas emissions have been very small, receiving any adaptation financing requires paying back loans with interest. More than half of the adaptation finance flows are channeled through debt.[12] The grant component for adaptation actions in important sectors for Africa's growth, like energy and transport, is as low as 15%.[13] Even for adaptation in agriculture, the grant component is only about half.[14] Africa needs more grants for climate adaptation action.

Positive news from the World Bank was recently announced with their agreement to the largest yet replenishment of IDA funds. Total donor commitments for the upcoming three-year cycle reached $24 billion that will generate about $100 billion, an increase of about $7 billion over the last IDA cycle. This is important and welcome news as the majority of the IDA resources go through Africa, and globally, 44% of their lending goes toward climate finance, with a goal of parity between mitigation and adaptation.[15] Multilateral development financial institutions provide about 53% of climate adaptation finance to

7 "Summary Report 11–22 November 2024," UN Climate Change Conference Baku (Baku, Azerbaijan: IISD, November 2024), http://enb.iisd.org/baku-un-climate-change-conference-cop29-summary.

8 Christina Lu, "What the COP29 Climate Finance Deal Means for the World," *Foreign Policy*, November 24, 2024, https://foreignpolicy.com/2024/11/25/cop29-climate-finance-outcome-china/.

9 "G77, China Rejects Framework for Draft Text on New Climate Finance Goal."

10 Baysa Naran et. al., "Global Landscape of Climate Finance 2024: Insights for COP29" (Climate Policy Initiative, October 2024), https://www.climatepolicyinitiative.org/wp-content/uploads/2024/10/Global-Landscape-of-Climate-Finance-2024.pdf.

11 "Annual Meetings 2024: Old Debt Resolution for African Countries – the Cornerstone of Reforming the Global Financial Architecture," *African Development Bank*, May 15, 2024, https://www.afdb.org/en/news-and-events/annual-meetings-2024-old-debt-resolution-african-countries-cornerstone-reforming-global-financial-architecture-70791.

12 "State and Trends in Adaptation 2023."

13 "State and Trends in Adaptation 2023."

14 "State and Trends in Adaptation 2023."

15 "Statement on Climate Finance Accounting," *World Bank*, November 19, 2024, https://www.worldbank.org/en/news/statement/2024/11/19/statement-on-climate-finance-accounting.

Africa.[16] The increase in IDA resources will certainly help, but the magnitude of the climate crisis requires even more resources.

What can Africa do? First, more financial resources require better institutions, planning, and execution of adaptation programs. According to the Global Center on Adaptation, only seven African countries have all the key strategic and planning elements to absorb larger adaptation finance.[17] There are important opportunities to learn and replicate lessons from these countries across the region. Second, the private sector in Africa is not yet engaged in adaptation actions. Nations, communities, and businesses need a vibrant ecosystem of enterprises that provide adaptation solutions, goods, and services to strengthen their resilience to climate shocks. Third, African countries should see adaptation not as a sunk cost but as an economic opportunity. With benefit-to-cost ratios of 4:1 and beyond for adaptation investments, the gap in adaptation finance for the region will imply foregone economic benefits due to missed adaptation investments of as much as $6 trillion by 2035 in Africa.[18] The region cannot afford to miss this opportunity.

16 "State and Trends in Adaptation 2023."

17 "Strategy and Planning to Redouble Adaptation in Africa: A Review - Conference Version" (Rotterdam, Abidjan and Nairobi: Global Center on Adaptation, 2023), https://gca.org/reports/strategy-and-planning-to-redouble-adaptation-in-africa-a-review/.

18 "State and Trends in Adaptation 2023."