

The Importance of Artificial Intelligence to Africa's Development Process: Prospects and Challenges

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Abstract

On a continent that is frequently portrayed in a condition of permanent crisis, development appears to be an impossibility. In fact, observers of African affairs, especially those in the West, cannot feel reassured by recent military takeovers and armed conflicts like those in Sudan and Gabon that Africa is rising—a claim once made by influential figures in world opinion like The New York Times, The Economist, and others. It appears that development is in critical need of an immediate revival. To put things in perspective, the Organization for Economic Co-operation and Development (OECD) reports that official development assistance (ODA) reached a total of USD 185.9 billion in 2021. However, the depressing results of development demonstrate the futility of international development. For instance, since 2019, the majority of the nations receiving aid from abroad have seen increases in their rates of poverty, with 50% to 70% of their people living below the poverty line (1,2).

Situations around the world are not promising. The World Bank estimates that in 2022, there will be over 700 million individuals worldwide who are living in extreme poverty. The UN's most recent SDG 2023 progress report (1.3) presents a dismal picture. On almost 50% of the targets, there has been insufficient and weak development. Even worse, almost 30% of the SDG targets have seen either a standstill in development or a reversal in them. This contains important goals about hunger, poverty, and the environment. Moreover, the research finishes on a very concerning note: over half of the world is falling behind, and most of those falling behind reside, you guessed it, in the Global South.

Artificial intelligence (AI) is being positioned as a useful tool for accelerating development objectives and targets and repairing the flawed international development paradigm as the global development agenda suffers. International development organizations and regional partners have implemented innovative AI for development (AI4D) initiatives in a number of African nations, including those in Sub-Saharan Africa and West Africa. With all of the hype around artificial intelligence, this seems like a reasonable and necessary endeavor. However, the deficit model of development serves as the foundation for AI initiatives in Africa. This deficit argument highlights how the lack of human and technological capability is the direct cause of the Majority World's inability to progress.

In an effort to maximize the amount of electricity available, the Responsible AI Lab (RAIL) in Ghana (1.4) is attempting to integrate efficient energy distribution models into the system. Natural language processing (NLP) is arguably one of the most promising uses of AI in the region. Emerging start-ups using development funding programs like the Lacuna Fund are attempting to create language models for indigenous African languages like Igbo, Hausa, Yoruba, Twi, Akan, and others. These models can be integrated into further applications in fields like education and healthcare. Given the regional circumstances in the majority of African nations, the advantages of these programs and apps may be obvious.

Actually, though, large multinational corporations' CSR programs (4) and the policies of international development organizations have a significant influence on most AI development in Africa. In an effort to become future bright spots in the field of technology, these initiatives which are carried out in partnership with Big Tech and regional players like scientists and practitioners are unduly focused on developing technological solutions and local African datasets. Much time and money are being spent collecting local datasets so that machine learning models for predictive analysis can be updated based on the local context.

But how much is known about the goals and applications of these AI programs, and which social groups and communities stand to benefit from them? How will the local context respond to these technology solutions? To put it bluntly, there isn't enough deliberate interaction with the political imaginations of the various local communities in terms of their aspirations for an AI-powered technological future¹.

Introduction

Introduction to Africa's Development

According to Africa's Development Dynamics 2023 (4.1), the continent will need an additional USD 1.6 trillion by 2030 to fund sustainable development and achieve its SDGs. This suggests that in order to reduce the investment gap, African governments and partners must strengthen African development capacity in financial institutions, support regional projects, and increase investor access to information. Together, these steps will need to generate \$194 billion per year for African countries and governments.

This annual sustainable financing shortage will account for 34% of Africa's investments and 7% of the continent's GDP by 2021. The gap divides less than 0.2% of total global assets and 10.5% of African financial assets each year.

African economies offer unique resources to address the continent's long-term financial gap for governments:

In 2023, real GDP growth is expected to return to pre-COVID-19 levels at a rate of 3.7%, ranking second globally after developing Asia (5%) and ahead of Latin America and the Caribbean (1.6%). East Africa is projected to grow at a pace of 4.9%, Central Africa at 4.3%, North Africa at 4%, West Africa at 3.8%, and Southern Africa at 1.4%.

By 2040, 34% of African youth could have finished upper-secondary or higher education, compared to 23% in 2020 and 18% in 2010. With a median age of 19, Africa has the world's youngest population, followed by emerging Asia at 31, Latin America and the Caribbean at 30, and Europe at 42.

African economies rely heavily on natural resources. Natural capital accounts for 19% of Africa's overall wealth, versus 7% in Latin America and the Caribbean and 3% in rising Asia. While carbon stocks in forests outside of Africa fell by 13 million kilotons between 2011 and 2020, the global carbon stock increased by 11.6 million kilotons of CO₂-equivalent net emissions from African forests².

Africa's financial resources offer enormous potential for long-term growth. Domestic government income in 2021 was USD 466 billion, or 17% of GDP, whereas Institutional investors in Africa (4.2) held assets of USD 1.8 trillion in 2020, or 73% of GDP. During the 2020-21 COVID-19 pandemic, intra-African foreign direct investment proved three times more resilient than foreign direct investment from outside the continent, boosting growth in information and communications technology and renewable energy sectors.

Regardless of this potential, global crises have a higher influence on investment in Africa than in other regions. The average inflation rate in 11 African countries is anticipated to reach 15% in 2023, the highest level in 27 years. As of February 2023, eight of the world's nine countries were in financial difficulty, while thirteen were at great risk of going into debt (of 27). While high-income nations in other parts of the world recorded their highest share ever (61%), Africa's share of global greenfield foreign direct investment has been decreasing recently, falling to 6% in 2020-21 (the lowest share in 17 years), compared to 17% for developing Asia and 10% for Latin America and the Caribbean.

Africa's financing costs have risen in comparison to other parts of the world, pricing certain African governments out of bond markets and limiting investment in game-changing technologies such as renewable energy. In September 2022, the spread on an average African Eurobond (4.6), a measure of a sovereign's potential borrowing costs, reached a 15-year high, topping previous highs by nearly 10 percentage points. In 2021, Africa's average capital cost for energy projects was almost seven times that of Europe and North America. Although experienced investors expect higher average returns in Africa than in other regions of the world, a key barrier to new investment is a lack of reliable information and statistics.

African policymakers (4.7) may work with global partners and African civil society to mobilize investments in Agenda 2063 and sustainable development, increasing resilience to external shocks and boosting investor confidence.

Despite these challenges, tech evangelists and AI proponents believe that adopting AI into Africa's development process can help to close the gap faster³.

Introduction to AI

Technological innovation has driven much of human evolution and progress. It fosters economic growth and human well-being. Humanity has made considerable progress as technology has matured. From the use of steel to propel the industrial revolution and get us to where we are today to the navigational compass that guided famous explorers. Even moving from the earliest computing device to the current artificial intelligence (AI) machine learning system. Both of these incidents had a significant impact on the technology industry.

"Artificial intelligence (AI) (5) refers to computer systems capable of performing complex tasks that historically only a human could do, such as reasoning, making decisions, or solving problems".

Artificial intelligence, or AI, is a type of machine learning intelligence that differs from human intelligence, which is made up of emotions and consciousness. AI's job in modern civilization is to execute activities that would otherwise require human intelligence and resources. The speed, accuracy, and precision with which particular jobs are completed distinguishes humans from machines.

The Internet has evolved from a window dressing platform (web 1.0) to Web 2.0 and Web 3.0, often known as Web3, built on the principles of decentralization, openness, and enhanced user usefulness. Web 1.0 is the "read-only Web," while Web 2.0 is the "participative social Web," and Web 3.0 is the "read, write, execute Web."

This stage of Web engagement and use shifts users away from centralized platforms such as Facebook, Google, and Twitter and toward decentralized, practically anonymous services. Tim Berners-Lee, the creator of the World Wide Web, initially referred to Web 3.0 as the Semantic Web and envisioned an intelligent, autonomous, and open Internet that employed Artificial Intelligence and Machine Learning to function as a “global brain” and interpret content conceptually and contextually⁴.

Here's a list of typical Web 3.0 characteristics:

- It is a semantic web, in which online technology transforms into a platform that allows users to produce, share, and connect material through search and analysis. It focuses on word comprehension rather than numbers and keywords.
- It includes artificial intelligence and machine learning. When these ideas are integrated with Natural Language Processing (NLP) (5.1), the end result is a computer that uses Web 3.0 to become smarter and more responsive to human demands.
- It demonstrates the connectivity of many devices and applications via the Internet of Things (IoT).
- Semantic metadata facilitates this process, allowing all accessible information to be efficiently used. Furthermore, users can access the Internet at any time and from any location, without the need for a computer or smart device.
- It allows users to engage openly or privately without an intermediary exposing them to hazards, resulting in “trustless” data.
- It has 3D graphics. In reality, we can see this in computer games, virtual tours, and e-commerce.
- It allows for involvement without the necessity for a governing body's authorization. It requires no permission.

Uses of Web 3.0

- Metaverses are 3D-rendered virtual worlds, while blockchain games are based on blockchain technology. They let users to actually own in-game resources, following the ideas of NFTs.
- Privacy and Digital Infrastructure: This includes zero-knowledge proofs, protected personal information, and decentralized financing. This use includes payment. Blockchains, peer-to-peer digital financial transactions, smart contracts, and cryptocurrency enable decentralized autonomous organizations. Community members own online communities.
- Web 3.0 allows people to engage, exchange information, and perform secure financial transactions without the need for a centralized authority or coordinator. As a result, each user is now a content owner rather than merely a content user⁵.

Some Institutions and Conferences promoting AI in Africa

- The African Center for Economic Transformation (ACET) (5.3) and African Observatory on Responsible AI (AOR-AI).
- The recent AfricAI Conference conducted in Kigali (5.4), Rwanda from June 12 to 14, 2023 (<https://conference.ai4d.ai/>) on advancing ethical and open AI ecosystems in Africa.

AI and Africa's Development

In a society that demands instant gratification, from ordering and receiving meals delivered to their doorstep to obtaining knowledge on any and all subjects through an instant search engine, we know that humans anticipate instant results. Artificial intelligence opens the way for progress and technical advancement in all fields.

- AI can process math equations faster than humans.
- Pay taxes at an accelerated rate.
- Provide reliable medical diagnostics for a lower cost.

Artificial intelligence is propelling us into the future and altering the landscape of business.

Businesses that use AI aren't merely following a 'new trend.' They are attempting to keep up with the fast-paced world around them. Whether you're establishing a next-generation automobile empire or performing something as simple as data entry, artificial intelligence is the most important invention to have in your pocket.

According to reports, Africa is trailing behind in artificial intelligence. However, the continent is beginning to close the gap through a number of programs aimed at capitalizing on its enormous potential⁶.

Take, for instance Google, the American behemoth, has launched the Google for entrepreneurs Accelerator, which is targeted at assisting African entrepreneurs seeking to apply AI to solve local problems. It is just one of many AI projects sweeping the continent as businesses seek to secure a foothold in a potentially lucrative market.

With a booming population of over 1.4 billion people, the majority of whom are under the age of 30, the African continent is ready for investment⁷.

Fatima Tambajang, Head of Developer, Startups, and VC Ecosystem for Africa at NVIDIA, says that despite constraints such as limited access to technology, data, and talent, Africa has made great advances in AI.

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Importance of AI to Africa's Development Process

Health

AI technology has the potential to significantly improve healthcare in Africa by automating medical operations. AI, often viewed as a futuristic promise, is rapidly altering healthcare in Africa, and the continent must prepare for this unavoidable force. The potential of artificial intelligence for healthcare in Africa is still being debated, particularly in terms of managing the global disease load, which is currently 25%. AI can help health practitioners accomplish more with fewer resources by automating medical operations. There is a lot to learn from organizations that are altering African health outcomes, especially those who are already testing the efficacy of specific AI applications.

In Africa, many organizations have already begun to use AI in healthcare. Here are a few instances of how AI is being used in the Continent:

- MinoHealth AI Labs in Ghana (7) is automating radiology using deep learning and the convolutional neural network technology.
- The Philips Foundation has successfully adopted AI software developed by Delft Imaging in 11 South African hospitals to help triage and monitor COVID-19 patients using X-ray imaging. Delft Imaging's AI-powered CAD4COVID software, which supplements existing COVID-19 diagnostic tools, evaluates the severity and progression of COVID-19 disease using routinely available chest X-rays.
- South Africa is also now using a multinomial logistic classifier-based system for individual resource scheduling, specifically to estimate how long health personnel will stay in public service.
- In Tanzania and Zambia, the Delft Institute's CAD4TB program was utilized to evaluate the utility of computer-aided analysis of pulmonary tuberculosis using chest radiographs.
- Ilara Health also provides accurate and economical diagnostics to patients in rural regions with compact, AI-powered diagnostic devices that are integrated into a proprietary technology policy and provided publicly to primary care practitioners.
- Antara Health is utilizing AI-assisted health technologies to simplify healthcare for patients and professionals.
- XELPHA Health operates Aphyra as the only mobile-first EMR solution that aids in the detection and optimization of individual

devices, allowing for active input and involvement from both patients and doctors.

Education

AI is rapidly altering the world, including education (EdTech)(8). In Africa, where access to quality education is frequently limited, AI has the potential to transform learning and make it more accessible to all.

There are already various applications of AI in African education. AI-powered chatbots, for example, can offer personalized tutoring and support to students, while AI-enabled learning systems can give personalized learning experiences tailored to each student's specific needs.

In addition to tailored learning, AI can help to increase the efficiency and efficacy of education. For example, AI can be used to automate chores like evaluating papers and generating lesson plans, allowing teachers to focus on more important things like giving students individualized attention⁸.

AI can potentially be utilized to address some of Africa's education-specific difficulties. For example, AI can be used to give instructional information in local languages⁹, bridging the language gap and making education more accessible to students who speak minority languages.

Overall, artificial intelligence has the potential to significantly improve education in Africa. By offering tailored learning experiences, enhancing educational efficiency and effectiveness, and solving some of the unique issues that African education systems confront, AI can assist to ensure that all children in Africa have access to the excellent education that they deserve.

Finance

AI is already making huge ripples in the banking business, with applications ranging from lending to fraud detection, insurance, customer service, investment, and process automation. The importance of AI in the finance sector, and how it is changing the landscape of the financial industry around the world, particularly in Africa, is significant.

AI in Lending: AI plays an important part in modern financing procedures. Machine learning algorithms use alternative data to evaluate creditworthiness, allowing lenders to make more educated decisions about borrowers than traditional credit scores. Fintech (Financial Technology) (9) companies like Upstart use AI models to screen borrowers, resulting in more accurate credit forecasts and lower default rates.

AI in Fraud Detection: Fraud detection is a major challenge for financial organizations. AI-powered algorithms examine massive amounts of transaction data to detect unusual activity, lowering the risk of fraud and identity theft. Companies such as IBM have created AI systems to improve fraud detection and prevention.

AI in Insurance: AI is transforming the insurance sector by boosting customer experience and accelerating claims processing. Companies like Lemonade utilize AI-powered chatbots to improve customer interactions, provide quotations, and handle claims more efficiently. Fraud detection algorithms are also employed to avoid false insurance claims.

AI in Customer Service: Banks utilize AI-powered chatbots and speech recognition systems to provide customer care. These chatbots enable banks to reply rapidly to consumer inquiries, make product recommendations, and automate account management. The application of AI in customer service enables banks to reduce staff expenses while improving client experiences.

Banks such as UBA utilize chatbots (Leo) to help consumers with basic transactions.

AI in Investing: AI is altering the investment environment by providing individualized investment recommendations based on individual preferences and risk tolerances. Companies such as Robinhood employ AI to recommend investment possibilities and enhance the user experience. New apps, such as Magnifi, use AI to deliver tailored investing advice and trading capabilities.

The Wealth Builders created an innovative trading robot to assist traders in analyzing the market and placing trades.

AI in Process Automation: Artificial intelligence-powered robotic process automation is transforming the back-end operations of the finance industry. It automates mundane, repetitive operations, decreasing the possibility of human error and increasing staff productivity. Financial firms, such as JP Morgan Chase, employ RPA to improve cash management procedures. African banks use a variety of these methods, ranging from SMS automation to mobile banking algorithms.

Fintech start-ups are adopting artificial intelligence to bring novel solutions to customers. For example, Nigerian Fintech start-up Kuda Bank introduced a chatbot function to facilitate transactions and provide real-time updates. Zande Africa (10), a South African fintech company, is leveraging artificial intelligence to provide microloans to small businesses. Additionally, Kenyan Fintech business Lendable uses AI-powered technologies to handle loan applications in minutes.

Manufacturing

African countries produce significant amounts of initial inputs but play little role in the intermediate steps required to manufacture the final product.

Fortunately, AI (Artificial Intelligence) can provide solutions in many areas by improving operational efficiency through the automation of monotonous processes.

Africa's manufacturing industry contributes considerably to the continent's economy by creating jobs, generating cash, and propelling development¹⁰.

In comparison, value-added manufacturing in Africa is quite low (Ghana = 4.16%, Burkina Faso = 5.5%, Nigeria = 8.74%, Rwanda = 5.93%, South Africa = 11.8%), while China is 29.34% (down from 32.24% in 2008), Brazil 10.1% (down from 25.4% in 2016), Germany is 20.7%, and Switzerland is 18%. Turkmenistan has the greatest rate of value-added manufacturing (40%)¹¹.

While the global average is 15.58%, and the more optimistic will say that Africa isn't far behind given its vast population, we can all agree that most African countries don't produce enough to meet their citizens' needs. This suggests that Africa has a lower manufacturing volume per capita.

High levels of manufactured imports would eventually result in significant monetary outflows from African nations. I won't go too far into detailing the challenges so that I may focus on the answers offered to us by artificial intelligence.

AI is more than just automation; it's data-driven automation. This is expressed succinctly, of course. Recurring data from a process can be used to anticipate its future behavior (this is known as predictive statistics or forecasting). Forecasting is employed in a variety of businesses, including sports betting and stock exchanges. However, in manufacturing, if you can forecast how a process/machine will behave using factual data, the next step is to prepare how to deal with negative events that will result in a loss of time, material, and equipment.

AI In The Development of Africa's Transport and Logistics Sector

South Africa is Africa's most advanced country in terms of AI implementation. The implementation of Artificial Intelligence (AI) technology in South Africa's transport and logistics industry is transforming the way goods and services are transported from one location to another, providing businesses and their partners with unprecedented visibility and control over their supply chains. This technology not only helps to increase distribution efficiency in South Africa, but it also has the potential to open up new options for growth and market expansion.

The proliferation of AI technology in logistics is benefiting the industry in South Africa, as more organizations use these technologies to boost efficiency, strengthen security, and shorten delivery times. Many experts feel that when technology is adopted and enhanced,

South Africa will emerge as the region's premier logistics hub, benefiting from the tremendous developments being made in this field referred to as "The Transport and Logistics Internet".

AI In The Development of Africa's Communication

Artificial intelligence (AI) has grown significantly with the evolution of ChatGPT and Bing Chat, becoming a commonplace in our daily life. From voice assistants like Siri and Alexa to chatbots and virtual assistants, AI has become an essential element of how we communicate. ChatGPT is the fastest growing 'app' on record, indicating that AI will have a significant impact on Africa, society, and how we communicate.

One of the most significant advantages of AI in communication is its capacity to increase accessibility and efficiency. Chatbots and virtual assistants, for example, can respond to questions and customer service requests in real time, allowing human customer service agents to focus on more difficult work. AI-powered translation services can also help people who speak different languages communicate more effectively.

With CEO Sundar Pichai introducing Google's new artificial intelligence (AI) system, Gemini, we may expect more competition and progress in Google search and interaction with Google's services, which are utilized by 90+% of Africans.

AI In The Development of Africa's Energy

Africa continues to experience massive electricity shortages, which is nothing new. Energy is the most serious threat to Nigeria's industrial development. Renewable and nonrenewable energy sources are critical for industrial development.

More crucially, A.I. could potentially tackle the decarbonization and socio-economic development difficulties that Africa is facing, which is the interplay between energy-intensive artificial intelligence.

One of the most common applications of artificial intelligence in the energy business has been to enhance supply and demand projections. Next-generation power requires a better understanding of when renewable energy (12) is available and when it is required¹².

However, this can be difficult for renewable technologies because the sun does not always shine and the wind does not always blow. Africa has significant untapped hydro-electric power potential, such as the Menchum Valley in the North West Region of Cameroon (estimated 450 MegaWats HEP Potential) (13) and the Sahara Desert (425,873 GWh of Solar Energy, enough to power Europe 7000 times over according to The World Economic Forum)¹³.

Not to mention Africa's geo-thermal energy potential, natural gas, undeveloped petroleum and uranium deposits across the continent, and more. AI may be used to accurately identify these deposits, avoiding large investment costs and lost operational efficiency.

This is where artificial intelligence may help significantly. It can assist in balancing fluctuating supply with rising and declining demand, increasing the financial value of renewable energy and making it easier to integrate into the grid.

Wind power output, for example, can be forecasted using weather models and turbine location data. However, variations in wind flow might result in output levels that are more or lower than predicted, raising operational expenses. To address this, Google and its AI subsidiary DeepMind created a neural network in 2019 to improve the accuracy of projections for its 700 MW renewable portfolio. Based on historical data, the network created a model that can estimate future output up to 36 hours in advance, which is significantly more accurate than previously achievable.

AI can considerably assist in the accuracy and waste-free production, transportation, distribution, and maintenance of Africa's major energy sources.

AI In The Development of Africa's Infrastructure

Even the construction industry, which is often considered as a laggard in the adoption of cutting-edge technology, has been unexpectedly quick to embrace AI.

Using AI is an important first step toward addressing Africa's infrastructure gap because it provides policymakers with better information and allows them to make more informed decisions about what infrastructure to build where and when, as well as ensuring that current projects can serve Africa's growing population for the next 50 to 100 years.

Using artificial intelligence can be a crucial first step toward solving Africa's infrastructure deficit by providing policymakers with better information to make more educated decisions.

The construction sector is prepared to reap the potential process, health, safety, and production benefits of developing and adopting artificial intelligence.

AI is transforming every element of infrastructure development, from forecasting demand for new projects to designing materials and even erecting structures¹⁴.

The technology is particularly valuable during the planning and design phases, since it enables enhanced generative design capabilities for BIM or 3D modeling. In generative design, a computer produces several hundred design choices based on predefined goals or limitations.

When it comes to onsite construction, current safety, monitoring, and maintenance systems now use advanced AI capabilities to predict and warn supervisors about hazardous situations automatically. These methods reduce the role of human error in any adverse incidence.

It is a fascinating and exciting time to study artificial intelligence's remarkable potential and watch the field evolve. The adoption of digital technology in Africa's construction industry has huge potential for improving performance and productivity.

Essential building blocks and barriers for a sustainable AI in Africa

To maximize the prospects for AI in healthcare and other sectors.

- Proper digital infrastructure for data storage.
- A strong data culture within enterprises that values data and makes tools and resources readily available.
- Appropriate legislation and standards for AI and data science, allowing authorities to review AI applications prior to implementation.
- Adoption of local solutions by understanding and identifying appropriate solutions, increasing self-reliance, and supporting the development of the local ecosystem.
- More focused investment for AI start-ups in Africa, connecting entrepreneurs with appropriate financiers and lowering the risk for private investors.

Conclusion

In conclusion, I believe that technology is God's gift to Africa for closing the development gap with the developed world since it allows everyone, regardless of gender, ethnicity, or race, to participate in its progress.

The African Union, African countries, the judiciary, legislative, and executive branches must all work together to create an enabling environment for the development and deployment of AI systems in various domains in order to foster economic growth and make life easier for everyone, while also ensuring compliance and safety as the technology evolves. There is no stopping AI. If you're concerned about its evolution, lead it.

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13. <https://www.power-technology.com/data-insights/power-plant-profile-menchum-hydropower-project-cameroon/?cf-view>
14. <https://www.mdpi.com/2071-1050/13/11/5788>