

Artificial Intelligence and Public Service Delivery in Africa

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Abstract

Artificial intelligence (AI) is one of humanity's most outstanding inventions but one of the least understood and utilized in Africa. While other governments have shown practical interest in harnessing the benefits of AI for their populace, African governments appear to be lagging behind in this area of innovation that has the capacity to enhance and boost its delivery of public services to the people. Although some African countries have developed helpful policies on Artificial Intelligence and have also witnessed AI deployments in some sectors of their polity, knowledge of what this technology can contribute to social development remains minimal among the citizenry. This paper provides basic information about artificial intelligence with the goal of stimulating interest in AI-focused knowledge acquisition, research, development and deployment across the African continent. The paper uses the latest (2022) UNIDO Government AI Readiness Index to gauge the degree to which African governments have responded to fast-expanding opportunities presented by Artificial Intelligence.

Keywords: artificial intelligence, AI Readiness Index, public service delivery, African governments, UNIDO



Introduction

Africa is in dire need of infrastructural expansion, efficient and easily accessible medical care, public transport system, educational advancement, and innovations in public service delivery systems. All of these can be greatly

enhanced through the creative application of artificial intelligence (AI) technology. AI increases the capacity of governments to deliver well-organized public utilities to the people because an AI machine can achieve within a given period what would take hundreds of human employees to do. And it is not all about quantity of output; AI-enabled public facilities can also leverage the technology's deep knowledge and efficiency to ensure the establishment and sustenance of uniform processes that generate quality products and services. The speed inherent in AI-enabled service-delivery systems orients them to serve a great number of people, thereby increasing capacity-utilization levels. Africa stands to benefit immensely from the utilization of AI machines in its drive to improve the social well-being of its largely impoverished and less-privileged population. Utilizing information and images obtained from electronic sources, written texts, articles from periodicals, corporate reports and books, this paper explores basic aspects of AI and some of its applications that point at how the technology can be employed to reinvigorate and improve public service delivery in Africa.

What is Artificial Intelligence?

Artificial intelligence has been described in different ways by different persons and groups all of whom agree that it involves the utilization of computer systems to make machines perform tasks and solve problems with the capacity and flexibility associated with human beings. According to one of the industries engaged in AI technologies, "artificial intelligence is a field, which combines computer science and robust datasets, to enable problem-solving. It also encompasses sub-fields of machine learning and deep learning, which are frequently mentioned in conjunction with artificial intelligence" (IBM). "These disciplines," IBM further notes, "are comprised of AI algorithms which seek to create expert systems which make predictions or classifications based on input data."

Other organisations incorporate the crucial element of autonomy seen in AI operations in their definition of AI. The Organisation for Economic Co-operation and Development (OECD) sees AI as "a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy" (OECD, 2019b, p. 7, as quoted in Gwagwa et al., 2020).

The European Commission emphasizes the foremost feature of AI – intelligence – in its definition; in Gwagwa et al, it describes AI as "systems that display intelligent behaviour by analysing their environment and taking actions—with some degree of autonomy—to achieve specific goals" (EC, 2018). AI systems are, therefore, "autonomous and intelligent systems (A/IS)"

that display, according to Copeland (2023),

the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—such as discovering proofs for mathematical theorems or playing chess—with great proficiency.



Source: theworld.org

The ability of an AI device to master the game of chess was demonstrated when “Deep Blue”, an AI machine developed by IBM, beat chess Grandmaster Garry Kasparov in 1997 (Joshi, 2019). AI has been put into more uses in the social and technological sphere, and we will identify some of these applications in a subsequent section of this paper.

Aspects of Intelligence Utilized by AI

What is intelligence, and what aspects of it are utilized by AI machines? Intelligence has been defined as “...the resultant of the process of acquiring, storing in memory, retrieving, combining, comparing, and using in new contexts information and conceptual skills” (Humphreys, 1979). In the view of Sharma (2008), intelligence involves, among other elements, reasoning, learning ability, understanding, abstract and critical thinking, self-awareness, emotional awareness, creativity, and problem-solving, particularly when these are applied as knowledge within a given context or setting. Copeland (2023) notes that intelligence must incorporate “the ability to adapt to new circumstances”.

As it pertains to AI, "Intelligence measures an agent's ability to achieve goals in a wide range of environments" (Legg & Hutter, 2007). To enable an AI agent to do this, some features of human intelligence identified above are employed by AI technologists; they include the learning, reasoning, perception,

formulative and problem-solving features. While an AI device is capable of rote learning, generalizing what it learnt in the past and adapting it to new situations is a more challenging task for most AI agents. Making AI machines to reason is equally challenging, if “To reason is to draw inferences appropriate to the situation” (Copeland, 2023). While computers have been trained to draw inferences, making AI draw inferences “appropriate to (a given or new) situation” remains a daunting problem. Regarding perception and problem-solving features, AI has made appreciable progress, some notable examples of which are briefly discussed below.

Benefits of Artificial Intelligence

Artificial intelligence is currently transforming the way people live, work, and communicate with other people and with non-human entities. Already in the United States, Europe and Asia, the positive impacts of AI are felt in business, education, transportation and healthcare.

In many businesses, AI is used in the areas of data analysis and customer service delivery; it enhances the processing of large volumes of data and the delivery of quick personalized service to numerous customers. In industries, machines are used to automate repetitious acts and processes that characterize many production lines. Employees who could have been engaged in undertaking or managing those processes are thereby freed to take on other business-relevant activities that require human capabilities.

Health is another sector where AI impact has been felt. On the specific contributions of AI in the medical field, Ask.com notes:

AI-powered medical imaging systems are helping doctors diagnose diseases more accurately and quickly. AI-based chatbots are providing patients with personalized health advice and support. And AI-powered robots are assisting surgeons with complex procedures. All of these advances are making healthcare more efficient and accessible, improving patient outcomes and saving lives.

AI automation is also helpful in carrying out day-to-day tasks such as data-entry, maintenance of medical records and scan analysis.

In transportation, AI’s major contribution is in the development of autonomous cars – self-driving vehicles that hopefully will eliminate human errors and guarantee greater safety for passengers. Traffic jam is a problem common to many cities of the world, and AI is currently providing a workable solution in many countries. As reported by PTV, AI is being used in “traffic management systems to optimize traffic flow and reduce congestion. By analyzing real-time traffic data, AI algorithms can adjust traffic signals and reroute vehicles to less congested roads, reducing travel time and fuel consumption.” PTV cites “cities

like Taichung, Vienna, York, or Rome” as those currently executing “real-time solution which combines machine learning techniques with dynamic traffic modeling”.

Regarding AI benefits in the area of education, the Berlin School of Business and Innovation (BSBI), which is in the forefront of AI engagement in this field, states that

AI is revolutionising education and changing the way we learn, teach, and organise educational institutions. One of the most important benefits of using AI in education lies in its capacity to tailor the learning experience to the specific needs of each student. Conventional classroom environments frequently struggle to accommodate the distinctive learning styles and requirements of individual students, but with AI, each learning experience can be adapted to suit a variety of students’ needs.

BSBI noted that AI impact in education also covers intelligent assessment of students and empowering of educators. The latter involves “AI-driven tools that assist in administrative tasks, such as managing schedules, grading, and organising course materials. This streamlines administrative work, allowing teachers to focus more on instructing and mentoring students” (BSBI, 2023).

Apart from the above areas, AI has been used in natural language processing, computer vision, computer games, and mathematical proof formulations.

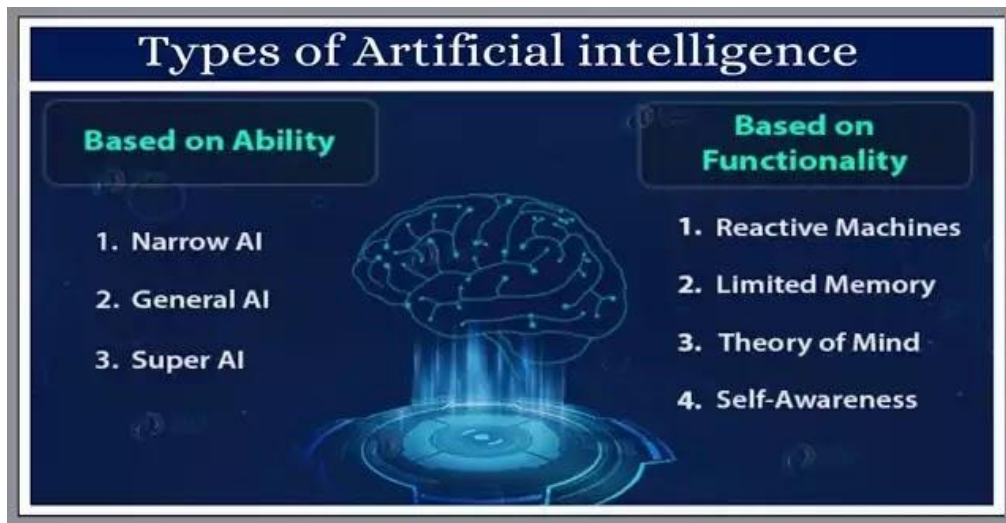
Types of Artificial Intelligence

There are two sets of classifications of AI systems. The first set of classification is based on AI’s “likeness to the human mind, and their ability to ‘think’ and perhaps even ‘feel’ like humans” (Joshi, 2019). The four classes of this set are as follows:

- Reactive Machines,
- Limited Memory Machines,
- Theory of Mind, and
- Self-Aware AI.

Another set of classification, based on the intelligence capabilities of AI machines, groups them into

- Artificial Narrow Intelligence (ANI),
- Artificial General Intelligence (AGI), and
- Artificial Super Intelligence (ASI).



Source: atlearner.com

Reactive machines are first-generation AI machines that respond to a set of inputs but have no memory or learning capabilities. In other words, they cannot be relied upon to perform a new task based on lessons learnt from their past experiences. They can only perform specific input-driven functions.

Limited memory machines are distinguished from reactive machines by the data stored in their memory as reference information or experience-based datasets utilized in working out a solution to future problems. Virtual assistants and self-driving cars, among many others, are powered by limited memory AI.

In psychology, theory of mind refers to the fact that people have feelings, emotions and thoughts that affect their behaviour. Theory of mind AI is an AI that understands these vital variable layers of the human person to enable it understand, predict and interact with them. For example, a self-driving car will need some level of theory of mind capabilities to enable it relate safely with human-driven vehicles. Because of its complex nature, little progress has been made in this type of AI technology.

Self-awareness is one of the highest manifestations of intelligence. Theoretically, a self-aware AI will be an AI that exhibits the complexity and flexibility of the human brain. It is an AI that can think, feel and show emotions as well as understand the thoughts, feelings and emotions of individual human beings. This type of AI may only be fully realized in the future.

Artificial narrow intelligence (ANI) encompasses all AI systems that autonomously utilize human-like capacities to carry out specific functions. They are narrow in the sense that they can only perform what they are programmed to do, and nothing more. Reactive and limited memory AI systems fall under ANI.

Artificial General Intelligence (AGI) is an AI system that has the ability to perform exactly like real human beings, an AI that can think, learn, understand and draw conclusions like a human being – an AI that has the general and adaptive intelligence of a human being.

Artificial Super Intelligence (ASI) will hypothetically have super-human abilities as well as the competencies of human beings, thereby being superior to human beings in terms of intelligence, speed, decision-making and problem-solving abilities, among others. Many people are apprehensive that AGI and ASI AI systems, whenever they are realized, will threaten human civilization, as we currently know it.

African Governments' Level of AI Readiness

From the foregoing, it is clear that in various areas – mass education, healthcare-delivery, public transport and traffic management systems, and mass communication, among others – African governments can take advantage of the fast-growing AI phenomenon to fast-track their delivery of public utilities and services to their long-suffering populations. Currently, African government's level of artificial intelligence utilization outside the narrow sector of internal security surveillance is very low.

According to the African Development Bank, the institution behind African Public Service Delivery Index (PSDI), "Public service delivery is at the centre of economic and social progress everywhere". Gafar (2017) elaborates:

It is instructive to note that, the existence of any government is presumed on its ability to fulfill the basic necessity of lives of its citizens. Put differently, the existence of government is justifiable on the basis that it supplies crucial services such as security of lives and properties, maintaining orderliness, providing social amenities and infrastructure, and offer legal framework for conflicts prevention and resolution and acceptable system of justice. The conventional wisdom deduced here is that, the government fulfillment of its own part of social contract agreement with its citizen will automatically confer legitimacy on government, its activities and strengthen its institutions.

African governments can take advantage of AI capabilities to transform public-service delivery in their respective countries, hence our interest in UNIDO's Government AI Readiness Index 2022, the latest of such index published by the organisation. UNIDO, through the index, wants to stimulate governments, including African governments, to do more to harness the benefits of AI for their teeming populations. According to the Government AI Readiness Index 2022, from where thenceforth I will be quoting (unless otherwise stated):

The pace of change in AI capabilities has not been matched by the

response of governments... We need governments to rapidly roll out responsive regulatory regimes... We need governments to build their own technological capability so that these tools can be used to improve the services used by all. Public services can and should be delivered to a high standard, with the human experience in mind. It is a government’s responsibility to ensure the benefits are felt by all, not just a select few... Doing more starts with officials keeping up with global developments and learning what their peers are working on (Government AI Readiness Index 2022).

In order “to score governments on their readiness to implement AI in the delivery of public services”, the Government AI Readiness Index 2022 ranked 181 countries according to “39 indicators across 10 dimensions, which make up 3 pillars”. The pillars are:

- The Government pillar (which looks out for “a strategic vision for how it develops and manages AI, supported by appropriate regulation and attention to ethical problems”);
- The Technology Sector pillar (which examines how government “depends on a good supply of AI tools from the country’s technology sector, which needs to be mature enough to supply the government... Good levels of human capital—the skills and education of the people working in this sector—are also crucial”);
- The Data & Infrastructure pillar (which focuses on data availability, representativeness and infrastructure).

The global Government Artificial Intelligence Readiness Index 2022 indicates that no African country is ranked among the first 64 countries. Below is a list of the first ten African countries showing their global ranking in the Government AI Readiness Index 2022 and their scores or degree of readiness in terms of the three pillars mentioned above.

| Degree of AI Readiness of First 10 African Countries* | | | | | |
|--|-------------------------|------------------------|--------------------------|---------------------------------|---------------------------------------|
| African Country | African Position | Global Position | Sectoral Scores | | |
| | | | Government Pillar | Technology Sector Pillar | Data and Infrastructure Pillar |
| Egypt | 1 | 65 | 63.46 | 36.07 | 48.72 |
| South Africa | 2 | 68 | 37.90 | 37.60 | 67.73 |
| Tunisia | 3 | 70 | 48.63 | 36.92 | 54.87 |
| Morocco | 4 | 87 | 34.81 | 34.00 | 55.13 |
| Kenya | 5 | 90 | 40.36 | 28.76 | 51.95 |
| Rwanda | 6 | 93 | 53.28 | 28.14 | 39.19 |
| Nigeria | 7 | 97 | 44.91 | 23.08 | 49.31 |
| Botswana | 8 | 98 | 33.42 | 26.61 | 55.05 |
| Ghana | 9 | 104 | 47.22 | 22.82 | 39.65 |
| Benin | 10 | 108 | 48.40 | 22.99 | 36.12 |

* Table prepared by the author based on data sourced from *Government AI Readiness Index 2022*

The above table shows that Egypt, which ranks 1st among African countries, is placed 65th in the world. Sadder than the implication of that ranking for AI-enabled public-service delivery in Africa is the fact that apart from Kiribati, Haiti, Yemen, Syria and Afghanistan, African countries make up the last 30 countries on the 181-country Government AI Readiness Index of 2022.

Conclusion

AI-enabled systems are improving the quality of life and service delivery in many parts of the world and African countries need not be comfortable with lagging behind in the acquisition and utilization of this critical and speedily expanding technology. African governments should put the right policies in place, stimulate and support their technological sectors as well as inspire and demonstrate interest in AI capabilities by incorporating artificial intelligence in their public-service delivery systems.

References

Copeland, B. (2023, November 30). *artificial intelligence*. *Encyclopedia Britannica*. <https://www.britannica.com/technology/artificial-intelligence>

European Commission (EC). (2018). *Artificial intelligence for Europe*. <https://www.europeansources.info/record/communication-artificial-intelligence-for-europe/>

Gafar, B.B. (2017). The travail of service delivery and developmental failure in post-independence Nigeria. *Journal of Public Administration and Policy Research*, Vol. 9(3) pp. 26-33. <https://academicjournals.org/journal/JPAPR/article-full-text-pdf/FFD76E965850>

Gwagwa, A., Kraemer-Mbula, E., Rizk, N., Rutenberg, I., & De Beer, J. (2020). Artificial intelligence (AI) deployments in Africa: Benefits, challenges and policy dimensions. *The African Journal of Information and Communication (AJIC)*, 26, 1-28. <https://doi.org/10.23962/10539/30361>

<https://www.afdb.org/en/documents/african-public-service-delivery-index-psdi>

https://www.ask.com/news/artificial-intelligence-revolutionizing-world?utm_content=params%3Aad%3DdirN%26qo%3DserpIndex%26o%3D740004%26ag%3Dfw&ueid=C15BBFE4-1C9D-4FC2-A21D-01B78DB226C3

<https://www.berlinsbi.com/blog/the-power-of-ai-in-education#:~:text=AI%20can%20also%20help%20teachers,methods%20and%20improved%20student%20engagement.>

<https://www.ibm.com/topics/artificial-intelligence>

<https://www.ptvgroup.com/en/application-areas/ai-in-transportation#:~:text=reflects%20public%20distrust.,AI%20in%20traffic%20management%20systems,travel%20time%20and%20fuel%20consumption.>

https://www.unido.org/sites/default/files/files/2023-01/Government_AI_Readiness_2022_FV.pdf

Humphreys, L. G. (1979). “The construct of general intelligence”. *Intelligence*. **3** (2): 105–120. doi:10.1016/0160-2896(79)90009-6

Joshi, N. (2019). <https://www.forbes.com/sites/cognitiveworld/2019/06/19/7-types-of-artificial-intelligence/?sh=7504389f233e>

Legg, S. & Hutter, M. (2007). “A Collection of Definitions of Intelligence”. *Advances in Artificial General Intelligence: Concepts, Architectures and Algorithms*. Vol. 157. pp. 17–24.

OECD. (2019b). *Recommendation of the council on artificial intelligence*. OECD Legal Instruments. <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449>

Sharma, Radha R. (2008). *Emotional Intelligence from 17th Century to 21st Century: Perspectives and Directions for Future Research*. Sage Journals. Vol. 12.

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