AI Hub

for Sustainable Development

Strengthening Local AI Ecosystems through Collective Action

The G7 Leaders' Summit in June 2024 welcomed the Italian Presidency's decision to establish the AI Hub for Sustainable Development, in collaboration with UNDP.

As affirmed in the G7 Leaders' Declaration, the AI Hub aims to enable multi-stakeholder partnerships to support local AI digital ecosystems, strengthen capacities to advance AI for sustainable development, and complement existing initiatives including the AI for Development Donors Partnership.

This is the first public report on the co-design of the AI Hub. It lays out initial suggestions and consolidated feedback from local AI ecosystems to understand opportunities and enhance ongoing AI development initiatives underway.

LEAD ORGANIZATIONS
Italian G7 Presidency
United Nations Development Programme

RESEARCH PARTNER
Aapti Institute

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Executive Summary

Driven by a youthful population, dynamic tech ecosystems, and increasing connectivity, there is an enormous potential to develop and scale local solutions tailored to African contexts.

Africa is at the threshold of a powerful Artificial Intelligence (AI) revolution. Driven by a youthful population, dynamic tech ecosystems, and increasing connectivity, there is an enormous potential to develop and scale local solutions tailored to African contexts. To realize this potential for inclusive economic growth, collaborative effort is needed to propel responsible AI development across the continent.

The G7 Leaders' Summit in June 2024 welcomed the Italian Presidency's decision to establish the AI Hub for Sustainable Development, in collaboration with UNDP. This report envisions the creation of the AI Hub as a central platform to empower innovators, bridge the digital divide, and unlock the transformative power of AI for emerging economies, particularly in Africa. The ambitions set forth respond and align with the needs and aspirations that were articulated during consultations across Africa with more than 40 stakeholders.

In addition, the vision of the AI Hub aligns with the G7 Italian Presidency through the Italy-Mattei Plan and the need for investing in Africa's technological evolution, with **Algeria, Côte d'Ivoire, Egypt, Ethiopia, Kenya, Morocco, Mozambique, the Republic of the Congo, and Tunisia** identified as priority countries.

The content of the report is structured as follows:

SECTION 1

1.1 What is the AI hub articulates the aim of the AI Hub to become a nodal point for businesses, academia, and governments to collaborate and leverage the power of AI to achieve the sustainable development goals (SDGs) in Africa, while prioritizing the interests of local communities.

1.2 Growing together: The need for the AI Hub draws attention to the factors determining the success of AI in Africa. It highlights

that AI initiatives hinge on collective action among different stakeholders, where a unified approach is required to shape the three pillars of AI development, namely data, compute and talent. It also observes that risks abound in the absence of collective action, potentially limiting AI's potential and sustainability.

1.3 The focus of the AI Hub 2024-2025: The GROW Approach explains why this approach is crucial to imagine pathways for creating exponential impact through AI initiatives. It creates impact by *guiding* research, *renewing* private sector participation, *orchestrating* the exchange of talent, and *weaving* shared public goods to accelerate innovation.

SECTION 2

2.0 Research: AI Pillars for Development offers a deep dive into each pillar — data, compute, and talent — and demonstrates how the GROW approach can aid in bolstering the existing infrastructure and networks, while also identifying and addressing their gaps.

2.1 Data explains how data pipelines ensure representation and resilience in AI systems, allowing for responsible and context-relevant AI innovation. The AI Hub proposes the GROW framework to tackle data challenges in Africa, emphasizing upon strategies like public-private partnerships to increase data quality and accessibility, data standardization and regulation, collaboration between sectors, investments towards building local capacities, and leveraging digital public goods, such as open data initiatives.

2.2 Compute refers to the vast physical and digital infrastructure that supports scalability and performance of AI applications. Through the GROW approach, the AI Hub suggests shifting the compute paradigm to bring down the cost of computation across countries and increase access, without which innovative and relevant AI applications are not possible. By fostering strategic collaborations, advocating for alternative computing, attracting investments, and encouraging secure open data policies to level the playing field and bridge digital divides, the AI Hub will ensure responsible and sustainable computing infrastructure for AI development.

2.3 Talent develops the cross-cutting pillar of talent development that is crucial to building a robust AI ecosystem. The AI Hub's GROW approach recommends mainstreaming AI education and research, building networks of talent, addressing skill gaps through work-integrated learning, improving upon both technical and soft skills, and increasing investments in talent development, and models of collaborations between industry and academia to support AI innovation and entrepreneurship.

SECTION 3

Looking Forward discusses how fostering an inclusive, well-resourced, and collaborative AI ecosystem moving forward can harness Africa's potential while promoting sustainable development. It underscores the potential of AI Hub as a kickstarter of a larger drive to build a collective, inclusive, responsible, and holistic avenue towards AI development in Africa.

SECTION 1

Introducing the AI Hub for Sustainable Development

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SECTION 1

Introducing the AI Hub for Sustainable Development

Artificial Intelligence (AI) is expected to contribute US$15.7 trillion to the global economy by 2030.[1] The use of AI can enhance productivity of existing processes, augment the use of labour, and drive development in a sustainable manner where present needs are met while empowering future generations to meet their own needs.[2] AI also has the potential to transform sustainable development, by improving the reach and effectiveness of projects and programmes, enabling the collection and processing of large amounts of data to generate actionable insights, and shortening the feedback loop between monitoring and implementation.[3]

However, this promise also comes with risks such as entrenched bias, a lack of legitimate institutions with clear guidelines, remits and expertise regarding the use of AI, and crucially, the risk of uneven distribution of AI systems. With AI making its mark upon the continent, there are concerns around inequality, vendor lock-ins, and growing digital divides that could hamper its sustained evolution. These issues need to be addressed through collective touchpoints and focused programmes, where responsible private sector innovation and partnerships, both global and local, can significantly influence the trajectory of AI for sustainable development.

The stakes here are high. The opportunities are profound.

1.1 What is the AI Hub?

The AI Hub for Sustainable Development aims to be a multi-stakeholder initiative that can steer private sector collective action across AI ecosystems within African countries to accelerate sustainable development. In addition to augmenting existing G7 initiatives[4] that support local AI ecosystems, the AI Hub will

The AI Hub will empower African countries to fully harness the transformative power and potential of AI through collective action.

transcend the mandate of accelerating sustainable development. By working directly with local AI stakeholders across countries and ensuring the AI revolution leaves no one behind, the AI Hub will empower African countries to fully harness the transformative power and potential of AI.[5]

The AI Hub for Sustainable Development aims to strengthen local AI ecosystems within African countries, and accelerate responsible private sector innovation and partnerships in the core foundations underpinning AI's potential for sustainable development (data pipelines, computational power and talent). The AI Hub will operate in tandem with governments and local ecosystems to ensure close collaboration with partners working on AI governance and its applications locally.

The AI Hub is designed to support paradigm shifts in the African landscape. It will coordinate collaboration between investments and innovation from the private sector, as well as the direction and governance from government and civil society to achieve sustainable development in Africa. **Driving investment to this area is straightforward — for every private sector enhancement of AI capabilities in local ecosystems, there must be equal coordination and collaboration in the research and development of systems to mitigate any possible harms.**

The AI Hub for Sustainable Development is being codesigned by the Italian G7 Presidency and the United Nations Development Programme (UNDP), the largest development agency within the United Nations, working in 173 countries and territories to achieve Sustainable Development Goals (SDGs). The AI Hub is aligned with the vision of the African Union (AU) and anchored in the development agendas of its member countries. The AI Hub aims to contribute to several sectors, including energy, agriculture, health, water, education and training, and infrastructure.

As the G7 Presidency gears up to strengthen the 'Digital Development: Growing Together', agenda – a core priority of the G7 in 2024 with a focus on Africa – a new era of collective action has become possible. The AI Hub highlights Italy's commitment to a partnership-based approach to collaborating with African nations and aims to foster equal cooperation and mutual benefits. To

support the broader industry and AI development agenda, the AI Hub will be steered by:

a. **A multistakeholder advisory board:** An advisory body with representatives from across the ecosystem, such as policy, academia and civil society players, as well as political and innovation leaders in Africa. Subcommittees representing these various stakeholders will amplify people's voices, allowing them to guide AI Hub interventions towards African priorities, needs and values.

b. **Private sector actors:** An agile structure for collective action driven by collaboration with global and local private sector entities that can drive innovation in data pipelines, computational power and talent within the African continent. Private sector entities will work closely with the advisory board to align on opportunities.

The AI Hub will work to bring together different private sector efforts into a unified approach, through collective action and collaboration.

This steering structure allows the AI Hub to draw from both the needs and expertise of the African ecosystem, as well as the value proposition of the private sector — regionally in Africa, and globally. The AI Hub will maintain a holistic view to ensure that it delivers on the theme of 'Digital Development: Growing Together' as outlined by the Italian G7 Presidency, and will strengthen industry partnerships focused on impact in local AI ecosystems in Africa. The AI Hub will work to bring together different private sector efforts into a unified approach, through collective action and collaboration. More significantly, the AI Hub will be informed by the perspectives of different stakeholders, including academia, civil society organizations and public institutions, ensuring that the development and deployment of AI systems in Africa are equitable, responsible, inclusive, and accountable.

1.2 Growing together: The need for the AI Hub

The African continent is teeming with youthful energy and untapped potential. With 60 percent of Africans under the age of 25, it has the world's youngest population.[6] Introducing AI into African education, technology, and entrepreneurship spaces will support African youth to implement AI technologies to drive sustainable development. The

continent's steep trajectory towards technological innovation could allow its AI economy to grow significantly — potentially making Africa a leading player in the global AI ecosystem.[7]

The continent is not starting from scratch. This continent, which will soon house one in five of the world's consumers,[8] is proving to be a compelling opportunity for investments by technology stakeholders across the globe. For instance, Google plans on investing US$1 billion in Africa to aid its digital transformation.[9] Microsoft, being committed to responsible AI, has invested in African AI endeavours, particularly in the space of climate solutions, through its AI for Good initiative.[10] Additionally, in 2021, 640 tech startups in Africa raised US$5.2 billion — a 92 percent increase in growth year on year — making tech innovation in Africa the fastest-growing ecosystem in terms of venture capital.[11] Because of such immense technological progress, several African countries have made headway in employing AI-driven innovations to address developmental challenges in agriculture, financial services, climate, education, and healthcare, surpassing other Global Majority countries in terms of meeting the SDGs.[12]

These opportunities and challenges are recognized by the G7,[13] with AI emerging as a powerful driving force for job creation, economic growth, and social inclusion.[14] The growing accessibility of AI is not only shaping new opportunities for individuals, communities and countries, but is also extending the reach and effectiveness of public services.[15] It has improved decision-making across countries,[16] optimized resource allocation within global supply chains,[17] enhanced capacities towards long-term planning,[18] and bolstered disaster response efforts.[19]

This shared direction can have real impact. AI's far-reaching potential can boost socioeconomic development of marginalized communities. In conjunction with bridging the digital divide, AI development in Africa can diversify global participation in exploring and implementing frontier technologies. This innovation can generate opportunities for employment and upskilling and will empower African stakeholders with greater agency to tap into global markets and develop locally-relevant solutions to pressing challenges and priorities.

There is a need for an integrated private sector approach to foster innovation and partnerships in data, compute, and talent pipelines — the three critical pillars underpinning the AI ecosystem. Without concerted and coordinated collective action to mitigate risks, the transformative power of AI may not be fully realized. Additionally, the persistence of foundational challenges across the AI value chain can lead to AI initiatives and systems that harm people and planet, or fail to scale.

Extensive research and engagement across the African continent illuminates the importance of interlinkages within the three pillars of data, compute and talent. These interdependencies create feedback loops and cascading effects, determining a country's capacity to steward and leverage AI systems for sustainable development. If robust, the three pillars can steer a country's AI priorities towards promising and productive goals that put people and planet at the centre. In contrast, a fragmented AI landscape can exacerbate structural inequalities in local ecosystems, further constraining AI's potential for sustainable development.

1.3 The focus of the AI Hub 2024–2025: The GROW approach

With the G7 priority of 'Digital Development: Growing Together', the AI Hub will create impact through a four-pronged 'GROW' approach: *Guide, Renew, Orchestrate* and *Weave*. The GROW approach is designed to create a unified approach towards developing a pioneering African AI system.

GUIDE

Research and advocacy to shape private sector-led collaboration to develop solutions that advance progress towards the SDGs across Africa

RENEW

Create **private sector cooperation** and innovation in critical resources that developing countries need — data pipelines, computing and talent — to forge sustainable development solutions

ORCHESTRATE

Talent exchange and start-up accelerators to drive the research and implementation of new use cases

WEAVE

Foster **shared public goods** to enhance transparency and accelerate innovation, driven by private players across various sectors

Vision Impact of the AI Hub

IMPACT

Responsible innovations with the private sector to steer and leverage AI for Sustainable Development in local ecosystems

LONG-TERM OUTCOMES

GUIDE

Shape private sector-led collaborations through research and advocacy towards meeting SDGs

RENEW

Create private sector cooperation and innovations in critical resources in 3 AI pillars

ORCHESTRATE

Promote talent exchange and start-up accelerators to drive research and implementation of AI uses

WEAVE

Foster shared public goods to enhance transparency and accelerate innovation from private players

CRITICAL RESOURCES: PILLARS FOR COLLABORATION

DATA

Building data pipelines that put people's privacy first

COMPUTE

Creating compute affordability and accessibility

TALENT

Accelerating capacities of people, startups and businesses

ECOSYSTEM

Enabling environment to catalyse private sector while ensuring accountability

PARTNER COUNTRIES 2024-2025

Algeria | Egypt | Ethiopia | Ivory Coast | Kenya | Morocco | Mozambique
The Republic of the Congo | Tunisia

By employing the GROW approach, the AI Hub will:

- **Harness** the power of global AI systems and ecosystems by stewarding responsible innovations and partnerships to solve Africa's unique challenges and opportunities;
- **Foster** cross-country, cross-sectoral, multi-stakeholder collaboration between the private sector, government, academia, industry and civil society to co-create and scale inclusive and innovative AI solutions, share best practices, and build local capacity; and
- **Promote** responsible AI deployment and innovation, thereby mitigating risks and ensuring sustainable growth across sectors.

The four-pronged GROW approach will focus on the nine priority countries of the Mattei Plan[20]: Algeria, Côte d'Ivoire, Egypt, Ethiopia, Kenya, Morocco, Mozambique, the Republic of the Congo, and Tunisia. This provides an opportunity to identify demands emerging from developing contexts, while attempting to make local AI ecosystems more equitable. The approach seeks to speak to and amplify existing regional priorities outlined in Africa-focused policy frameworks — such as the African Development Bank's High 5 Framework — to ensure a sensitive and inclusive path towards achieving SDGs.[21] The *table* on the next page illustrate the possible ways in which the AI Hub can contribute to the current infrastructure and good governance of local AI systems in these countries.

While focus countries may evolve and shift, exploring their AI infrastructure through this report represents an opportunity to understand African challenges. The table offers a high-level snapshot of trends in the respective countries' AI infrastructure. It is important to note that in-depth research is required to gain a deeper understanding of each country's context. A needs assessment to carefully gauge gaps in their respective AI ecosystems is especially necessary. Continuous engagement with AI experts from these countries will help illuminate particularities with countries and guide the processes of the AI Hub in the next phase of the co-design.

GROW in action (1/3)

KEY: COUNTRY • Situation • Action

	GUIDE	RENEW	ORCHESTRATE	WEAVE
ALGERIA	Algeria, through its National Artificial Intelligence Strategy 2020-2030, is poised to improve Algerian talent in AI through education, training, and research.[22] The AI Hub can encourage private sector-focused research, working with the Government of Algeria and industry to identify responsible innovation opportunities towards achieving the SDGs.	The Algerian compute and data pipelines are still nascent, with additional boost needed to augment local players' expanding operations.[23] The AI Hub can support private sector partnerships to enhance responsible local innovation.	While data protection in Algeria is robust, new use cases can benefit underserved communities including cross-border communities.[24] The AI Hub can enable accelerator programmes for Algerian and regional start-ups.	Algeria is increasing its AI influence by hosting international conferences and events, such as the African Startup Conference, inviting investments.[25] The AI Hub can catalyse emerging global public goods such as open-source software, open data, and open AI models — creating a thriving and robust Algerian AI ecosystem.
THE REPUBLIC OF THE CONGO	By introducing Vision Congo Digital 2025 (a national strategy for digital transformation), the United Nations Educational, Scientific and Cultural Organization (UNESCO) is helping the country's legal stakeholders to gain a better understanding of AI and its risks.[26] The AI Hub can help demonstrate AI's potential within a rights-based and inclusive innovation ecosystem.	With financial support from the African Development Bank, the government of the Republic of the Congo has launched its first Tier III data centre, complete with a cybersecurity centre and a back-up data centre.[27] The AI Hub can enable both internal and external stakeholders to prioritize building a digital economy while encouraging responsible development, safeguarding privacy, and addressing potential risks.	Tunisian telecom giant Phone Control is in contact with the government of the Republic of the Congo to launch a startup incubator for AI.[28] The AI Hub can leverage private player participation across sectors to provide resources and foster diverse networks.	The United Nations Economic Commission for Africa (UNECA), Smart Africa, and the Government of the Republic of the Congo launched the African Research Centre on Artificial Intelligence in Brazzaville.[29] The AI Hub can be a game-changer for innovators, creating the opportunity to elevate their services and champion AI education and skills training programmes and platforms.
CÔTE D'IVOIRE	The National Development Strategy 2021–2025 under the E-Government Strengthening Support Project (PARAE) in partnership with the African Development Bank is making the Ivorian government AI-ready.[30] The AI Hub, with private partnerships, can directly contribute to all of the Strategy's priority areas of digital infrastructure, digital services, digital financial services, digital skills, digital business environment, innovation, and digital confidence — paving the way for developing solutions for achieving SDGs in Africa.	Côte d'Ivoire, in collaboration with the regulatory body ARTCI,[31] requires pre approval for data processing outside the Economic Community of West African States (ECOWAS) region. The AI Hub can partner with relevant stakeholders to ensure that AI development in Côte d'Ivoire aligns with freedoms of the privacy protections of the country's users, which can foster innovation in critical resources that developing countries need.	The Ivorian data centre market is nascent but growing, for instance, US firm Cybastion is investing US$60 million to construct a Tier-III national data centre.[32] The AI Hub can assist the Ivorian data centre market by opening doors to more investment, while also helping it explore cloud and edge computing (which has the potential to act as an accelerator for start-ups in the region).	To build its talent, Côte d'Ivoire is benefiting from programmes of multilaterals and global players, such as UNIDO,[33] Smart Africa,[34] and Google.[35] The AI Hub can boost Côte d'Ivoire's endeavours to seek external interventions to build indigenous AI capacities and accelerate innovation across sectors.

GROW in action (2/3)

KEY: **COUNTRY** • Situation • Action

	GUIDE	RENEW	ORCHESTRATE	WEAVE
EGYPT	The National Council for Artificial Intelligence (NCAI), established in 2019, has developed the National AI Strategy to develop a whole-of-government approach to AI development.[36] The AI Hub, with private sector actors, can act as an implementation partnes to ensure the National AI Strategy aligns with Egypt's development goals.	The Egyptian Charter on Responsible AI has created guidelines and best practices to mitigate existing AI risks in the country.[37] The AI Hub can help the country carry out its strategies towards responsible AI. Developing solutions in data, compute and talent can help forge sustainable development solutions.	The rising need of data for AI systems is complemented with the development of a local data centre industry whose revenue is projected to grow by 8.39% resulting in market volume of US$369.9 million in 2028.[38] The AI Hub can facilitate strategies to improve Egyptian computing infrastructure through colocation services and green technology through partnerships.	Egypt is strengthening its innovation ecosystem by investing in centres of excellence, for instance between 2019–2020, the state inaugurated seven AI faculties and announced plans for 10 more.[39] The AI Hub can build on the vibrant AI ecosystem in the country to increase collaboration between educational and capacity-building institutions and private enterprises.
ETHIOPIA	The Digital Ethiopia 2025 initiative plans to build an inclusive digital economy by bringing together government, private sector and development actors.[40] The AI Hub, through research and advocacy, can broaden the initiative's scope by fostering cross-sector collaboration and innovation of the private sector towards meeting the SDGs.	Ethiopia is experiencing a growing demand for skilled professionals in fields such as cloud computing, programming, data analysis, and software engineering.[41] The AI Hub can improve technical and vocational education through collaboration with the private sector to develop a dedicated future AI workforce focused on addressing Ethiopia's pressing issues.	To bridge the demand for computing infrastructure, some progress is being made, for instance, the Ethiopian Education and Research Network (EthERNet) unveiled a state of the art High-Performance Computing (HPC) facility in 2019.[42] The AI Hub can help advance infrastructure to attract investments in data centres and cloud computing services which can act as a stimulant for a thriving start-up ecosystem.	The Ethiopian Ministry of Health has partnered with the Bill and Melinda Gates Foundation to create the Data Use Partnership to improve collection of data for AI use cases in healthcare.[43] The AI Hub can expand partnerships with the global technology stakeholders to create public goods that improve the quality and quantity of the data for relevant AI systems, thereby improving transparency and innovation.
KENYA	In 2019, the Government of Kenya implemented the Data Protection Act, which provides a comprehensive structure for gathering, utilization, safekeeping, and sharing of personal data.[44] The AI Hub can supplement Kenya's push towards creating a solid regulatory foundation for advancement of AI innovations.	Kenya requires funding for AI R&D projects, so as to ensure that local talent is retained.[45] The AI Hub can harness strategic private sector collaborations to invigorate Kenya's AI research and talent capacity, inviting indigenous voices to create AI use cases relevant for the Kenyan landscape.	Kenya is trying to promote a collaborative knowledge-sharing AI environment, for example, the mLab East Africa Initiative.[46] The AI Hub can boost Kenyan talent through knowledge sharing environments and sharing relevant resources, such as high-quality data, to develop meaningful AI solutions.	Partnerships with Google and Microsoft are helping Kenya improve its data centre infrastructure[47] and capital is flowing into Kenya's burgeoning startup ecosystem, bolstered by grants like the Mradi Research Grant.[48] The AI Hub can bolster Kenya's innovation environment, allowing local innovators to access shared public goods made available by global opportunities and resources.

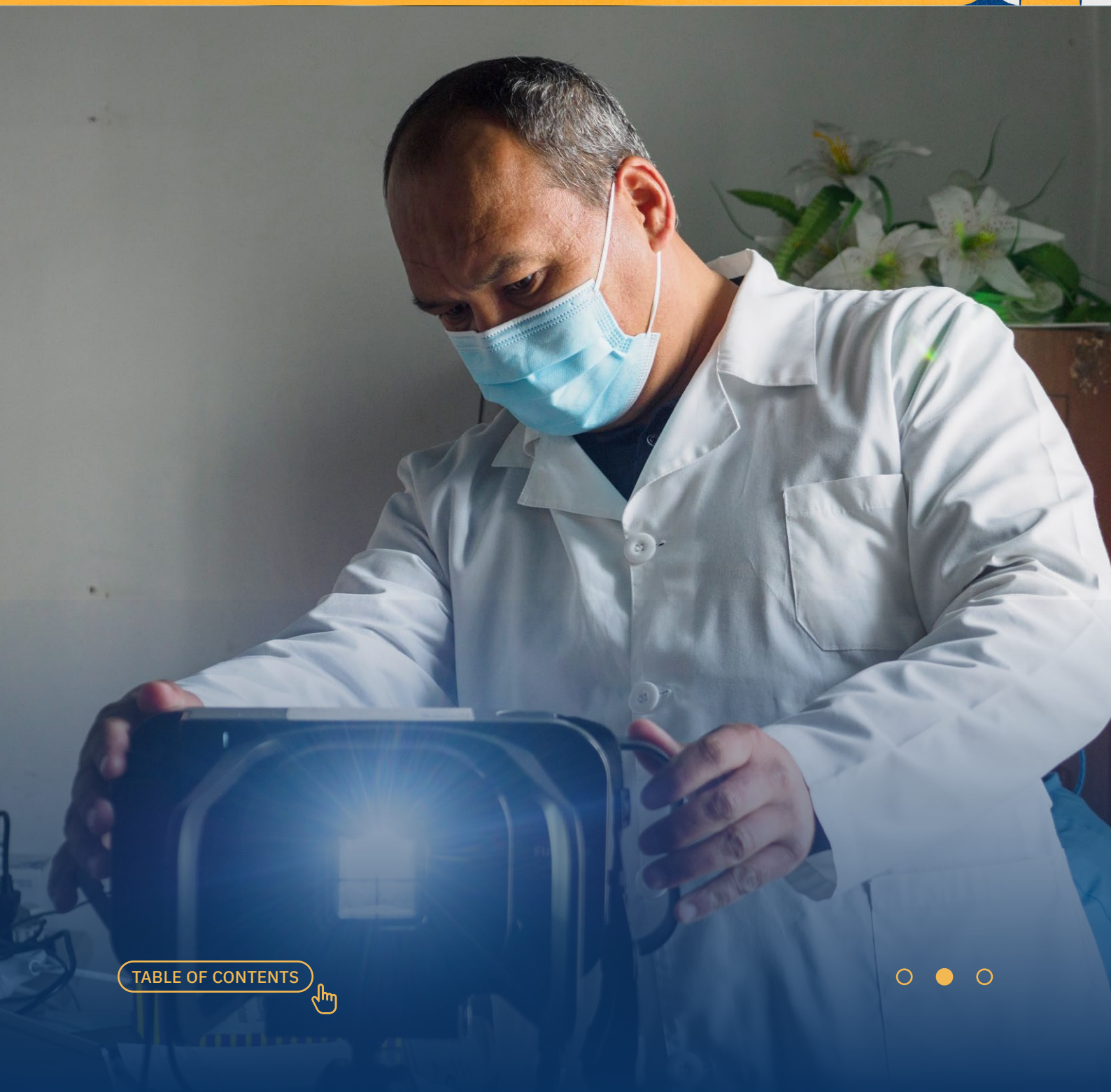
GROW in action (3/3)

KEY: COUNTRY • Situation • Action

	GUIDE	RENEW	ORCHESTRATE	WEAVE
MOROCCO	Recommendation was put forward for the Moroccan AI Strategy to align with the larger goals and framework of the New Development Model (NDM)[49] — a proposed development path with priority areas for sustainable development.[50] The AI Hub can take up these recommendations and provide guidance to steer the proposed National AI Strategy to address the NDM's priority areas of public services, healthcare, education, energy, and agriculture.	Microsoft, as a cloud service provider, is collaborating with the public sector to optimize Moroccan Government ICT spending and maximize its return on investment.[51] The AI Hub can facilitate core public–private partnerships in building critical infrastructure, thereby increasing Morocco's AI use cases for sustainable development.	Although Morocco has national funding capacities, there is a greater need for international funding and participation.[52] The AI Hub can bridge gaps in Moroccan AI infrastructure, making way for investments while putting in place foundations for responsible AI.	The *Haut Commissariat au Plan* (HCP), responsible for collecting, analysing, and disseminating statistical data, aims to provide stakeholders such as policymakers and AI researchers with national-level socioeconomic data.[53] The AI Hub can support the country's push towards its agenda for open data, thereby enhancing its capacity to build powerful and contextual AI models.
MOZAMBIQUE	The Information Society Policy, outlining the vision for Mozambique's digital transformation, focuses on improving computing capacities and encouraging open data.[54] The AI Hub can create the research and good practices to bring relevant public and private stakeholders together to address core digital issues in Mozambique.	Mozambique is growing its computing capacity — in addition to the government-led Maluana Park data centre,[55] entities such as Seacom, Webmasters Lda, Teledata Mozambique, and Eduardo Mondlane University are also contributing to this landscape.[56] The AI Hub can galvanize Mozambique's priorities towards creating a robust ICT infrastructure by bringing in private sector interventions.	Investment from global technology stakeholders is bringing in capacities to improve Mozambique's digital infrastructure. For example, in 2021, Facebook (now Meta) has invested in the 2Africa cable system in north Mozambique.[57] The AI Hub can invite investments from external private entities to augment Mozambique's computing infrastructure.	Mozambique can benefit from an investment in ICT infrastructure and legal frameworks for data regulation.[58] The AI Hub can help provide good practices for ensuring datasets are public goods, including those from the private sector.
TUNISIA	The Elgazala Technopark fosters collaboration between academic, industry and training initiatives, equipping the workforce with the necessary skills.[59] The AI Hub can leverage this initiative to bring in critical global technology stakeholders, thereby revitalizing the country's business landscape.	Tunisia is poised to become a leading AI tech hub in the region, which can be further spurred with increases in funding.[60] The AI Hub can offer research and development resources to aid Tunisia's growing interest in producing indigenous AI capacities.	If AI development is supported, Tunisian IT professionals would create a thriving Tunisian innovation market.[61] The AI Hub can bring in investments to help build adequate infrastructure to match the growing talent, while also offering research grants, incubation programmes, and venture capital funding.	The national Open Government Data initiative provides access to public data to promote transparency, interoperability and support innovation in socioeconomic endeavours.[62] The AI Hub can provide good practices to increase the quality and quantity of shared digital public goods available for creating AI solutions to developmental concerns by encouraging data sharing and combating data scarcity.

SECTION 2

Research: Pillars of AI Development



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Research: Pillars of AI Development

AI can reflect the fullness of human innovation and potential, but it also highlights the collective challenges and ethical dilemmas we face. It embodies the synthesis of vast scientific and creative knowledge, while challenging stakeholders to think deeply about ethics and societal structures. These systems with unparalleled capabilities are not merely automating tasks or solving problems — they are redefining the very perception of knowledge, creativity and agency. The choices made in shaping and deploying AI will fundamentally define the legacy of industrial innovation and progress.

AI is not a monolith. Understanding its impact, potential, and risks requires examining its interconnected components. To develop and implement innovative AI solutions, research suggests breaking down the complex landscape of AI development into three pillars[63]: data, computing power, and talent. These pillars can lay the groundwork for robust digital foundations across Africa, offering opportunities for strengthening and scaling via collaborative and collective action.

Three Pillars of AI Development

	DATA	COMPUTE	TALENT	ECOSYSTEM
Why it is important	High quality datasets make AI initiatives relevant, resilient and innovative	Essential computing infrastructure is key to better development results	AI talent development enhances livelihood and ensures prosperity	Forward-thinking policies, regulations and initiatives empower countries to innovate
What the AI hub can do	Create public databases that accurately represents the population and reduce error and bias	Attract global technology players to invest in and share knowledge to enhance compute infrastructure	Provide training and capacity building resources to build innovation spaces	Ensure AI ethics and innovation by augmenting responsible policies, regulations and initiatives

Figure 2. The three pillars of AI development form the bedrock of the GROW approach.

1. First, **data** pipelines form the bedrock of AI systems,[64] driving outcomes such as representation, robustness and resilience. Leveraging datasets bolstered with local knowledge and languages provides governments and companies opportunities to build AI-driven products and services that speak to context-specific experiences, while adhering to utmost standards of good local governance.

2. Second, on the **compute** front, AI systems rely on vast physical infrastructure (for example, fibre optic cables, telecommunication centres for internet) and digital infrastructure (including cloud computing capacity) to deliver unprecedented processing capabilities.[65] By encouraging countries to invest in foundational infrastructure such as the internet and electricity, as well as to improve sustainability and affordability of compute, they can not only advance their capacity for AI innovation, but also improve their development outcomes and public services.

3. Third, the availability of **talent** for the growing AI landscape can help academic institutions adjust syllabi and train students to meet industry needs.[66] More broadly, there is an opportunity for countries to think critically about skilling as a means to revitalize job creation and employment, especially for countries seeking to escape the 'middle-income trap'.[67] Population-wide efforts to democratize AI technologies in ways that empower people to understand and leverage the potential benefits of such systems, as well as encouraging them to use AI for better lives and livelihoods, is also a crucial priority.[68]

The three-pillar framework helps identify how value is added at each stage and where improvements, interventions, or investments are needed, while emphasizing that each component of AI development is a part of a larger ecosystem.

It highlights interdependencies and allows stakeholders to address challenges and leverage opportunities at each step more effectively. This holistic view is particularly useful for policymakers, businesses, and researchers looking to enhance the efficiency, fairness, and impacts of AI technologies.

An enabling ecosystem: Unbundling AI risks

AI can advance sustainable development in emerging economies, but there are potential risks that can undermine its manifold benefits. Careful deployment of AI, with attendant scaffolding for risk management, is critical.

A vibrant AI ecosystem bridges gaps and bolsters positive trends inherent to the three pillars of data, compute, and talent. Importantly, it bears the onus of mitigating risks in AI, building trust and safety within AI systems, improving digital inclusivity, and upholding human rights and ethics. By doing so, the ecosystem invites greater collective action and investments from global stakeholders, granting the local AI market a competitive advantage. Thus, the successful growth of AI is hinged on building ecosystem-wide efforts that promote effectiveness of AI systems.

Advance AI technology

Transparency and accountability: Frameworks that champion ethical sourcing practices are key towards creating transparent and accountable AI technologies that centre human welfare, safety and justice.[69] Tools like explainable AI (XAI) make it easier to identify and rectify biases or errors.[70] 'Human-in-the-loop' solutions can recommend options for verifying or choosing from provided information. Algorithmic transparency and accountability can prevent misuse of AI outputs, and calibrate AI use cases towards maximum positive impact.[71]

Data integrity: Biases in training data can exacerbate structural discrimination. The AI ecosystem needs to value sensitive data collection of high-quality, unbiased, and representative data. Fairness can be embedded in AI systems through techniques such as counterfactual fairness. Incentivizing such measures can help AI become interoperable and relevant across different scenarios and populations.[72]

Security and privacy: Strengthening the security of AI systems is essential to prevent malicious attacks and ensure user privacy — thereby setting the stage for trustworthy and safe AI. Differential privacy[73] and secure multi-party computation[74] can protect sensitive data.

Foster inclusivity and collaboration

Community involvement and representation: An effective way to combat biases in AI applications is by including the widest range of voices within the global AI community. Inclusion can begin with meaningful and participatory approaches across demographics, empowering them to drive sustainable development through AI applications. Creating a vibrant space for grassroot initiatives in AI entails structuring them into streams and granting opportunities for them to scale up.

AI as digital public goods: Making critical AI assets publicly accessible, while being supported by a strong human rights and governance framework, will not only build digital trust and safety but also

make the AI market more competitive. Normalizing AI as digital public goods with open public sector data and open-source tools will reduce entry barriers and promote AI innovation. Developing common standards on open data, in line with the UN Secretary-General's Roadmap for Digital Cooperation, will guide private sector endeavours and stimulate economic growth, enabling local solutions to contribute directly to the SDGs.[75]

Incentives for public-private-academia collaboration: The collaboration of public and private bodies, business incubators and accelerators, research centres, communities and professionals is the benchmark for a robust AI ecosystem. Global investment pipeline relies on an innovative environment that can facilitate such multi-stakeholder engagement while pushing for advocacy and awareness for digital trust and safety in AI systems.

Just and sustainable computing infrastructure: Policy interventions, both on a local and international level, can allow for efficient and sustainable use of AI infrastructure, while also ensuring financial prudence. For instance, policies directed towards unbundling compute software and hardware to promote competitive markets, building compute-related digital public infrastructure, developing open protocols for cloud compute, and creating regional agreements for sharing and decentralizing computing resources can be explored.[76]

Enhance robust governance

Legislation: To build trustworthy and safe AI, regulatory approaches can uphold ethics, create an innovative business environment, allow for fruitful interactions between different industries and sectors, promote responsibility, and create a robust ecosystem attractive to investments. In particular, a legal framework must consider, in terms of AI systems, the regulation of copyrights and patents, protection of intellectual property, accountability mechanisms, and competition laws.

Soft regulation: Soft regulation can infuse ethics and international best practices in AI development. Governance mechanisms like regulatory sandboxes, strategy frameworks, guidance documents, industry standards, codes of conduct, and certification programmes can ensure a robust and competitive AI infrastructure that is socially, economically, and ecologically sound.[77] Regulation should prioritize a comprehensive approach that integrates AI development within existing national strategies and public services — providing coordination mechanisms, peer-to-peer exchanges, and benchmarking mechanisms.

Independent oversight: Independent AI ethics initiatives can align and direct business interests towards local needs and provide monitoring and evaluation of AI systems. Oversight bodies can offer guidance, conduct audits, and ensure compliance with internationally agreed upon ethical standards and regulations. For instance, the UN Secretary-General launched an Advisory Body to support AI governance, putting forth a set of interim recommendations that are anchored on principles of public interest, data commons, and multistakeholderism.[78]

Collective action is a fundamental driver of the AI Hub. By understanding AI development across three pillars, this report highlights that collaborative efforts across public and private sectors are crucial for every country to leverage the potential of AI. The AI Hub will undertake initiatives to address developmental challenges in sectors such as energy, water, agriculture, health, education, and infrastructure by working with multiple stakeholders and focusing on partnerships, innovations, and knowledge sharing. To illustrate the contributions that the AI Hub could implement, the following sections examine these three pillars, and provide an overview of the challenges and opportunities they pose in the African context. They also communicate how the GROW approach can identify such challenges and find means of addressing them through strategies under Guide, Renew, Orchestrate, and Weave.

The AI Hub's vision is informed by noteworthy initiatives that have contributed to the African AI ecosystem. It acknowledges the impact of existing programmes such as AI4D, Lacuna, GIZ FairForward, and Smart Africa. For instance, Smart Africa's contributions in supporting AI development in Africa for climate action,[79] as well as Lacuna Fund's work on bridging data gaps in Africa,[80] are representative of collective action on the continent. While recognising such important work, the AI Hub seeks to integrate the catalytic role of government, the contributions of the private sector, and the role of local ecosystems to guide its own contributions.

The catalytic role of government

Given that AI value chains rely on fundamental pillars, it is imperative to focus on the role of the state in advancing an enabling environment for AI and broader innovation. In doing so, it is helpful to examine the powerful precedents afforded by governments and multilateral institutions that previously joined forces to ensure equitable access and distribution of critical digital technologies such as the internet[81] and digital public infrastructure,[82] all of which benefited from considerable investment, governance, policymaking, and standard-setting. Thus, the state is best positioned to orchestrate a comprehensive and integrated push towards leveraging AI's potential in meeting SDGs. Building state capacity to understand, use and support private AI innovation is as crucial as providing regulatory guardrails that mitigate AI risks.

The crucial contributions of the private sector to the AI Hub for Sustainable Development

Private companies are heavily investing in AI research and development and driving the innovation and creation of advanced AI solutions. Open-source contributions, such as sharing code, enable the AI community to leverage existing advancements, thereby expediting progress and potentially reducing the emissions generated by compute-intensive programming. Collaboration between private companies and government agencies can speed up the development of AI as a public good. Providing access to HPC power through cloud platforms can democratize AI development for smaller companies and startups.[83] By embracing these opportunities and responsibilities, the private sector can act as a crucial driver of AI advancement.

AI from the ground up: The role of local ecosystems

Local ecosystems, including universities, research institutions, civil society and tech startups are crucial for nurturing AI talent. They offer specialized and lifelong education, facilitate collaboration between academia and industry, and foster an environment for inclusive innovation and safe-and-secure experimentation in AI.[84] These ecosystems also provide vital resources and infrastructure for AI development, including access to diverse datasets essential for training AI models. They can ensure transparency, fairness, and greater participation of the Global South in AI governance. They can also bring together experts, data providers, and otherwise marginalized stakeholders together to shape AI solutions.[85] Local AI industry associations serve as platforms for collaboration, knowledge sharing, and collective action on policy and ethical considerations, contributing to a responsible, inclusive, and transformative global AI revolution.

2.1 DATA

The term 'data' refers to the raw information or input that is gathered, processed and utilized to train machine learning models and enable AI systems to carry out tasks. The success of OpenAI's GPT-3 model illuminated both the importance of massive datasets, as well as the risks associated with the lack of safeguards in the data ecosystem.[86] It is imperative to understand ethical frameworks around data to ensure effective AI deployment.

To establish data economies that can fuel data-centric technologies and AI in the Global South, there is a need to devise new approaches to data collection, curation, analysis and utilization that are relevant to regions with lower levels of digitization and unique resource contexts. The absence of sufficient infrastructure, resources, and data management protocols are major roadblocks to creating representative datasets in Africa.[87]

Data in Africa

DATA SOURCES

Diverse or specifically suited, on internet, online repositories, public datasets

DATA MODELLING

Simplify complex data to improve accuracy and adaptability

DATA GOVERNANCE

Ensure data quality, integration, security, privacy, risk management, ethics and regulatory compliance

GUIDE

- Advocate for data standardisation to ensure quality, interoperability, and scalability of AI solutions
- Support initiatives dedicated to building a contextual data collection architecture

RENEW

- Encourage cross-sectoral collaboration to push towards secure data sharing
- Build local capacities for data modelling through private investments in infrastructure

ORCHESTRATE

- Convene technology stakeholders to reinvigorate the African data landscape
- Augment current African efforts to increase data accessibility, by forging strategic partnerships with the private sector

WEAVE

- Boost accessibility and availability of high-quality open datasets by crucial private sector collaboration, particularly to meet development needs
- Augment pan-African partnerships to maintain an open data repository
- Support data cooperatives and data stewardship models to empower the African digital public infrastructure

Figure 3. The data ecosystem in Africa: Sources, modelling, and governance

Data sources: AI products and services require diverse and specifically suited data sources, which can be found on the internet, online repositories, and public datasets, through web scraping, APIs, surveys, or partnerships. Recently, the use of synthetic data has increased in contexts with low data availability.[88]

Data modelling: Data modelling organizes, structures and visualizes data to simplify complex data for AI systems, improving accuracy and adaptability. Datasets are essential for training the model, evaluating performance, testing generalizability and improving output quality and accuracy.

Data governance: Data governance involves managing and governing data assets to safeguard people within an ecosystem. It includes processes, policies, standards and technologies to ensure data quality, integration, security, privacy, risk management, ethical standards and regulatory compliance throughout its life cycle.

With promising data foundations on the continent, and important gaps and challenges being addressed, the AI Hub for Sustainable Development could drive important initiatives and accelerate progress in making data work for developing countries.

The GROW approach offers a comprehensive framework for improving the AI data infrastructure in Africa. Its four components address African data challenges such as fragmented data accessibility, emerging data processes, and gaps in shaping comprehensive data governance. By fostering collaboration and innovation between private and public sectors in Africa, the AI Hub aims to drive sustainable AI development across the continent by confronting data gaps head-on.

GUIDE

Increase the quality and quantity of data by leveraging public–private partnerships in data collection

Africa has abundant demographic, health, and economic data but it is often fragmented and not easily accessible.[89] Efforts such as the G20 Data Gaps Initiative (DGI3) are starting to address the issue by making open datasets easily accessible to address issues such as climate change, financial inclusion, and public service delivery.[90]

Due to a lack of comprehensive data collection mechanisms across African countries, many datasets are incomplete.[91] With institutions and agencies collecting data in varied formats, consolidating and analysing this data is made difficult. This is exacerbated by inconsistent internet access, especially in rural areas, which poses a barrier for real-time data collection or the use of cloud-based AI processing.

There is a growing need for a contextual data collection architecture (see below)[92] which will help generate datasets and provide the foundation for developing accurate and relevant AI models in Africa. For example, the grassroots organization Masakhane, which promotes Natural Language Processing (NLP) in African languages embodies African knowledge, equity, and fairness in its data collection processes, with its principle of "Umuntu Ngumuntu Ngabantu". In the Bantu language of IsiZulu, this translates to 'I am because you are', and reflects the Ubuntu philosophy of communitarianism over individualism.[93] Masakhane also demonstrates other principles of Afrocentricity, ownership, multidisciplinarity, kindness, responsibility, openness, sovereignty, reproducibility, and sustainability.[94] Nigerian AI startup, Awarri, is slated to become the country's first government-backed large language model (LLM), a powerful tool with applications in natural language generation (NLG) and beyond.[95]

Strategies

1. **Advocate for data standardization to ensure quality, interoperability, and scalability of AI solutions**: Data standardization is the process of structuring and formatting data in a consistent and uniform manner across different sources and formats. To make sure that an AI system is robust, guidelines and protocols around data standardization need to be in place. Governance mechanisms that call for strengthening data standardization processes can lead to responsible innovations.

2. **Support initiatives dedicated to building a contextual data collection architecture**: A contextual data collection architecture in Africa refers to a framework specifically designed to gather data that is relevant and appropriate for the

unique socio-economic, cultural, and infrastructural contexts of African countries. Initiatives such as Masakhane require support from multiple stakeholders to make their data collection architecture more robust and interoperable. Leveraging local African knowledge and inviting diverse African languages into the fold of global AI development should be a crucial consideration.

RENEW

Bolster the African data pipeline by strengthening the critical physical and governance infrastructure

Investments are a necessary catalyst for strengthening the African capacity to process and analyse large datasets.

Effective and efficient use of computing power is key to creating a sustainable data infrastructure. For instance, high-performing data modelling tasks require substantial computing power. The absence of HPC facilities in Africa presents a challenge for conducting complex data analysis. As such, investments are a necessary catalyst for strengthening the African capacity to process and analyse large datasets.

The bedrock for this data infrastructure is data regulation. Only 36 out of 54 African countries have implemented data protection and privacy regulation.[96] Acknowledging this, in 2022 the AU published its Data Policy Framework.[97] This sets out a shared vision to steer AU member states towards creating adequate national and regional data frameworks, with the aim of unlocking the power of an integrated African data ecosystem through a common approach. African governments must now implement these recommendations by establishing national data policies and leveraging the African Continental Free Trade Area (AfCFTA) Phase III negotiations.[98] This will harmonize data protection frameworks and enable the development of a data-inclusive AfCFTA implementation plan.

It is important to note that data localization could hinder data sharing, a critical component of the AI revolution. Data sharing is a common policy theme, as observed in the case of Algeria, Côte d'Ivoire, and Morocco, where national regulations require certain sectors to store their data locally.[99] Although localization can reinforce data silos and further limit avenues for access and collaboration, sound data protection principles can safeguard both privacy and data sharing. For instance, the national AI strategy in

Kenya includes actionable initiatives towards creating a Data Sharing Framework. While leading the demand for data governance professionals, Kenya is aiming for collaborative cross-industry, public–private partnerships for implementation.[100]

Strategies

1. **Encourage cross-sectoral collaboration to push towards secure data sharing**: Governments across the AU should work with each other and with the private sector to reinforce data policies that engender data sharing while maintaining digital sovereignty and individual privacy. Collaborations with academia and civil society organizations can ensure returns on such investments.

Inviting private sector investments into the data infrastructure can allow for carefully and ethically designed and monitored data models, which can mitigate biases in data and algorithms.

2. **Build local capacities for data modelling through private investments in infrastructure**: Inviting private sector investments into the data infrastructure can allow for carefully and ethically designed and monitored data models, which can mitigate biases in data and algorithms. Private sector interventions can be sought at the level of computing to make data more affordable, and to build local capacities towards data collection, data modelling and data analysis.

ORCHESTRATE

Empower African talent to accelerate AI solutions through critical private sector interventions

African data ecosystems are still emerging, with the private sector playing an important role in this growth. In response to the demand for AI use cases, governments are also shaping open data policies and processes. In areas where data collection is difficult, non-traditional data, such as satellite imagery and metadata from mobile phones, both of which are collected and made available by private entities, is particularly useful.[101] One example is the Open Buildings Project supported by the Google Research Centre in Accra. This project provides open-access datasets based on satellite imagery available to low-income countries across the world. In Africa, the project pinpoints the locations and geometry of buildings — which inform use cases in AI solutions, such as analysing electrification needs, urban planning, and survey sampling.[102]

Although the data ecosystem in Africa is still nascent, research institutions and non-governmental organizations are investing in training programmes to equip field researchers with the best practices for data collection methods and data quality control. Several bootcamps and training programmes are emerging across Africa to provide individuals with data analysis and modelling skills using tools such as Python and R.[103] Private investments can further bolster the ability of African stakeholders to develop a strong data infrastructure across Africa.

Strategies

1. **Convene technology stakeholders to reinvigorate the African data landscape**: The private sector can strengthen African AI solutions by making their resources and datasets available. They can form crucial collaborations with African innovators and institutions to generate AI systems that are capable of addressing pressing development challenges. Accessibility can also be enhanced through non-traditional data sourcing mechanisms. Synthetic data, digital-twin technology and AI experimentation can be important tools to address data scarcity.

2. **Augment current African efforts to increase data accessibility, by forging strategic partnerships with the private sector**: Openly accessible data stimulates economic growth, and encourages businesses to innovate AI solutions that can address key development issues. Strengthening current efforts towards data accessibility can create a wider data ecosystem that can scale up private sector investments. Private sector leaders in Africa, such as established telecom providers, banks and technology companies, may have access to databases of citizen data that could potentially be as extensive as state databases. Thus, collaborations with African private sector leaders will allow for greater data accessibility.

WEAVE

Incorporate digital public goods such as open-source resources to ensure accountability, transparency, and interoperability in the data ecosystem

Even though investments by global technology stakeholders in Africa have spurred AI innovation and provided critical services such as open mapping, weather forecasts and healthcare, concerns still remain about extracting valuable data from African countries without consent or without providing adequate returns.[104] Moreover, if the data collection projects make their datasets proprietary, resource-poor African stakeholders may struggle to gain access to such datasets. Thus, it is important to promote digital public goods — open data, open-source resources, open AI models, open standards and open content — to empower African talent to innovate and progress towards achieving the SDGs.[105]

Due to a dearth of representative datasets, African developers are more likely to rely on AI algorithms developed and trained abroad using data that might not accurately capture the African context.[106] Even when African countries generate data through platforms, their languages lack digital presence. However, to derive value from such data, organizations like Masakhane[107] (that strengthens NLP research in African languages) and Digital Umuganda[108] (that creates open-source datasets, models and tools for NLP) are driving the movement towards improving the quality of publicly accessible African datasets.

Strategies

1. **Boost accessibility and availability of high-quality open datasets by crucial private sector collaboration, particularly to meet development needs**: African countries need to define data as a 'public asset' that is crucial to AI applications, and make actionable attempts to promote data access. As open data promotes transparency, accountability and value creation for local ecosystems, African countries need to invest in initiatives similar to those that create open government data.

2. **Augment pan-African partnerships to maintain an open data repository:** Existing data governance initiatives within Africa must be revamped to comprehensively cover aspects such as

A comprehensive, pan-African data strategy is needed to enable the collection, sharing and analysis of data for AI development.

data quality, privacy, responsible data sharing, compliance, transparency, data localization, cross-border data flows, standards for collection and labour protections for data workers. As such, a comprehensive, pan-African data strategy is needed to enable the collection, sharing and analysis of data for AI development.

3. **Support data cooperatives and data stewardship models to empower the African digital public infrastructure:** According to a recent study,[109] trust, social duty, and understanding the purpose behind the use of personal data significantly predicted a willingness to provide data to AI via participatory data stewardship. Data stewards can play a central role in managing data flows to create more equitable pathways for data sharing and usage by large AI companies. This can foster accountability for creating a responsible AI data ecosystem, and lead to better representation of populations in a world where decisions are becoming more and more data-informed, while also creating an attractive environment for private investments through effective data governance.

CASE STUDY

Natural Language Processing "by Africans for Africans" — Masakhane

With approximately 200 languages spoken across different regions, Africa boasts an impressive linguistic diversity. However, this rich tapestry of languages is not yet adequately represented in the field of Natural Language Processing (NLP). The majority of NLP resources and tools are developed for dominant languages such as English and French, leaving a significant digital language divide that impedes millions of people from accessing vital information, education, and technology.

Masakhane is an open-source initiative founded in 2019 that aims to unite linguists, researchers, and technology enthusiasts across Africa to collaborate on NLP research for African languages. The programme's name, meaning 'We Build Together' in IsiZulu, is reflective of its mission to foster a virtual community that can work towards advancing NLP research for African languages. The collaborative network focuses on various NLP tasks such as:

Machine Translation: Using datasets to create machine translation models that can translate between African languages and languages such as English or French;

Speech Recognition: Promoting data collecting and annotating to improve speech recognition models for African languages; and

Text Analysis: Developing NLP tools for African languages can help overcome language barriers and unlock valuable insights for sentiment analysis, topic modelling, and other NLP tasks.

Masakhane has been making impressive strides in recent times by emphasizing the significance of NLP for African languages. This emphasis has resulted in attracting more researchers and resources to the field. Furthermore, Masakhane has created open-source datasets and tools that enable other collaborators to contribute to NLP development for African languages. In addition, Masakhane has fostered a collaborative environment that allows African researchers to work together and share their knowledge to bridge the digital language gap in Africa. Masakhane is paving the way for a more inclusive and accessible digital future for the continent by empowering local communities to develop NLP tools for their own languages.

2.2 COMPUTE

Compute can be considered as the "stack of hardware such as graphics processing units (GPUs) and central processing units, as well as software that enables the use of specialized chips and supporting infrastructure in data centres (including servers and cooling equipment)".[110] Compute is a critical dimension of AI infrastructure — supporting scalability and performance of AI applications. The emergence of powerful language models with extensive processing capabilities is made possible through substantial investments in computing power for training AI models.[111] Computing power allows stakeholders like students, developers, researchers and start-ups to scale up their AI endeavours. Without compute, AI innovation will be slower and limited in scale. Thus, it is imperative to emphasize on affordable

and accessible compute infrastructure that levels the playing field and ensures responsible AI use towards sustainable development. For instance, it can allow greater economic opportunities to women. Greater compute access can also help build accurate predictions in terms of climate and disaster resilience, allowing for relevant mitigation and adaptation strategies at the local level.

Compute in Africa

COMPUTE ACCESS AND AFFORDABILITY

Decrease cost of computation and increase access for AI use-cases to scale and foster sustainable development

POLICY AND REGULATION

New regulatory incentives to reduce costs and create sustainable access and leverage over critical resources

ACCESS TO FINANCE

New investments in innovative partnerships with and among the private sector

GREEN COMPUTE

Environmental impact created through unmanaged and inefficient use of computing resources must be mitigated

GUIDE

- Advocate for strategies and incentives to increase affordability and access to compute
- Ensure inclusive and sustainable compute infrastructure

RENEW

- Enable High Performance Computing (HPC) in Africa
- Strengthen regulatory incentives to foster private-sector trust in alternative computing options that can reduce costs and empower end users
- Invest in renewable energy for sustainable data centres

ORCHESTRATE

- Accelerate funding for African computing infrastructure
- Develop specialized skills for AI compute economy
- Cultivate talent exchange for AI supply chain efficiency

WEAVE

- Encourage collective action to achieve supercomputing goals
- Promote open data policies for AI development
- Promote open-source community development

Figure 4. From components to connectivity: The computing landscape in Africa

Compute access and affordability: The compute infrastructure requires components such as processors, memory chips and graphic cards as well as critical infrastructure such as fabrication units, data centres, servers and networking equipment for processing and storing data. Essential materials include silicon and rare earth

metals for components such as semiconductors, and conductive materials for wiring. Building and maintaining compute infrastructure entails ensuring the affordability and accessibility of its materials, components, catalytic infrastructure and all supporting resources. Importantly, the compute supply chain must also remain accessible and affordable to all. Thus, a robust compute infrastructure needs to bring down the cost of computation and increase access for AI use-cases to scale and foster sustainable development.

Policy and regulation: An important first measure for governments in today's AI economy is to acknowledge that the supply chain for compute is global, and that strategic collaboration can enable greater access to computing power. On a national level, governments need to take stock of their resources to drive effective compute policies, including driving new investment incentives to explore compute innovations to increase access and affordability. Additionally civil society organizations can advocate for compute accessibility for low-resourced use-cases.

Access to finance: AI companies are spending roughly 80 percent of their raised capital on computing resources, indicating that AI development is closely bound by access to these resources.[112] As AI becomes widespread, the demand for computing power will grow exponentially and inherent inequities and disparities between countries will feed into AI compute divides. Private actors can play a role by investing in building and expanding data centres, cloud infrastructure, and HPC facilities that provide the necessary foundations for AI development.

Green Compute: The demand for AI development and use impacts the energy required for running large-scale computing infrastructure. To put this into perspective, the International Energy Agency (IEA) estimates that if ChatGPT were integrated into the nine billion global web searches conducted daily, world electricity demand would increase by 10 terawatt-hours a year — the amount currently consumed by around 1.5 million European Union residents.[113] Therefore, managing compute use and efficiency is critical through responsible usage for sustainable development.

The GROW approach offers a structured framework for addressing AI development challenges in computing power in Africa.

Through the Guide, Renew, Orchestrate and Weave facets, the approach facilitates an understanding of the African computing landscape and promotes the creation of strategies for effective collaboration to address gaps. By leveraging these facets, stakeholders can analyse existing challenges, develop targeted strategies, and foster collaboration to enhance Africa's computing power for AI development.

GUIDE

Harnessing private sector collaboration to enhance computing resources in African AI ecosystems

Africa requires investment in data infrastructure: broadband networks, supercomputing clusters and graphics-processing units, data centres, servers, and cloud computing optimized for machine learning. This may include exploring new models of compute infrastructure for parts of the African continent, including approaches such as miniaturization to leverage AI components like Large Language Models.

The growing interest in AI has further encouraged stakeholders across the African continent to invest in critical AI infrastructure. Even though sub-Saharan Africa scored the lowest globally on critical AI infrastructure resources, server investment growth in sub-Saharan Africa is about 13 percent higher than the global average.[114] Rwanda's open policies have facilitated the construction of the Kigali Innovation City, allowing a company like Liquid Telecom to invest in a state-of-the-art data centre in Kigali.[115] Additionally, the African Development Bank's Africa Digital Financial Inclusion Facility (ADFI) supports the construction of ICT infrastructure through public–private partnerships.[116] Even though penetration of cloud compute in Africa is still at 15 percent, foreign investors are keenly eyeing the African cloud computing market as internet connectivity and infrastructure to host data centres improves.[117] IBM, Microsoft, and Amazon, with established data centres in Africa, are further investing in expanding their capacity.

Strategies

1. **Advocate for strategies and incentives to increase affordability and access to compute**: The significant long-term capital and skilling investments required to set up on-premise infrastructure demonstrates that cloud computing is proving to be an effective alternative for local AI developers across the private sector, academia, and government.

2. **Ensure inclusive and sustainable compute infrastructure**: The region could empower its mobile-first markets by building research capacity in distributed-edge computing, thereby enhancing participation and inclusion even in remote or underserved areas with limited access to centralized computing resources. Such bandwidth-efficient and scalable computing infrastructure will spur diverse African communities to develop AI innovation that can serve local needs while also providing a sustainable alternative.

RENEW

Mobilize local companies to innovate compute access, sustainability, and affordability

Inherent inequities and disparities between countries are feeding into AI compute divides.

As AI becomes more widespread, the demand for computing power is growing exponentially. Inherent inequities and disparities between countries are feeding into AI compute divides. This is a particularly challenging situation for many African countries with nascent local funding and financing systems, and whose fundraising mechanisms from global venture capital are limited.

Africa plays a key role in supplying the resources required to maintain AI systems. For instance, the continent provides critical natural resources such as silicon and rare earth materials that contribute to the essential raw material components required for semiconductor production. Algeria, Egypt, Morocco and South Africa possess significant deposits of silica sand, while Nigeria has large deposits of rare earth metals. South Africa is emblematic of how critical infrastructure can allow countries to become leaders in AI development. The country has dominated the African data centre landscape due to its geographical location, access to sub-sea cable landing stations, political stability, mature enterprise and

corporate markets. Moreover, in Pretoria, the Microelectronics and Nanotechnology Centre at the Council for Scientific and Industrial Research (CSIR) has set up a research and development (R&D) facility for semiconductor and chip production.[118] Thus, governments need to evaluate their place in the global market and their capacities to participate in the compute supply chain, allowing them to outline pathways to enable access to computing power for their own AI systems.

Strategies

1. **Enable High Performance Computing (HPC) in Africa**: Africa is making strides in recognizing the need to enable access to computing power. This is evident in Rwanda's National Artificial Intelligence Policy,[119] which outlines a roadmap for establishing a continental hyperscale data centre. The initiative aims to provide affordable, reliable, secure, scalable storage and HPC capability.

2. **Strengthen regulatory incentives to foster private-sector trust in alternative computing options that can reduce costs and empower end users**: Strong data protection and privacy regulations also provide a legal framework for safeguarding data stored in data centres. This fosters trust in cloud computing services and encourages investment in alternative computing infrastructure. This will allow the African continent to rely on affordable technologies that allow for greater AI innovation. Such enhanced computing options will empower end users such as universities and start-ups as well as marginalized stakeholders like women and low-income communities.

3. **Invest in renewable energy for sustainable data centres**: As a region that is still in the nascent stages of establishing data centres, early investment in renewable energy sources such as solar or wind power could drive global best practice. Lower carbon emissions for data centres could help to create world-leading standards for efficient energy consumption in compute.[120]

ORCHESTRATE

Enable African talent through partnerships with global stakeholders to develop local and green compute capacities

Private sector investments have proved to be a crucial factor in ensuring the compute landscape evolves in the continent. For instance, Google has established a R&D technology hub in Accra, the Microsoft Africa Development Centre (ADC) has offices in both Nairobi and Lagos, while IBM Research has outposts in Johannesburg and Nairobi. Ghana, in particular, has benefited from Google Research's early investment. The country is now seeing the launch of its most advanced data centre, the Onix Accra 1 — the only Tier-4-accredited facility in West Africa, designed to run on renewable solar energy during the day.[121] Private sector innovation can usher in AI solutions tailored to address the specific needs of the African continent, particularly in sectors such as agriculture, healthcare, or financial inclusion.

The AI Hub for Sustainable Development would prove crucial in uplifting investments and innovation in Africa's computing capacities and affordability. Public–private partnerships can help create specialized skills and talent in compute, by incentivizing major technology companies to move parts of their manufacturing and R&D supply chains to African countries.

Strategies

1. **Accelerate funding for African computing infrastructure**: Investment funds dedicated to financing the construction of computing infrastructure can be supported by public–private partnerships and international development finance institutions.
2. **Develop specialized skills for AI compute economy**: It will be crucial to outline key areas of the compute supply chain where specialized skills will be required, and tailor training to focus on developing the capacity of science, technology, engineering and mathematics (STEM) graduates to contribute to the new AI economy.
3. **Cultivate talent exchange for AI supply chain efficiency**: Specialized skills, such as software engineering or technical

hardware expertise, are needed to support the different processes within the AI compute supply chain. For instance, the EU-ASEAN High-Performance Computing Virtual School (European Union-Association of Southeast Asian Nations) hosted by Thai SC, was launched in 2021 to bring together experts, students, and researchers from Europe and ASEAN member states to share best practices and learn HPC design and programming skills.[122]

WEAVE

Enable a collective path towards a robust AI landscape in Africa by sharing digital public goods

According to a report from the African Data Centres Association and Xalam Analytics,[123] another 1,000 megawatts of power and 700 new facilities are needed to bring the rest of the continent up to speed with South Africa, which currently leads the way in infrastructure on the continent. Poor internet connectivity also restricts the adoption of AI-based services. The high cost of mobile internet data or home-based broadband connections limits the market size and uptake of services.[124] Across Africa, there are critical infrastructure challenges, power needs, and local supply chain shortages of on-premise infrastructure. This varies across regions, leaving some areas more marginalized than others. Thus, computing infrastructure must promote the sharing of digital public goods to ensure last-mile access.

Countries like South Africa and Kenya have benefited from AI use cases as they have fostered an enabling environment. To incentivize innovation, policies should focus on ICT development. For instance, Kenya's ICT Masterplan emphasizes investment in broadband infrastructure, exemplified by the construction of the National Optic Fibre Backbone Infrastructure (NOFBI) to connect underserved areas to high-speed internet.[125] Similarly, Nigeria's National ICT Policy prioritizes the development of data centres and cloud computing services, as seen in the establishment of the Lagos Internet Exchange Point (Lagos-IXP) to improve internet connectivity.[126] National broadband expansion programmes, such as Ghana's National Broadband Strategy[127] and Tanzania's National ICT Broadband Backbone (NICTBB),[128] can help extend high-speed

internet access to underserved areas, facilitating cloud computing adoption and digital transformation.

Strategies

1. **Encourage collective action to achieve supercomputing goals**: Collective action must be taken to bring nations in Africa into the fold of multilateral partnerships — such as the Partnership for Advanced Computing in Europe (PACE) initiative which brings together the supercomputing centres of 15 European countries on a common network to enable efficient use of HPC capabilities.[129] Pan-African initiatives, such as the Programme on Infrastructure Development in Africa (PIDA)[130] can also help to improve regional connectivity and reduce internet transit costs. These can play a crucial role in determining the policy interventions, strategic partnerships and path to financing. Existing computing resources should be mapped. For instance, telecommunications companies in Africa already possess computing infrastructure that can be shared for minimal AI computations.

2. **Promote open data policies for AI development**: By restricting access to alternative decentralized frameworks of computing infrastructure, data localization regulations constrain AI development in Africa. Governments can implement open policies that encourage the construction and operation of data centres by public and private entities. These policies may include tax incentives, streamlined permit processes, and access to government-owned land on which to build data centres.

3. **Promote open-source community development**: Enabling the creation of vibrant open-source communities can invigorate alternative computing systems (such as distributed-edge computing and cloud computing), helping overcome vendor lock-in and tackling barriers arising from closed loop solutions. This can also lead to broader innovation.

State of Compute

Key
- Harware
- Software

	PRE-PRODUCTION		PRODUCTION				APPLICATION		UTILITY
COMPONENT	Undersea Cables	Rare Earth Minerals	Chip Design	Lithography	Fabrication Units	Assembly, Testing, Packaging	Semiconductor Chips	Data Centres	Cloud Compute
FUNCTION	The backbone of global communication, high-capacity fibre optic cables lie on the ocean floor, facilitating the transmission of massive amounts of data across continents.	A collection of 17 metallic elements characterised by distinctive physical and chemical properties. Despite their name, they are not especially scarce, but their concentrated deposits are infrequent.	Chip design is defining the chip's architecture and physical layout of its individual circuits, which enable them to receive, transmit, process, and store data.	The process of shining ultraviolet light through patterned masks: the light then interacts with photoresist chemicals to carve patterns on silicon wafers.	Referred to as fab or foundry, a semiconductor fabrication plant is a manufacturing facility in which raw silicon wafers are turned into chips or integrated circuits (IC).	Assembly, Testing, Packaging (ATP) involves cutting wafers into chips and adding wire connectors to chip frames. It can occur in-house or be outsourced.	Running large-scale AI models requires state-of-the-art (SOTA) chips, for logic, memory and interconnect. These differ in output: Graphics Processing Unit (GPU): for training and storing an AI model Field Programmable Gate Arrays (FPGA): for application of an AI model Application-Specific Integrated Circuits (ASIC): accelerator chips designed for specific use-cases	A facility composed of networked computers, storage systems and computing infrastructure to assemble, process, store and disseminate large amounts of data. Large AI models are trained using a cluster of many chips known as an AI supercomputer. Supercomputers are hosted in data centres, which provide the infrastructure to keep the AI hardware running. Published standards are used for networking communication, and orchestration softwares are used to enable cloud compute.	Cloud computing refers to the delivery of computing services, including servers, storage, databases, and software, over the internet. Cloud computing enables organisations to access computing resources on-demand, helping them access AI capabilities without infrastructural investments. Cloud Service Providers (CSPs) provide infrastructure-as-a-service, but also set up custom marketplaces where any third-party service can be developed.
BARRIER	The deployment of undersea cables can be hindered by the **high capital investmen**t and insufficient infrastructure. Complex regulations may cause delays and complications to undersea cable projects. Moreover, reliance on these cables raises concerns about **potential vulnerabilities to damage or sabotage**. **AT&T**, **Verizon**, and **China Telecom** are major stakeholders in the ownership, operation, and investment in undersea cable infrastructure.	**China dominates the global rare earth metals (REM) market**, controlling about 70% of mining, refining, and processing. However, REM mining creates environmental issues like **radioactive waste and water pollution**. on the REM market has prompted efforts to invest in diversifying the supply chain and exploring alternative sources. **MP Materials (US)**: Focuses on developing a sustainable domestic supply chain in North America. **Lynas Rare Earths (Australia)**: One of the largest producers of Rare Earth oxides outside of China. **Rio Tinto (UK-Australia)**: Mining giant with REM exploration and development projects underway. **Sociedad Minera Cerreño (Peru)**: Owner of largest known deposit of rare earth elements (Bastnasite).	The top three companies—Cadence (American), Synopsys (American), and Mentor Graphics (American but acquired by the German company Siemens in 2017)—**control about 70% of the global EDA market**. There are only three designers of SOTA GPUs: **Intel, AMD, and Nvidia**. Nvidia chips are class leading, with the next-tier companies **at least a year behind in development.**	Dutch manufacturing firm **ASML** is the **only firm capable** of producing the photolithography equipment required for leading node chips. **ASML** dominates the lithography market with an **82.9% market share** followed by Canon and Nikon.	In 2017, the fixed cost of building a fabrication facility was estimated to be around US$7 billion. **Today, that cost is more than US$20 billion.** **TSMC dominates leading node chip production**, making roughly 70–80 percent of the revenue, followed by Samsung, and Intel who are a year behind. **TSMC** is the only company currently **manufacturing both Nvidia and AMD's high-end chips**, and is the only company making Intel's Arc GPUs.	Firms historically set up ATP facilities in developing countries as it is **labor-intensive** and **lower value than design and fabrication.** **Taiwan, the United States, China, and South Korea** are the main providers of ATP services, with **China accounting for 22 percent** of the world's ATP facilities — increasing dependence on the need for a global supply network.	There is a **scarcity of state-of-the-art (SOTA)** chips needed for training large-scale AI models efficiently, **limiting production and access of chips to firms and nation-states with high access to capital**. Leading chipmaker, **Nvidia,** announced the launch of **Blackwell, a new generation of superchips** that are many times more powerful than its existing GPUs—giving them further control of the market that is likely to be bolstered by their **proprietary hardware-software ecosystem through NVIDIA CUDA**.	There are approximately **10,000 and 30,000 data centres in the world,** and **only about 325–1400** of these **could host an AI supercomputer.** **Construction cost** of a typical data center (20 MW), excluding hardware is roughly US$100M to US$200M, with large players like Meta investing up to a billion dollars on their Altoon data centre. Concerns about **data sovereignty** have pushed regulators to set up data centres locally, creating **bottlenecks for AI developers** in some countries.	**Amazon Web Services (AWS), Google Cloud, and Microsoft Azure** command **66% of the market share** due to early investments in data centres and data services platforms.

Energy

Talent and Expertise

Policy and Regulation

CASE STUDY

Bridging the gap — European Union opens up High Performance Computing in Africa

Given the significant disparity in science and technology metrics across the continent, access to advanced computing resources is far from democratized. Vital research in areas such as climate change modelling, disease outbreak prediction and drug discovery are heavily reliant on High Performance Computing (HPC), which is not readily available in several African nations. This deficiency in adequate HPC infrastructure not only impedes market innovation across various fields, but also limits the evolution of data-driven solutions to address key development challenges such as climate change and food security.

The significance of HPC for scientific progress in Africa has been acknowledged by the European Union. The African Open Science Platform (AOSP) is a programme that enables African scientists to access HPC facilities, empowering them to leverage powerful computing resources for complex simulations and data analysis. The European Union invests in training and workshops to equip African researchers with the skills required for effective use of HPC, thereby maximizing the benefits of accessing these advanced computing resources. Collaborative partnerships between the European Union and Africa utilize HPC to address shared challenges such as climate change and public health issues. Combining European expertise with African research priorities can lead to significant advancements.

Previously, African scientists faced resource constraints that hindered their ability to conduct complex research projects. However, with the emergence of HPC, data-driven solutions for African challenges in areas such as agriculture, healthcare and environmental sustainability have become more feasible.

The collaborative efforts between European and African scientists have contributed to a more globally connected research landscape. The European Union's initiatives for HPC in Africa represent a significant stride towards a more equitable and technically sophisticated research landscape across the continent.

2.3 TALENT

Shaping and empowering human capital is a crucial component of building and sustaining AI ecosystems. This includes enhancing human capacities to understand and engage with AI systems through education, research, advocacy, and innovation.[131] Formal and lifelong learning are also crucial, with computer science and social sciences being equally fundamental to addressing the broader technical and ethical challenges of AI.

AI continues to impact industries across the board, exacerbating fears of job displacement and redundancies. Thus, with such rapid technological progress comes the urgent need for an AI-ready workforce. Collaboration between academia and industry would guarantee that AI education is in line with the changing needs of the labour market while ensuring inclusivity and equity to combat potential digital divides.

Talent in Africa

EDUCATION & RESEARCH

Mainstreaming AI education fosters innovation

SKILLS & EMPLOYMENT

Technical expertise in data science, programming, and statistics

BROADER TOOLS

Domain-specific knowledge and soft skills

DISPARITIES

Existing inequities hinder AI talent development

GUIDE

- Instil foundational skills necessary for AI systems within curricula
- Improve existing human capacities for teaching AI programmes
- Ensure an enabling policy and regulatory space for developing AI talent

RENEW

- Provide the relevant resources to build specialized AI skills through private sector collaboration
- Contribute to building broader industry-relevant skills for encouraging a more robust AI ecosystem
- Leverage international partnerships to tackle foundational problems that hinder AI skills development

ORCHESTRATE

- Promote AI entrepreneurship and innovation in Africa
- Facilitate on-the-job training to ensure industry-relevant capacity building
- Develop technology spaces that nurture talent networks

WEAVE

- Infuse inclusivity and diversity in AI talent development
- Establish vital industry-academic collaboration
- Revitalize pan-African networks and collaboration
- Leverage multi-stakeholder collaboration to create and attract talent

Figure 6. Empowering Africa: Bridging skills to employment.

AI Education and Research: Taking AI education into the mainstream will foster innovation and drive economic empowerment. By equipping students with AI knowledge and skills, a workforce can be created that is fit for the jobs of the future and that can help drive local solutions to local challenges. Moreover, AI education can ensure ethical and inclusive AI development, promoting sustainable growth and global competitiveness. Government funding for AI research in universities and research institutions can drive innovation and attract top talent.

Skills and Employment Support: Shaping a sustainable AI talent sector for the continent requires a wide-ranging approach. Technical proficiency in machine learning, deep learning frameworks and NLP techniques will be crucial. Data science expertise, including skills in data collection, data preprocessing, exploratory data analysis and predictive modelling, will allow talent to build AI systems, products and services. By partnering with educational institutions, private companies can offer training programmes and workshops to develop a skilled AI workforce.

Broader AI Tools: Broader skills are also needed. This includes specialist knowledge for domain-specific AI use cases (such as in healthcare, agriculture, finance and education) to develop contextually relevant solutions that address priority challenges. Additionally, 'soft' skills, including communication, collaboration, problem-solving and project management, will ensure the sustainable success of AI enterprises.

Disparities: Talent challenges are not homogenous, and can be exacerbated or entrenched due to existing divides, inequities and inequalities. This can undermine the potential of many countries, with a sizable proportion of the population unable to actively participate in shaping AI. Civil society organizations can raise awareness about the potential benefits of AI, ensuring marginalized communities are not left behind in the AI revolution.

Talent is a core component of AI development, and Africa's young population shows promise in this direction. By employing the GROW approach, the AI Hub for Sustainable Development can maximize the potential of African AI talent. The four components of the GROW model can help elaborate upon the state of AI education

and shine a light on skills gaps, opportunities for capacity building, academia–industry partnerships, scope for AI innovation, and multi-stakeholder interventions when developing a local AI workforce in Africa.

GUIDE

Mainstream AI education and research across the educational ecosystem

Only 0.3 percent of global AI journal citations come from sub-Saharan Africa.[132] This highlights the need for educational systems in Africa to be updated to adapt to the challenges posed by the Fourth Industrial Revolution. African universities, including the University of Johannesburg, the Centre for Artificial Intelligence Research (CAIR), the Pedagogical University of Maputo, and centres of excellence such as the African Institute for Mathematical Sciences (AIMS) are responding to the growing need for AI professionals.

Among 32 African countries surveyed by UNESCO, 19 highlight gaps in educational resources and human capacities for teaching AI programmes. More broadly, more than half of all countries highlighted 'updating education, skills and training systems for imparting AI skills and knowledge' as one of their top five AI-related priorities.[133] More specific skills gaps and priorities have also been identified in wider research, including building data science and machine learning capabilities.[134] Thus, the need to mainstream AI skills at all levels of education has been felt across African countries. For instance, Egypt has launched AI programmes in schools, including programmes on data science. The government also grants scholarships for MSc and PhD-level programmes in AI-related fields.[135] Similarly, Data Science Nigeria has provided free textbooks to primary and secondary schools on how AI plays an important role in the African context.[136]

Strategies

1. **Instil foundational skills necessary for AI systems within curricula:** Foundational skills in AI should become part of different levels of education, as well as outside of formal curricula and institutions, with a focus on lifelong learning. AI research should be promoted on a sociocultural level and be

backed by multi-stakeholder partnerships between academia, industry and government. Encouraging the uptake of STEM education from an early age can help cultivate interest and aptitude in AI-related fields among students. Initiatives such as STEM competitions, coding clubs and mentorship programmes can inspire and support the next generation of AI talent. Academia must also develop in-house expertise on AI systems and their socio-economic implications, ethical AI approaches, and best practices to ensure that there are regulatory frameworks and standards for ethical AI that address societal challenges.

2. **Improve existing human capacities for teaching AI programmes:** Initiatives aimed at training educators in AI pedagogy and providing resources for AI curriculum development can help bridge gaps in AI education. Centres of excellence in AI across the continent can also receive support to strengthen the AI education and AI research landscape.

3. **Ensure an enabling policy and regulatory space for developing AI talent:** Universities must play a fundamental role in developing critical research that can inform policy and the public about AI innovation.[137] With training programmes and adequate protections through regulation, these talent pipelines can be developed in the African continent — a region with the world's youngest population. Capacity building and training of stakeholders involved in policy will allow them to comprehend and harness AI's potential in accelerating progress towards the SDGs.

RENEW

Increase access to resources that can build AI skills

For AI systems to evolve, programmers, statisticians, data scientists, data engineers and analysts represent an important talent pool. However, gaining the right skills has been a systemic challenge for many African countries. One study using self-reported data from white-collar workers in knowledge sectors including ICT and professional services revealed that most sub-Saharan African countries are positioned at around 50 percent of the global average in terms of digital skills. Broader challenges can also limit skills development. For example, the availability of the

internet and reliable electricity affects digital skills acquisition.[138] Additionally, language barriers, varying policy environments, and disparities in education systems, resource access, and collaboration between African countries, may result in differing levels of progress in terms of AI development.

Nevertheless, Africa is heading towards progress. Between 2016 and 2021, there has been a 115 percent increase in internet users in sub-Saharan Africa. Recognizing the importance of capital to access high-performance devices and quality datasets to nurture AI talent, the Government of Nigeria, through its Artificial Intelligence Research Scheme, is offering grants of around US$3000 each to local AI researchers and startups.[139] In 2021, the Government of Nigeria also partnered with Microsoft to enhance its digital economy, equipping five million people with digital skills.[140] Initiatives such as openAFRICA, Kaggle, and Zindi are shaping new learning opportunities, allowing African talent to gain access to real-world datasets and tackle real-life issues. Other initiatives, including Ghana NLP, AI Saturdays Lagos, Data Science Africa, Masakhane and Deep Learning Indaba, are also shaping a vibrant research and innovation community.[141]

Strategies

1. **Provide the relevant resources to build specialized AI skills through private sector collaboration:** It is crucial that the African ecosystem does not become 'trapped' in lower value-added tasks within the global AI value chain. It is essential to identify and address skills gaps across the value chain. Widely accessible online educational material can also be used to reach large numbers of people; these resources can empower African AI talent and be introduced into the ecosystem through private sector-led collaboration. Academia and research will play an important role in steering such interventions in AI talent development. For instance, local players like Zindi Africa represent a huge community of data scientists that can complement private sector-led talent development initiatives in AI.

2. **Contribute to building broader industry-relevant skills for encouraging a more robust AI ecosystem:** Ensuring the positive potential of AI for Africa will require a matrix of

There is also a need for AI talent to be trained in ethical and responsible AI practices to make sure that AI solutions cause no harm, tackle and remove bias, and do not entrench or exacerbate inequalities.

specialized and broad skills. For AI to be sustainable, skills cannot be restricted to technical expertise. Strong problem-solving skills and critical thinking foster innovation and ensure that the AI solutions created solve problems on the ground. Effective collaboration and communication will foster interdisciplinarity, inviting diverse African points of view into the AI infrastructure. There is also a need for AI talent to be trained in ethical and responsible AI practices to make sure that AI solutions cause no harm, tackle and remove bias, and do not entrench or exacerbate inequalities.

3. **Leverage international partnerships to tackle foundational problems that hinder AI skills development:** With a younger and increasingly tech-savvy population, and a strong history of shaping locally-owned and led technologies and innovation, the continent has all the requisite ingredients to shape new avenues towards AI innovation. Global technology stakeholders can aid this endeavour, and help to strengthen the public infrastructure. For example, Microsoft, as a cloud service provider, is collaborating with the Government of Morocco to optimize its ICT spending and maximize returns on investment.[142]

ORCHESTRATE

Forge enabling environments that nurture African 'unicorns' and entrepreneurship

Similarly, the rate of contribution to the open-source community is higher for the African continent than across Asia, Oceania, North America, and Europe.

Limitations aside, innovators in sub-Saharan Africa are now developing their skills and technical talent. Similarly, the rate of contribution to the open-source community is higher for the African continent than across Asia, Oceania, North America, and Europe.[143] However, many graduates from existing AI and related programmes often struggle to secure relevant employment as they lack the industry-specific skills, knowledge, or training. This suggests a broader mismatch between current learning pathways and the needs of the AI ecosystem, and has created a 'brain drain' among African AI talent.[144] With skilled professionals leaving the local ecosystem, knowledge and innovation gaps deepen, further discouraging investments in existing AI initiatives and businesses.

This issue reinforces the need to develop a sustainable AI labour market in Africa. To this end, supporting AI entrepreneurship is

important. South Africa, the continent's highest ranking country for entrepreneurship, still only ranks 44th globally, among 87 countries.[145] However, increasingly, African experts are coming together to form enabling technology spaces to reinvent the African relationship with AI, like the aptly named 'Silicon Savannah' in Kenya, the 'Sheba Valley' in Ethiopia or the 'Yabacon Valley' in Nigeria.[146]

Strategies

1. **Promote AI entrepreneurship and innovation in Africa:** An increase in entrepreneurship opportunities will generate sustainable wealth, expand employment and diversify sources of growth — providing greater opportunities to develop local and vibrant technological expertise that enjoy easier access to capital and resources.[147] Granting funding, mentorship and resources to aspiring entrepreneurs and startups will create a conducive environment for AI development. An environment that has access to capital, incubation centres and networking opportunities can help retain local talent and stimulate innovation.

2. **Facilitate on-the-job training to ensure industry-relevant capacity building:** Companies could also be incentivized to offer on-the-job skills transfer to develop a solid workforce.[148] Specialized training programmes can bridge the gap between academic learning and industry demands and will ensure that the African AI ecosystem puts African voices first, leaving no one behind. This will require collaboration with industry partners who are able to tailor programmes to international industry standards. Work-integrated learning can encourage individuals to continuously update their knowledge and acquire new competencies throughout their careers. Exploration into policy initiatives, apprenticeships, and traineeship funding presents potential avenues to enhance the accessibility and effectiveness of practice-based learning initiatives.[149]

3. **Develop technology spaces that nurture talent networks:** Innovation hubs and technology parks can provide the necessary infrastructure, resources and support services to AI innovators and entrepreneurs. These spaces serve as hubs for collaboration, creativity and knowledge exchange, bringing together diverse stakeholders from academia, industry,

government and civil society. By creating a conducive environment for AI innovation and entrepreneurship, these spaces can help retain talent, attract investment and drive economic growth.

WEAVE

Leverage collective action such as private sector collaboration and digital public infrastructure to tackle the 'twin technology challenge'

In Africa, the diversity and representativeness of AI systems is compromised in the absence of pathways to integrate Francophone nations within its fold.

The 'twin technology challenge' refers to the struggle to keep pace with the exciting and important developments of AI while also building and strengthening core digital foundations and prioritizing digital inclusion.[150] In this context, it can be useful to examine the challenges in developing African AI talent through the lens of intersectionality. In Africa, only 36 percent of the population has access to broadband internet, and the gender gap in internet usage is immense (35 percent male versus 20 percent female, as of 2020), and though mobile connectivity has improved, access remains unequal across regions.[151] With significant gender digital divides, women and girls can be disempowered — or actively excluded — from AI careers and opportunities. Other forms of sociocultural and economic marginalization can further exacerbate their exclusion from the AI revolution in Africa.

One study[152] noted that a sizable portion of Africa-based startups were founded by non-African founders. Furthermore, an analysis of AI startups across the continent indicates that Francophone countries such as Benin, Côte d'Ivoire, Senegal, Togo and Tunisia are underrepresented in the innovation landscape.[153] This could be due to the language barrier for accessing AI-related resources which are primarily in English. Consequently, the diversity and representativeness of AI systems is compromised in the absence of pathways to integrate Francophone nations within its fold.

There have been endeavours to address disparities between African stakeholders. In 2021, the World Bank launched a pilot project in Uganda to enhance women's digital literacy and inclusion among refugee and host community participants. The pilot led to a fourfold increase in digital skills among its participants. Moreover, pan-African networks, including organizations such as DeepLearning

Indaba and Responsible AI Network Africa (RAIN-Africa), as well as local stakeholders, startups and the AI community are contributing to a multi-stakeholder AI innovation ecosystem that is relevant to the African context, its concerns and culture.[154]

Addressing this issue is complex,[155] which is why stronger links between academia and the private sector can play an important role. For instance, Samsung partnered with GoMyCode to establish the Samsung Innovation Campus in Algeria — an education programme providing AI courses and digital upskilling opportunities in line with current technological and market trends, as well as other skill training programmes in design, project management and problem-solving.[156] The aforementioned Google Research Centre in Accra has also been driving research in Africa by supporting AI projects in weather forecasting, food security, maternal health, spatial analysis and flood forecasting. Broader efforts are also underway. For instance, Smart Africa's capacity-building arm, the Smart Africa Digital Academy (SADA), in partnership with the Ministry of Communication and Digital Economy in Côte d'Ivoire, has launched an initiative to nurture the country's emerging digital sector.[157] Public institutions can also contribute to this endeavour. Digital public infrastructure can be a path towards ensuring that AI learning can reach even the most marginalized. For instance, in India, DIKSHA (National Digital Infrastructure for Teachers) grants teachers and learners access to educational resources, thereby facilitating inclusivity and best practices in education.[158]

Strategies

1. **Infuse inclusivity and diversity in AI talent development:** Efforts to address foundational problems should prioritize inclusivity and diversity to ensure that AI talent development is accessible to individuals from diverse backgrounds and underrepresented groups. Creating inclusive learning environments, providing scholarships and mentorship opportunities and actively promoting diversity in AI communities can help foster a more equitable and representative workforce. It is necessary to equip women with the skills to participate in creating AI solutions, fostering economic inclusion through support for women-led businesses and training programmes catering to women.

2. **Establish vital industry-academia collaboration:** Collaboration between academia and industry is crucial for ensuring that educational programmes are aligned with the evolving needs of the labour market. By exploring the potential for incubation centres, secondments and other initiatives, AI talent will be better able to access international resources. Establishing partnerships, internships and apprenticeship programmes can provide students with hands-on experience and industry-relevant skills, bridging the gap between theoretical knowledge and practical application.
3. **Revitalize pan-African networks and collaboration:** Collaboration and knowledge-sharing among African AI experts, startups and communities through pan-African networks and initiatives should be encouraged. This will also ensure the scalability, interoperability and impact of African AI solutions. By fostering a culture of collaboration and collective problem-solving, these networks can create a vibrant and sustainable AI ecosystem that addresses African concerns and priorities.
4. **Leverage multi-stakeholder collaboration to create and attract talent:** Embedding sustainability within the AI talent sector will require multiple perspectives. A multi-stakeholder approach involving public bodies, civil society organizations, developers, researchers and local communities can play an important role in strengthening AI skills and priorities. Initiatives such as the United Nations Global Pulse, and the Government Engagement Program on Standards (GEPS) from IEEE are designed to foster such collaboration.[159]

CASE STUDY

Networks of excellence — the African Institute for Mathematical Sciences (AIMS) and the Next Einstein Forum (NEF), supported by the International Development Research Centre (IDRC)

Africa's most valuable asset lies in its people. Thus, investing in education remains the most important step towards shaping the continent's AI future. Incentivizing education and collaboration of AI talent will foster a multifaceted and relevant AI-literate workforce, adept in understanding and addressing critical developmental issues such as agriculture, resource management,

public health, climate and finance. Robust education and training in STEM (science, technology, engineering and mathematics) disciplines will cultivate indigenous African capacity to unlock solutions to both African and global challenges.

Since its inception in 2003, the African Institute for Mathematical Sciences (AIMS) has been a pioneering network of centres of excellence in STEM education, nurturing the next generation of African leaders and scientists. With six centres of excellence spanning Cameroon, Ghana, Rwanda, Senegal, South Africa, and Tanzania, AIMS advocates for investment in STEM education, emphasizes multi-stakeholder collaboration, promotes diversity and inclusion in STEM fields, and drives innovation. The organization is committed to technological advancement, economic development, lifelong learning and scientific excellence.

AIMS facilitates networking and collaboration among African and global AI talent. Through its partnerships and initiatives such as the Next Einstein Forum (NEF), AIMS provides opportunities for knowledge exchange, technology transfer and joint initiatives to advance AI research and development in Africa. Launched in 2013, the NEF has brought together stakeholders from the scientific and academic sector, governments, policymakers, science funding agencies, industry, media and civil society to showcase African AI talent.

The NEF operates through four key programmes:

1. **The NEF Global Gatherings**, held biennially, serve as flagship events where science converges with global development agendas. With participation from political and industry leaders and a strong emphasis on youth and women, these gatherings amplify the voices of scientific leaders, shaping Africa's scientific future;
2. **The NEF Policy Institute** aims to enhance science and innovation foresight in Africa through benchmarking activities, roadmapping for the digital economy and policy papers;
3. **The NEF Community of Scientists**, comprising NEF Fellows and Ambassadors, showcases Africa's brightest young minds on the global stage, and champions science and technology across the continent; and

4. **The NEF Platform** drives public engagement through online content, social media campaigns and research roundtables, fostering collaboration between government, academia and industry leaders to address Africa's challenges and set scientific priorities.

In 2018, the NEF also launched the quarterly *Scientific African* — a peer-reviewed, open-access, and multidisciplinary scientific journal dedicated to expanding access to African research, increasing African scientific collaboration and building African research capacities.

SECTION 3

Looking forward

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Looking forward

Africa stands at the crossroads of transformation — possessing immense potential for growth and development, while also facing considerable development challenges. AI is not a silver bullet for Africa's development, but it offers a promising pathway that can support and accelerate the innovation ecosystem. AI-powered solutions such as chatbots, virtual assistants, and e-commerce platforms are helping businesses to streamline their processes, expand their market reach and better meet the needs of customers. Beyond its use in the private sector, AI-centric workflows and technical skills are also improving the quality, reach, and impact of the public sector.[160]

AI is spurring technological and business innovation in Africa, deepening its digital economy.[161] Moving forward, the growing accessibility of AI and digital technologies can shape new opportunities for individuals, communities, and countries. By embracing diversity and inclusion in AI development, countries across Africa are exploring new avenues for employment and upskilling.[162]

Just as importantly, AI has already proved itself crucial in helping countries achieve the SDGs. For instance,

1. **Zero hunger (SDG 2):** African innovators have used AI to boost agricultural productivity and food security, making farmers resilient to socioeconomic and climate contingencies;[163]

2. **Good health and well-being (SDG 3):** AI enables early detection and diagnosis of diseases and increasing healthcare access in remote areas;[164]

3. **Quality education (SDG 4):** AI has helped provide quality education to all — through personalized platforms, interactive experiences, and adaptive and engaging learning systems;[165]

4. **Clean water and sanitation (SDG 6):** By helping assess water quality, detect gaps in water distribution systems, and identifying risks of water scarcity and contamination, AI has also allowed policymakers and communities to employ actionable insights;[166] and

5. **Climate action (SDG 13):** AI allows innovators to understand vast and complex data. By supporting climate modelling, climate risk assessment, and environmental monitoring, it has informed resilient and adaptive climate strategies.[167]

There are several other examples. However, the advancement of AI algorithms has primarily focused on enhancing performance, resulting in complex 'black box' systems — models whose internal workings are not easily understood by humans. Incorporating human values into AI systems requires a paradigm shift among researchers and developers, prioritizing transparency over performance.[168] This shift could lead to innovative techniques and applications. Specifically, it entails supplementing the prevailing individualistic perspective of AI systems with one that recognizes and integrates collective, societal and ethical values into the design, development, and utilization of AI systems.

The AI Hub for Sustainable Development seeks to concern itself with the African AI landscape — one as defined by opportunities as it is by inequities — as a development priority. It will serve as a central hub examining, exploring and tackling key concerns in terms of data, compute and talent pipelines. By understanding and addressing significant bottlenecks which contribute to the digital divide, the AI Hub will unlock the developmental potential of AI in Africa.

As discussions on AI policy across the African continent gain traction, there is a pressing need for a holistic approach to AI governance. Efforts should encompass policies on privacy, security, data access, intellectual property protection, human rights and cross-border data sharing mechanisms.[169] It is imperative for

diverse stakeholders to collaborate and integrate these policy aspects into a unified action plan for policymakers.

The establishment of this AI Hub holds the potential to not only advance the continent, but also to drive global change by generating diverse and valuable datasets, as well as creating robust AI models, policies, and approaches. The AI Hub can serve as a collaborative platform for both African and international researchers, facilitating the exchange of knowledge and expertise on a global scale. Additionally, its emphasis on ethical considerations and responsible development can set a precedent for a more inclusive and equitable future shaped by AI.

This is just the beginning.

The establishment of the AI Hub requires commitment, collaboration, and a long-term vision. By enabling the knowledge, insights, best practices, and expertise of the global AI community to connect with and amplify the African innovation ecosystem, this initiative can unlock the vast potential of AI for progress and prosperity — not just for Africa, but for the entire world.

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- G7 Industry Working Group Co-Chairs:
  - Eva Spina, Head of Department for Digital and Connectivity and New Technologies
  - Vincenzo Del Monaco, Minister Plenipotentiary and Deputy Diplomatic Advisor
- Eleonora Iannuzzi, Head of Unit, Coordination of the Department's Policies, Studies and Analysis, and International Relations
- Valeria Vinci, Head of Unit, Digital Economy and New Enabling Technologies

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Research: Vaishnavi Patil, Rohan Pai, Soujanya Sridharan, Bharat Menon, Astha Kapoor, and Amrita Nanda

Design: Antara Madavane, Priyam Vadaliya, Vasudha Varadarajan, and Meher Rajpal

Subject matter experts

Mr. Blaise Bayuo, Dr. Charles Kimpolo, Dr Nii Longdone, Dr. Katleho Mokoena, and Professor Olaynka David West

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