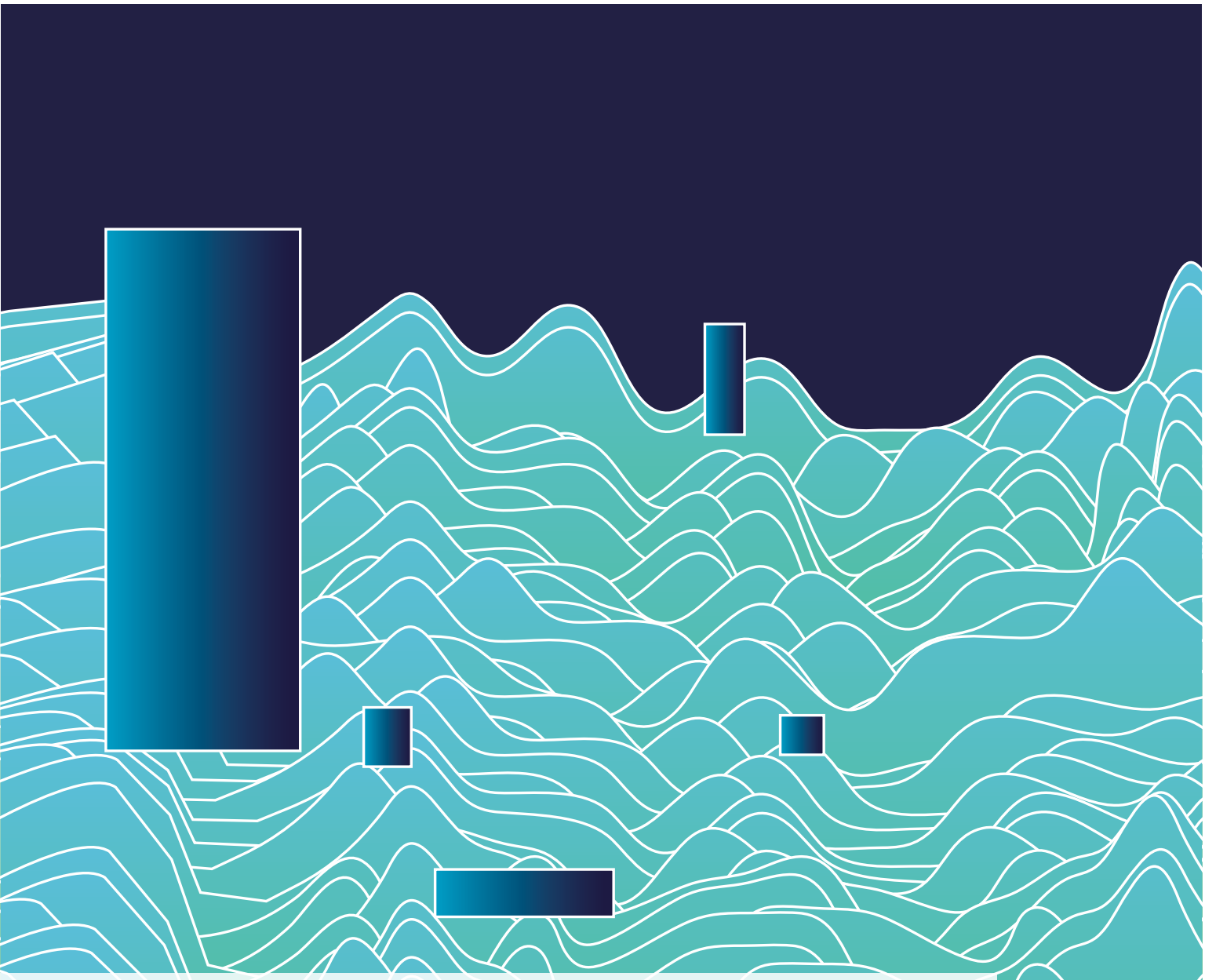

ARTIFICIAL INTELLIGENCE PRACTITIONERS' GUIDE: KENYA

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DIGITAL TRANSFORMATION CENTER KENYA

FAIR FORWARD
Artificial Intelligence for all.

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FOREWORD

These artificial intelligence (AI) guidelines for practitioners have been co-developed with the AI community in Kenya and come at a critical time in the country's development discourse, especially with increased focus on tech and digitization. We learned there's a large and highly progressive, but siloed AI sector in Kenya. Areas span tackling critical elements related to the building blocks of AI (infrastructure, data, capacity and skills, investments, and financing), the principles of responsible AI and enabling factors (tools, barriers, bias, risks, and harms), and the legal landscape for AI in Kenya (legislative, regulatory, and ethical environment, national policy, and institutional frameworks).

I invite you to read the guidelines to better understand the AI landscape and the specific recommendations made by the multi-stakeholder community of practice established by the Global Partnership for Sustainable Development Data and GIZ Kenya under the auspices of the GIZ "FAIR-Forward – Artificial Intelligence for All" project. The project focused on mobilizing the community to remove entry barriers to AI – access to training data and AI technologies for local innovations, bring the community together to strengthen local technical know-how on AI and contribute content that could lead to the development of policy frameworks ready for AI – ethical AI, data protection, and privacy. The partners were drawn from government, think tanks, academia, local and international non-governmental organizations, journalists, human rights advocates, civil society, private sector, and legal experts, among others.

In September 2023, the world will mark the midway point through the implementation of the SDGs, albeit set off track by the COVID-19 pandemic. According to the Sustainable Development Goals Report 2020, an estimated 71 million people were expected to be pushed back into extreme poverty in 2020, the first rise in global poverty since 1998. With decades of progress wiped away within the last three years, a lot more needs to be done to get back on track. What intrigues me is the assumption that we would have been better prepared for the pandemic in this digital era, but also recognize it is never that straight forward even with the increased availability and penetration of digital technologies.

With the worst of COVID-19 slowly ebbing away, other challenges remain. The global economic prospects are increasingly stark with a recession looming. The scale and magnitude of natural disasters is unprecedented partly due to the devastating impacts of climate change. In 2022, Kenya faced a devastating drought, with the National Drought Management Authority reporting that, as of January 2023, 22 of the 23 arid and semi-arid (ASAL) counties remain drought-critical due to the late onset and poor performance of rains coupled with four previous consecutive failed rainfall seasons. These are some of the issues development and AI practitioners now grapple with beyond access, sharing, and use of data, with questions around how to better equip decision-makers with lifesaving evidence for mitigation of potential impact of such disasters. Whereas the private sector has proactively embraced AI, testing and applying it in multiple areas ranging from predictive analytics, scenario planning, workflow processes and management, robotics, digitization and mechanization, the public sector remains miles behind in Africa and Kenya is not spared.

AI holds so much potential as an enabler and accelerator of development as we have learned from the community in Kenya while developing these guidelines, but remains least understood with many actors in the exploratory stage. We fortunately learned that great progress is being made in the industry and the challenge is not so much about AI as a technology, but several interrelated and critical components that will facilitate its application for timely and in-depth insights that spur decision-makers and other actors into action, while deriving learning that strengthens the enabling environment, fosters innovations, and minimizes barriers to entry and risks and harms in the Fourth Industrial Revolution.

Davis Adieno
Senior Director of Programs
Global Partnership of Sustainable Development Data

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Agnes Mwaura / Office of the Data Protection Commissioner

Alfred Ongere / AI Kenya

Alloys Siaya / Kenya Airports Authority

Angeline Wairegi, PhD / Strathmore University

Annita Mwagiru / Global Partnership for Sustainable Development Data

Benjamin Charagu / Open Institute

Betsy Muriithi, PhD / Strathmore University

Brian Omwenga / THiNK

Davis Adieno / Global Partnership for Sustainable Development Data

Dr. Lawrence Nderu / JKUAT

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Mary Naiduya / Office of the Ombudsman

Monica Okoth / KEBS

Natasha Ochiel / Ada Labs Africa

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Prof. Audrey Julia Waleghwa Mbogho / USIU-Africa

Richard Kiarie / Ministry of ICT

Rosemary Okello-Orlale / Strathmore University

Selina Ochukut / University of Nairobi

Sharon Obade / Office of the Data Protection Commissioner

Stacy Njimu / Strathmore University

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EXECUTIVE SUMMARY

Artificial intelligence (AI) is a key driver of the Fourth Industrial Revolution. PWC estimates that increases in productivity and consumption stemming from AI could contribute up to $15.7 trillion to the global economy in 2030, with the biggest economic impacts in North America and China and a modest increase among developing countries due to lower rates of adoption (PWC, 2017, n.p.). In many African countries, data collection and privacy reforms, infrastructure, education, and governance are needed to realize the benefits of AI.

Kenya, dubbed "Silicon Savannah," is among the handful of African nations where the application of AI solutions is gaining traction, thanks to a vibrant technology ecosystem that boasts more than 55 tech hubs. According to the 2021 United Nations Conference on Trade and Development's (UNCTAD) Technology and Innovation Report, Kenya is among the advanced developed economies, in addition to the United Kingdom and Russia, in utilizing Fourth Industrial Revolution technologies to address various challenges (UNCTAD Division on Technology and Logistics, 2021, p.27). Kenya ranks among the top five African countries, 78 globally, in the 2021 edition of the Government Artificial Intelligence Readiness Index (Oxford Insights, 2022, pp.44-46).

AI has the potential to play a critical role in tackling real-life challenges in sectors such as health, agriculture, climate, energy, and urban development in the country. Thus, African countries should adopt measures that integrate the adoption of AI in various sectors. For instance, advancements in digital technologies have necessitated legal intervention to meet the resultant challenges. Global tech players are keenly vested in Kenya's human resources and talent, which are built on our education, technical skills, creativity, experience, problem-solving skills, and personal resilience.

Kenya is the third most innovative economy in sub-Saharan Africa, behind Mauritius and South Africa. (Oxford Insights, 2022, pp.44-46). Therefore, this Artificial Intelligence Practitioners' Guide (the Guide) has been developed to address AI's disruption in the tech and legal sector in Kenya. The guide highlights legal frameworks and policies enabling the development of AI-sensitive communities, with well-defined Kenyan-led and -owned entities, as a global node for AI and machine learning growth. It also provides a vehicle for formalizing an independent oversight/advisory body to foster Kenya-led AI and informs

AI practitioners of relevant legislative, regulatory, and ethical frameworks. Further, it proposes legislative and regulatory reform to address barriers to AI for social good, thereby promoting a nurturing AI environment while safeguarding citizens' civil and privacy rights.

The legal resource guide highlights best practices and key legislative, legal, and regulatory considerations for diverse stakeholders seeking to apply AI in Kenya. The Guide discusses the building blocks of AI and how to operate ethically while deploying innovations. It also seeks to help AI practitioners understand the landscape, and for local and international tech entities to tap into the existing talent for developing and deploying emerging technologies. Expectedly, this guide will catalyze innovation work in Kenya and its presence in global tech. It seeks to turn the fear of AI into a trust in its ability to deliver to a country where economic security, food security, and safety remain important realities especially to the most vulnerable.

This practitioner's guide is a legislative and ethical starting point for anyone in Kenya, whether established entities, startups, or users, including young people, looking to utilize technologies to create efficiencies and, in turn, spur economic opportunities.

GLOSSARY

This Glossary introduces key terms in the field of artificial intelligence and is a resource for better understanding this guide and other related work throughout the industry.

Artificial Intelligence

The intelligence of a machine or computer that enables it to mimic human capabilities by processing large amounts of data, reasoning, and learning historical patterns from the data fed into the machine and, finally, analyzing and solving complex problems.

AI Systems

Systems with the capacity to process data and information with intelligent behavior (reasoning, learning, perception, prediction, planning, or control (UNESCO, 2021, p. 10.).

Developing computer-based systems that can behave like humans, with the ability to learn languages, accomplish physical tasks, use a perceptual apparatus, and emulate human expertise and decision-making (Laudon and Laudon, 2007, p.464.).

Intelligent Agent

Software program that uses a built-in or learned knowledge base to carry out specific, repetitive, and predictable tasks for an individual user, business process, or software application.

Intelligent Techniques Technologies

Aid human decision-makers by capturing individual and collective knowledge, discovering patterns and behaviors in large quantities of data, and generating solutions to problems that are too large and complex for human beings to solve on their own.

Startups

Businesses recently established, typically small, financed and operated by their founders, and often attempting to offer innovative solutions to a common, shared problem. NB: There is no agreed definition of a "startup." Companies as large as WhatsApp and Uber often call themselves startups (Select Committee on AI, 2018, p. 48).

Public Key Infrastructure

System for creating public and private keys using a certificate authority and digital certificates for authentication.

Information

Any record held by a public entity or a private body, regardless of the form in which it is stored, its source, or the date of production.

Fair Information Practices

A set of principles originally set forth in 1973 that governs the collection and use of information about individuals and forms the basis of most U.S. and European privacy laws.

Machine Learning

Technology that allows computers to learn directly from examples and experience in the form of data, where systems set a task, and are given a large amount of data to use as examples of how this task can be achieved or from which to detect patterns. The system learns how best to achieve the desired output. It can be thought of as narrow AI: machine learning supports intelligent systems, which are able to learn a particular function, given a specific set of data to learn from. Machine learning lives at the intersection of computer science, statistics, and data science. It uses elements of each of these fields to process data in a way that can detect and learn from patterns, predict future activity, or make decisions (Royal Society, 2017, p.5, 19).

Intellectual Property
Intangible property created by individuals or corporations that is subject to protections under trade secret, copyright, and patent law.

Algorithms
A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

Electronic Record
A record generated in digital form by an information system, which can be transmitted within an information system or from one information system to another and stored in an information system or other medium.

Open Data
Data published under a license with express permission to re-use, share, and modify (Royal Society, 2017, p. 49).

Big Data
Data sets with volumes so huge that they are beyond the ability of typical relational database management systems to capture, store, and analyze. The data are often unstructured or semi-structured.

Data Mining
Analysis of large pools of data to find patterns and rules that can be used to guide decision-making and predict future behavior.

Data Quality Audit
A survey and/or sample of files to determine accuracy and completeness of data in an information system.

Personal Data
Any information relating to an identified or identifiable natural person.

Sensitive Personal Data
Data revealing a natural person's race, health status, ethnic social origin, conscience, belief, genetic data, biometric data, property details, marital status, family details including names of children, parents, spouse or spouses, sex or sexual orientation.

Biometric Data
Personal data resulting from specific technical processing based on physical, physiological, or behavioral characterization, including blood typing, fingerprinting, DNA analysis, earlobe geometry, retinal scanning, and voice recognition.

Health Data
Data related to the state of physical or mental health of the data subject, including records regarding the past, present, or future state of health; data collected during registration for, or provision of, health services; and data that associates the data subject with the provision of specific health services.

Consent
Any manifestation of an express, unequivocal, free, specific, and informed indication of the data subject's wishes by a statement or by a clear affirmative action, signifying agreement to the processing of personal data relating to the data subject.

Anonymization
Removal of personal identifiers from personal data so that the data subject is no longer identifiable.

Profiling
Any form of automated processing of personal data to evaluate certain personal aspects relating to a natural person, in particular to analyze or predict aspects concerning that natural person's race, sex, pregnancy, marital status, health status, ethnic social origin, color, age, disability, religion, conscience, belief, culture, dress, language, birth, personal preferences, interests, behavior, location, or movements.

Personal Data Breach
A breach of security leading to the accidental or unlawful destruction, loss, alteration, unauthorized disclosure of, or access to, personal data transmitted, stored, or otherwise processed.

Computer Forensics
The scientific collection, examination, authentication, preservation, and analysis of data held on or retrieved from computer storage media in such a way that the information can be used as evidence in a court of law.

Artificial Intelligence Practitioner
An individual or organization that develops (including research, design, or provision of data for), deploys (including implements) or uses AI systems, excluding those who use AI systems in the capacity of end user or consumer (High-Level Expert Group on Artificial Intelligence, 2019, p.38).

Data Controller
A natural or legal person, public authority, agency, or other body that, alone or jointly with others, determines the purpose and means of processing of personal data.

Data Processor
A natural or legal person, public authority, agency, or other body that processes personal data on behalf of the data controller.

Data Subject
An identified or identifiable natural person who is the subject of personal data.

Identifiable Natural Person
A person who can be identified directly or indirectly, by reference to an identifier such as a name, identification number, location data, online identifier or one or more factors specific to the physical, physiological, genetic, mental, economic, cultural, or social identity.

Hardware
Processors, servers, sensors, sensor networks, embedded systems, tiny machine learning.

Software
Programming and development environments: languages, integrated development environments, operating systems, cloud computing, virtualization; business intelligence tools.

Metadata
Data about data, comprising information about a data set (Royal Society, 2017, p. 123).

High-Performance Computing
The practice of aggregating computing power in a way that delivers much higher performance than one could get out of a typical desktop computer or workstation, to solve large problems in science, engineering, or business (U.S. Geological Survey, n.d.).

Encryption
The process of converting the content of any readable data using technical means into coded form.

AI Developers
These include key developers of AI, AI start-ups, and AI companies including but not limited to, Oracle Kenya, IBM Kenya, Adanian Labs, AI Centre of Excellence, AI Kenya, Twiga Foods, and M-Shule.

AI Users
End users of AI products and services are key players in the sector and the most affected by the regulatory regime put in place.

CHAPTER 1 / THE BUILDING BLOCKS OF ARTIFICIAL INTELLIGENCE IN KENYA

In the context of this Artificial Intelligence (AI) Practitioner's Guide, AI is defined as:

> The intelligence of a machine or computer that enables it to mimic human capabilities by processing large amounts of data, reasoning, and learning historical patterns from the data fed into the machine and, finally, analyzing and solving complex problems.

The adoption of AI technology has transformed how the world operates. Whether AI-for-profit or AI-for-good, it continues redefining how we live, work, and socialize (Siyonbola, 2021, n.p.). In Africa, more and more actors are optimistic about its potential to transform the continent. Consequently, they are actively investing in technology to gain a slice of the AI market, solve some of the continent's most pressing challenges, and drive growth and development (Ngila, 2022, n.p.).

In Kenya, AI technology is transforming key sectors, including education, agriculture, health care, and government services, stimulating significant economic growth. For instance, in the education sector, M-shule, an SMS-based learning platform, aims to scale learning in Africa despite low mobile and internet penetration. The platform provides learners with self-paced and personalized learning courses and measures progress through quizzes and examinations.

Furthermore, Eska is an application that detects crop diseases and soil deficiencies in the agriculture sector.[1] The application enables farmers in Kenya to capture photos of their crops using a smartphone's camera. The application instantly diagnoses the crop's health and any issues with pests or diseases and displays the results (Youssefi, 2018, n.p.). The Government of Kenya is also on a digitization spree of public-sector services to provide access to fast, efficient, and round-the-clock delivery, for example, through the eCitizen (www.ecitizen.go.ke) portal. This digital portal allows citizens to renew their driver's licenses, apply for birth certificates, etc.

Despite the benefits that African countries could accrue from AI, many lack the critical building blocks for this technology to take hold in data collection and privacy, infrastructure, education, and governance. To a limited extent, Kenya, South Africa, Nigeria, Ethiopia, and Ghana are exceptions, as the conditions in these countries are increasingly favorable for the rapid adoption of AI technologies (Gadzala, 2018, p. 2).

This guide identifies the building blocks for the success of AI technology in Africa. These include AI infrastructure, data, capacity and skill, investments, and financing. AI practitioners should find this guide useful for exploring AI technologies in the region to advance sustainable development and inclusive growth.

[1] A technology developed by a botanist and biochemist.

1.1 Artificial Intelligence Infrastructure

Modern information technology (IT) infrastructure is crucial for trustworthy AI.[2] In a broader sense, infrastructure covers physical and information and communications technology (ICT) elements. The physical element includes laboratories (with equipment for simulation and implementation), physical storage, and data centers that can run workloads. The ICT element covers high-performance computing (HPC) clusters, servers, graphics processing units, and tensor processing units. Additionally, ICT encompasses stable and high-speed internet connections, high-speed computers, machines that can work in machine learning or image processing, mobile phones, reliable electricity connections, energy, broadband, and the availability of data from various sources.

Providers of such infrastructure in Kenya include Kenya Power & Lighting Company, Safaricom PLC, Zuku, Telkom Kenya, the Kenya National Bureau of Statistics, and the Kenya Open Data portal.

Additionally, AI infrastructure is based on hardware and software systems. The **hardware** includes processors, servers, sensors, sensor networks, embedded systems, and tiny machine learning (ML). The **software** includes programming and development environments, programming languages and integrated development environments, operating systems, cloud computing, virtualization, and business intelligence tools. Software is either open source (available to all) or proprietary (owned by an individual or company).

If choosing open-source software, one should consider platforms that are safety compliant and secure enough to protect assets and manage energy. Proprietary platforms offer less flexibility in terms of modes and understanding of how the protocols behind the platforms work, as these are not disclosed. In contrast, open-source platforms are flexible in terms of protocol and can be a financially savvy choice for practitioners who have started working with AI systems (Resource Data Management, 2018, n.p.).

The choice of software, servers, and storage can determine how well you can create and use AI systems, decrease the cost of data ingress and egress, and protect your data with a trustworthy AI framework (IBM, n.d.). Infrastructure not built for AI and hybrid cloud is not flexible enough to respond to AI system workloads and demands. As such, factors to consider when evaluating the infrastructure needs of a platform to be used include (Tim Group LLC, n.d.):

i. Computing capacity;
ii. Data aggregation, where consolidating data from multiple sources and storage are significant elements of AI applications that influence hardware design;
iii. Storage capacity;
iv. Networking infrastructure;
v. Security;
vi. Cost-effective solutions.

[2] AI infrastructure in this guide refers to infrastructure for machine learning, deep learning, natural language processing, and computer vision, as those are common types of AI focused on in Kenya.

1.1.1 Best Practices

For AI systems and infrastructure, it is vital to understand the minimum requirements for your needs to avoid paying hefty fees for the infrastructure you use. Furthermore, as the world continues to deal with a changing climate and each person's role in the degradation of the environment, energy needs, and offsets must be factored into the system being created or deployed. Therefore, it is important to set up infrastructure scalability and model maintainability in the framework of the AI system.

1.1.2 Enabling Factors

New technologies are advancing the characteristics defining the digital era: speed, granularity, and scale. Rapid technological trends, such as computing, bandwidth, energy, and analytical solutions, are all factors opening the doors for AI and setting the stage for innovations (Van Kuiken, 2022, n.p.). The AI sector in Kenya is growing and changing the IT landscape and how businesses, education, health care, and the public sector work. Coupled with global trends, several enabling factors in Kenya have led to this local growth:

- Increase in internet access and availability;
- The modularity of infrastructure, hardware, and microservices (low overall costs);
- Moore's Law (which has seen the cost of devices gradually reduce, making them affordable);
- Access to global infrastructure, e.g., cloud services (Amazon Web Services (AWS), Azure, Google Cloud, etc.);
- Provision of free credits for the training of practitioners;
- Availability and accessibility of open-source tools, with no license barriers;
- Big tech's inclusion of open-source programming languages on their platforms;
- Constantly improving human resource capacity, readily available with skills, e.g., data center management, developers, etc.;
- Availability of valuable products, such as early warning systems;
- Localized research centers, e.g., Microsoft Africa Research Institute (MARI), IBM Research, Kenya Education Network (KENET), High Performance Computing Systems (HPCs).

1.1.3 Barriers to Entry

Barriers to entry change as AI systems are updated, made efficient, and streamlined. Current infrastructural barriers in Kenya include infrastructure cost, which restricts AI creation and deployment. This includes HPCs, graphical processing units, gadgets, and other materials. In addition, there are little local infrastructure, e.g., HPCs and data centers, which makes their use expensive and limiting. Even where local infrastructure exists, it cannot compete with global products already on offer in terms of speed and capacity. Further, in some instances, it isn't easy to figure out which use cases or implementation systems best fit an organization. This leads to people in leadership or AI practitioners wanting to use AI but not necessarily understanding why or how they work.

1.1.4 Recommendations

AI infrastructure continues to blossom with the introduction of cloud computing and 5G internet access. There is a need for improvement in HPCs, data centers, and localized research centers. Recommendations for infrastructure development and use include:

i. Invest more in localized infrastructure, such as local HPCs and data centers.
ii. Consideration of infrastructure requirements to reduce cost.
iii. Co-sharing of infrastructure as much as possible to keep costs down.
iv. Consider climate change and energy sources when selecting and setting up infrastructure, bearing in mind that for many systems, monitoring, optimizing, and reporting your carbon footprint are a necessary part of the system life cycle.

1.2 Data

Traditionally, the data life cycle was clear, proportionately sequential, predictable, and often managed by a single organization. It was comparatively easy to erase data sets that were no longer in use or needed. Today, data creation, transmission, and storage continue at unprecedented levels. As data collection activities increase in speed, scale, and variety, and the analytics techniques used to process these data sets become more sophisticated, individuals and communities are affected in new and unexpected ways.

Emerging technologies are responsible for the generation of new ways to collect data, such as wearable devices, the Internet of Things (IoT), search engines, social media platforms, and individuals connecting to public Wi-Fi hotspots or using services such as on-demand taxis. Data is being captured deliberately and unintentionally, with large amounts increasingly available from various sectors and devices (British Academy and the Royal Society, 2017, p.49).

Mobile phones, sensors such as temperature and position sensors, company and government databases like the National Education Management Information System (NEMIS) or eCitizen portal, and individual, nonprofit, and academic organizations collect data in various formats (Royal Society, 2017, p.16). With this amount of data, new kinds of data analysis, such as machine learning, have exponentially increased the ability to link this data and use emerging patterns. These technological innovations have revolutionized several fields by extracting knowledge for data-driven decision-making.

Kenya's data and dataset availability have improved over the years. For example, open access to National datasets such as the 2019 KNBS Census dataset saw many organizations and individuals analyzing the census data, generating insights for different areas such as financial inclusion. This is a true testament to the growing knowledge of data analysis in the Kenyan tech and research space and a strong indicator that we will see more private and public organization efforts to provide easily accessible datasets.

Many data hackathons by tech communities and data organizations in Kenya also indicate a strong culture of dataset collection in Kenya. AI Kenya has been holding a series of National data hackathons in partnership with Zindi Africa (https://zindi.africa/). These data hackathons involve datasets collected from large enterprises such as Uber and Small enterprises such as Flare Emergencies. Thus, the absence of data sets allows Kenya to use the data for AI.

1.2.1 Best Practices

The increased complexity of data life cycles and entities has blurred the lines on who is collecting, managing, and storing the data. Therefore, one key best practice is to treat data life cycles as interconnected and interdependent open data networks (Royal Society, 2017, p.55-56.).

AI practitioners also need to be more data aware. Data awareness leads to better decisions regarding data creation, collection, structuring, combination, use, processing, altering, consultation, management, erasure, storage, and destruction (EU, n.d.). In addition, it's important to adhere to data principles such as the globally recognized FAIR Principles (GO FAIR, n.d.).

Below, we have elaborated data best practices in three key areas:

Data Collection

1. Collect a minimum data set for use. The best practice in each data collection activity is to collect only what is needed and relevant while adhering to privacy and data protection principles.
2. In the data life cycle, utilize the seven principles of privacy: lawfulness, fairness and transparency, purpose limitation, data minimization, accuracy, storage limitation, integrity, and confidentiality (security), and accountability (ICO, n.d.).
3. Anonymize sensitive attributes at source — especially where large amounts of personal data are involved. Further, ensure maximum use of the available, anonymized data with the minimum possible infringement on the privacy of individuals. For instance, in "anonymization" or "de-identification," a branch of data science, data sets are processed to efface as much data that pertains to individuals as possible while still maintaining the usefulness of the data set for the desired purpose (Select Committee on AI, 2018, p.31).
4. Safeguard against leakages during data handling.
5. When creating a project budget, include funds for data handling, including the costs associated with preparing the data and metadata (Royal Society, 2017, p.8).
6. The collection of data should not be extractive. Publicly funded data should be open; privately funded data could have minimum requirements for openness.
7. Data Controllers and Processors should conduct Data Protection Impact Assessments in conjunction with the Data Commissioner, particularly when processing data poses a significant risk to the rights and freedoms of the data subject.
8. Ensure compliance with international regulations and data laws such as the General Data Protection Regulation (GDPR).

Data Storage

1. Store data in an accessible format using open tools such as CSV. Data should be stored in machine-readable and editable formats and easily accessible to interested parties.
2. Ensure security at source, specifically primary data, to prevent alteration. This can be achieved through systems with audit trails, preventing unauthorized access and data redundancy, and monitoring existing storage references.
3. Record and report users' details when accessing sensitive data, e.g., personally identifiable information and GPS data, in protected areas.
4. Identify where you store your data. Consider elastic/mirroring, who the providers are, data center locations (e.g., Icolo, Safaricom; Liquid, Africa Data Center, KENET), the type of data you collect and store (i.e., whether government/public data), availability of the right infrastructure, and the cost. Issues of sovereignty and control of sensitive data should also be baked in.
5. Establish a personal data retention schedule that includes the reason for retention, the term of retention, a provision for regular data audits, and the actions done following the audit of personal data retained.

Data Access and Use

1. Data licenses are key to dictating the terms and conditions for access and use. Practitioners should identify licenses that work for their data. The Creative Commons License, Responsible AI Licenses (RAIL) guidelines are recommended.
2. The provenance of data needs to be considered in data access and use, and broadly for the entire data life cycle, as well as the significance of the practitioners' analyses. In the current field, where more people than ever are utilizing more data for different purposes, the standards associated with metadata need to be relevant to a variety of users.
3. Standards are necessary to govern metadata as it is transferred between systems by establishing from the outset where the data came from and how it will be processed and stored, for instance the Dublin Core metadata Initiative 2006. Many standards are presently used for metadata, creating confusion among the AI community, and reducing interoperability between systems. Therefore, an open standard for data frameworks needs to be created. The Government of Kenya needs to explore ways to catalyze safe and swift delivery of these standards to support AI growth in Kenya (Royal Society, 2017, p.55-56).
4. Anonymize sensitive attributes at processing to deal with threats of de-anonymization by linking datasets.
5. Adopt the models account (sampling/resampling), assess (bias indexes), and report bias in data, to determine corrective steps.

1.2.2 Enabling Factors

The key enabling factors leading to increased data creation, use, collection, storage, and transmission are:

- Ubiquity: Big data provides an opportunity for innovation, as data analysis is more efficient than other mechanisms.
- Government openness: The government makes more data available and updates such data through licenses that allow use and reuse.
- Interoperability: Datasets have components that make them unique but, at the same time, can be duplicated at a minimal cost, such as compute cost, which allows the sets to be utilized in multiple ways by various people without diminishing the value of the dataset.
- Infrastructure: Lower costs result in greater availability, including tools.
- Local workshops/events such as Data Hackathons: These sensitize and drive local data generation, access, and use.
- The skill within infomediaries is an enabler of data use.
- Access to reasonably priced computers/equipment.
- Increasing tech-savvy population.

1.2.3 Barriers to entry

AI is a journey that begins with data. Data-enabled technologies can provide research evidence, stimulate innovation and efficiency in public services, improve productivity, and deliver significant economic and wider social benefits to Kenya. However, several barriers hold back the production of innovations or the use of data for research, and include:

- Data curation is expensive: The cost and effort to create and distribute useful data are still quite high, especially for researchers who must collect the data themselves and need to provide a financial incentive to individuals participating in the research.
- Limited access: Access to data used by private companies such as mobile network operators or supermarkets is extremely expensive and difficult to obtain. Large technology corporations, often headquartered in the United States but with a global reach, have huge quantities of data that they collect and manage. This gives large tech companies a massive advantage in developing and applying AI systems compared to smaller competitors, public sectors, and academic researchers (Select Committee on AI, 2018, p.28).
- Privacy concerns: There is a trust deficit between individuals and state actors, as the roll-out of data-driven services and products is challenged by data rights concerns, such as privacy, which hinders collection and eventual access to that data.
- Skill gaps and lack of sensitization in data handling, management, and secure storage by data controllers and processors: As data management and availability have become more crucial, there is a greater need to bring in expertise in data handling, processing, and preparation for use and release (Select Committee on AI, 2018, pp.55-58).

1.2.4 Recommendations

The following recommendations relate to the use of data in Kenya:

- Adopt data dividends for commercial output. In this model, data subjects receive a share of the revenue from their data's sale and commercial use, e.g., through targeted advertising and other revenue-generating activities.
- Encourage local enterprises to democratize data to help address the risk of data monopolies (Select Committee on AI, 2018, pp. 44-46). Furthermore, to safeguard the interests of local companies, which have a late joiner disadvantage, the government should enact regulations on these market/competition factors with an inclination to support local tech growth.
- Establish data trusts to facilitate the ethical sharing of data between organizations. These trusts would monitor and supervise the sharing of data sets between organizations and companies. A data trust does not have to be a legal entity or institution; it can be a set of relationships between organizations to share data safely, fairly, and equitably (Royal Society, 2017, p.34).
- Encourage local industry players to increase their capacity for localized data storage and infrastructures, such as Liquid Telecom, Angani, Node, Safaricom, and tools, e.g., Ndovu Cloud.
- The Kenyan Government needs to increase the accessibility of public sector data in the spirit of open data, recognizing the value of strategic data sets.
- Data generated by non-governmental organizations, international non-governmental organizations, and publicly funded research should be open by default and curated in a way that allows for machine-driven analysis, which is critical in enabling wider use of research data (Royal Society, 2017, p.54).
- Comply with the Data Protection Act 2019 regarding data use, distribution, and storage.
- Encourage and support more events and workshops such as data Hackathons and data analysis trainings, which share knowledge on how to access, handle and gain insights from data.

1.3 Capacity and Skills

In Kenya, AI will create new job opportunities, accelerate efficiencies, and improve government/public services (Sey and Mudongo, 2021, p.3). The role of sensitization, for instance, at the organizational/leadership level to champion AI and identify use cases will significantly contribute to service/job/upskilling improvements. However, skills gaps (both technical skill and knowledge to govern the deployment of AI) inhibit the ability to leverage AI's opportunities and potential fully. The critical questions that need to be addressed while evaluating capacity building and skills for AI in Kenya are:

Key Questions

1. What are the existing skills gaps?
2. Are there skill gaps in industries such as universities, governments, and the private sector requiring training and re-skilling?
3. What are the open opportunities for skilling and upskilling?
4. What are the levels of capacity building/skills (novice, intermediate, etc.)?
5. Who are the trainers (e.g., foreign companies/organizations, local research centers specializing in training in AI)?
6. How do you navigate the volatility of AI technology changes (skills and capacity evolution)? Is there a framework for adaptive learning needed to cope with this evolution?
7. What is the future of learning and capacity building?

What is the current state of AI education in Kenya?

Local universities in Kenya provide training in standard mathematical, engineering, and computer science courses that are transferable to AI technologies. However, a clear translation of knowledge to actionable use cases in AI is needed. Some technical degree courses even have modules /units specifically tailored for artificial intelligence as a subject area. Additionally, universities and schools are rapidly introducing courses and degrees specializing in AI to develop frontier skills and AI capacity.

The following is a breakdown of examples of Universities and Schools engaged in training related to AI, with the courses offered, level, curriculum, and entry requirements, to provide insights into AI education in Kenya.

Strathmore University

Course Name
Intermediate Certificate in Data Science

Training Level
Short Course with Certification

Curriculum
Data analytics, SQl for data science, machine learning, GIS, statistics, Big Data Analysis

Entry Requirements
Experience in python for programming

Moringa School

Course Name
Data Science

Training Level
Short Course with Certification

Curriculum
Python for Data science.

Scientific Computing & Quantitative Methods.

Machine Learning.

Professional development

Entry Requirements
Basic understanding or strong background in math and statistics.

University/College education (ongoing students or graduates are more likely to join).

Jenga School

Course Name
Data Science Foundations and Core Course

Training Level
Short Course with Certification

Curriculum
Python for Data science.

Data Visualization, SQL, EDA, Feature Engineering.

Intro to AI, machine learning, deep learning

Soft skills.

Entry Requirements
University/college education

JKUAT

Course Name
Bachelor of Science in Data Science and Analytics

Training Level
Undergraduate

Curriculum
Computer Science foundational courses, Machine learning, Python programming, Application of ML in health, Agriculture, education

Entry Requirements
Mean Grade of C+ (C plus) in K.C.S.E (or equivalent examination) and a minimum grade of C (C plain) in Mathematics and English. Or, Two (2) principal passes in 'A' Level / Kenya Advanced Certificate of Education (KACE) with Credit pass in Mathematics.

Or, a degree or degrees in a relevant field from a university recognized by the Commission for University Education. Or, a Credit pass in a Diploma in Data Science recognized by the University Senate will join the programme in the first semester of the second year.

JKUAT

Course Name
M.Sc. Artificial Intelligence

Training Level
Postgraduate

Curriculum
Machine Learning, Natural Language processing, Data Engineering, ETL, Scientific Research in AI, Responsible and Ethical AI

Entry Requirements
Holders of a Bachelor degree in Computing/ Computer Science/Information Technology/ Computer Technology/Computer Engineering or related field of at least Upper Second Class Honours from a recognized University.

Holders of a Bachelor degree in Computing/ Computer Science/Information Technology/ Computer Technology/Computer Engineering or related field of Lower Second Class Honours from a recognized University with at least three years' experience.

USIU-Africa

Course Name
Bachelor of Science in Data Science and Analytics

Training Level
Undergraduate

Curriculum
Disciplines in computer science, mathematics, modeling (applied mathematics) and statistics.

Research methods.

Language.

General education electives

Entry Requirements
C+ (KCSE) holders

2 principal passes in KACE or EACE.

5 upper-level passes at IGCSE/IB

5 credits in any 5 subjects at O Level or A Level passes of C at GCE.

Kenya National Examination Council diploma or equivalent.

University of Nairobi

Course Name
Master in Computer Science (Computational Intelligence Specialization)

Training Level
Postgraduate

Curriculum
Language Technologies.

Data Analytics and Business Intelligence.

Embedded Intelligent systems.

Image and Vision Systems.

Intelligent Systems Applications Development

Entry Requirements
Degree in computer science, Engineering, Mathematics, Physics and statistics

Strathmore University

Course Name
Master of Science in Data Science and Analytics

Training Level
Postgraduate

Curriculum
Business analytics (Business Intelligence and Big Data in Finance and Banking).

Computational statistics (Optimization for Data Science and Bayesian Statistics)

Entry Requirements
First Class or Upper Second Class honors degrees in Statistics, IT, Commerce, Economics or Finance.

Lower Second Class degrees and postgraduate diplomas or certificates, or with at least two years' work experience

1.3.1 Best Practices in Capacity Development

Universities should devote urgent attention to recruiting outstanding research leaders in AI. This academic leadership is crucial to inspiring and training the next generation of AI research leaders. The best practices adopted in capacity development and skill building in relation to AI include mapping out industry needs, skill sets, the people to be trained, and the levels of training available (Royal Society, 2017, p.72).

To facilitate the necessary integration of academia, government, and industry, embracing the importance and value of a diverse AI workforce is necessary. This requires breaking down stereotypes and broadening participation (Royal Society, 2017, p.73). Benchmarking, exchange programs, and training to meet needs, for example, IBM Africa skills development training, is another best practice for establishing the role of tech giants/major players in AI development. It has also proved crucial to harness and maintain talent locally to avoid brain drain while encouraging knowledge sharing across Diasporas.

1.3.2 Enabling Factors

The enabling factors for capacity development in Kenya include:

- Skilled practitioners to develop AI: The industry is constantly evolving, providing opportunities for both new entrants and existing talent who are upskilling to keep up with the changes in the sector. As a result, AI attracts interest from young people seeking to diversify their skills and employment (Hall and Pesenti, 2017, p.4).
- Universities and research centers: These are foundational for developing skills and knowledge in AI.
- Informal training: Learning to create or deploy AI systems has become relatively affordable through informal training, such as online courses. Further, several affordable options are available to practice what has been learned, with some available for free (ai.nl, 2021).
- Communities of practice such as Ai Kenya: These help with the continued growth of existing or new skills necessary for AI systems and provide a support system to keep learning and gaining greater knowledge and skills capacity.

1.3.3 Barriers to Entry

Barriers to entry into AI in Kenya include:

- Specialized training: Despite growing interest in AI, it remains a relatively specialized field, and it remains difficult to obtain formal employment or the recognition of skills without a bachelor's degree. This is prohibitive to individuals who cannot afford higher education.
- Expense: While specializations can help distinguish workers within broader fields, keeping up with changes can become expensive. The cost of gaining skills in this field is relatively high, including Ph.D. research, self-learning certificates and licenses, computing power/resources, and data access.

1.3.4 Recommendations

- Leverage tech communities as a gateway for supporting new practitioners in the field as they learn best practices and participate in peer-to-peer learning in both formal and informal settings. These communities can attract new talent to the sector who are interested in participating but do not have the qualifications to undertake formal training, such as a bachelor's, master's, or doctorate degree.
- Schools at all levels need to ensure that key concepts in AI are taught to those who will be users, developers, and general citizens. In addition to the pertinent areas of mathematics, computer science, and data literacy, AI's ethical and social implications should be included in teaching activities in related fields. Doing so will build trust in AI across the board and provide a foundation for all STEM courses.
- Develop a pipeline of informed practitioners or users. The most credible and effective mechanism for doing so will likely be for academic institutions and governments to endorse and champion advanced courses that those working across a range of sectors can use to pick up AI skills at a high level. This is in parallel with encouraging approaches to AI training via massive open online courses (MOOCs), continuing professional development (CPD), and short courses, aiming to increase the pool of informed users of AI.
- Practitioners shouldn't specialize too early. It is important to figure out which aspect you are interested in and are good at and then forge a path to specialization (Warren, 2020, n.p.).

1.4 Investments and Financing

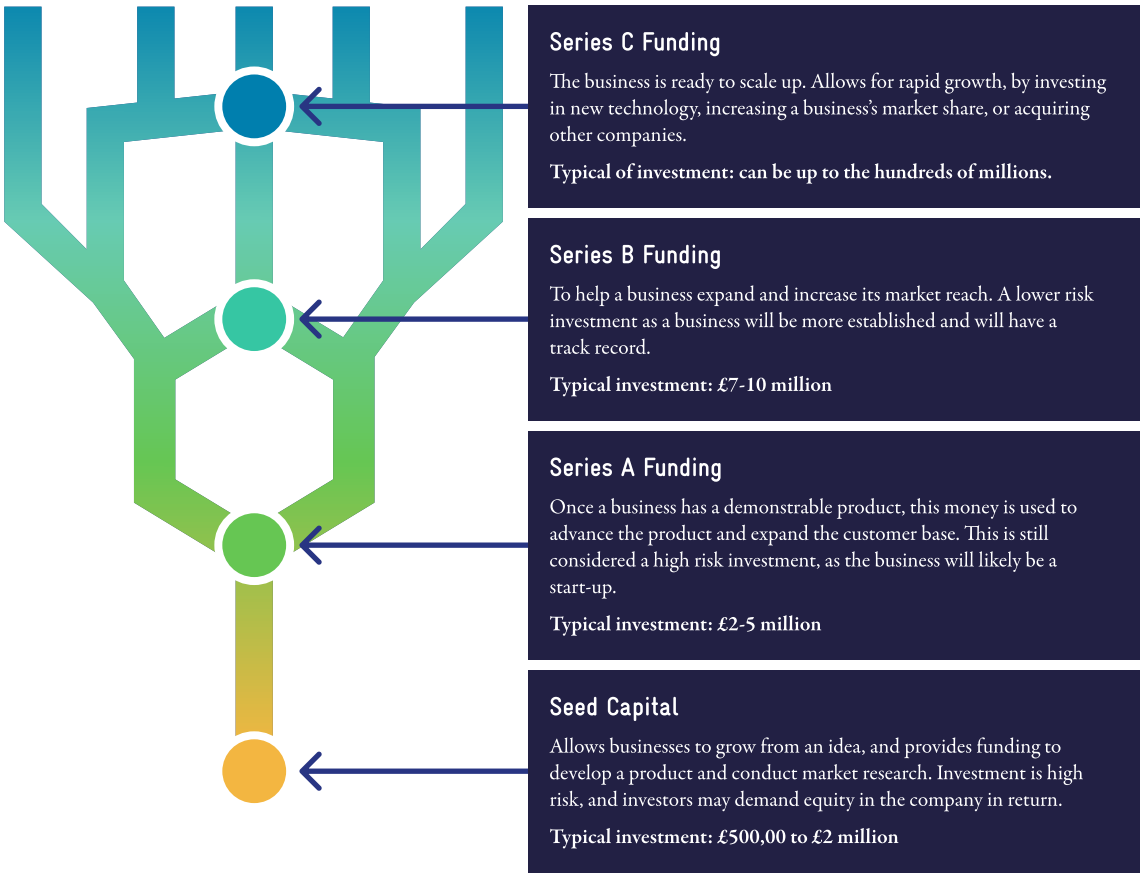

Figure 1: Example of Investment Rounds (Select Committee on AI, 2018, p.50).

Investments and funding are vital to AI startups as they ramp up, and this growth aspect must be approached thoughtfully. It raises questions about the current investors, whether local or foreign, the source of financing, and how this ultimately impacts AI and its development locally. There are opportunities for more solutions to be built for the "good." As an AI practitioner, key questions to answer include:

1. At what point do you need investment/financing?
2. What types of investments/finance opportunities are available (i.e., in-kind contributions, equipment, credits for computing resources, loans, grants, crowdfunding)?
3. What form of partnerships should be adopted to ensure saving costs across different needs of an AI startup/ project?

1.4.1 Best Practices

- Ensure that the solution/product meets the market's needs.
- Consider undertaking feasibility studies and market analysis.
- Achieve clarity on the goal of your product, and bear in mind global practices, rules, and regulations on the various aspects such as data—for example, the U.S.'s Health Insurance Portability and Accountability Act (HIPAA) regarding patient information, the European Union's General Data Protection Regulation (GDPR), Kenya's Data Protection Act 2019 that gives effect to the right to privacy and the protection of personal data in Kenya and Kenya Information and Communication Act which drives the development of the country's information and communication sector as well as e-commerce.
- As a startup in the AI space seeking investment, focus more on the outcomes that the technology achieves, which would make investors better understand the value of the proposed AI solutions.

1.4.2 Enabling Factors

- Local investment funds for startups: These have been a primary enabler, with examples such as Standard Chartered Bank's Women in Tech program and Total Energies' Startup of the Year Challenge and awards for startups.
- Increased AI-related skills: This has resulted in a willingness to invest and fund various AI projects and research, increased awareness among local investors, and created a shift toward AI and technology.

1.4.3 Barriers to Entry

- The local environment: This is not conducive to entrepreneurship, as there are still restrictive and bureaucratic structures around this sector, including challenges in uptake.
- Lack of awareness about funding opportunities: Local accelerators and incubators are not offering to fund (House of Lords Select Committee on AI, 2018, p.50-54), and there is perceived bias around accessing investment and finance.
- Limited knowledge of intellectual property rights, terms, and conditions: This results in little or no bargaining power for terms and conditions in product agreements.

1.4.4 Recommendations

- Develop mentorship through participating in forums such as investment summits and events that create awareness of funding opportunities.
- Build your investing skills by learning aspects such as proposal writing, pitching, intellectual property rights, and how to bargain on terms and conditions.
- Increasing and organizing Africans-for-Africa-led Venture Capitals. According to Crunchbase Report, Africa's VC landscape continues to become more African with increasing numbers of investment funds being based and headquartered in the continent and run by locals (TechCrunch, 2018, n.p.).

CHAPTER 2 / PRINCIPLES OF RESPONSIBLE AI

Responsible AI (also referred to as ethical or trustworthy AI) is a standard for ensuring that AI is safe, trustworthy, and unbiased. It is a holistic discipline relating to what you build; why and how you build it; the long-term implications of AI for your customers, staff, and society; and the governance of AI. Stakeholders in Kenya agree that AI can unlock social and developmental benefits in the country's diverse sectors.

The community of practice convened to develop this guide confirmed that many initiatives are testing concepts and ideas in AI, deriving critical learning that will shape the industry; inform legal, policy, and regulatory agendas; and promote the mainstreaming of AI for social good. Consequently, with numerous advancements in the sector, critical questions arise, as there are widely recognized benefits and harms with emerging risks.

Stakeholders hold differing views on the relative importance of different proposed characteristics for responsible AI. Standardizing terms and a conceptual framework for responsible AI would enable clear, unambiguous communication between stakeholders so that these different perspectives can be understood and resolutions can be sought. Such synchronization would address how different stakeholders can be affected/impacted by AI technology deployed in a project, product, or service; how any assets that different stakeholders value are used or affected using AI in a project, product, or service; and how the use of AI in a project, product, or service relates to values held by different stakeholders.

This chapter focuses on clarifying definitions and concepts around responsible AI and prescribing a set of principles that can guide practitioners in navigating this complex yet critical subject.

2.1 Definition of Terms

As an AI practitioner, you will repeatedly interact with key terms in building responsible AI. These terms are specifically defined under this Chapter as they relate to the basics of the adoption of responsible AI, as follows:

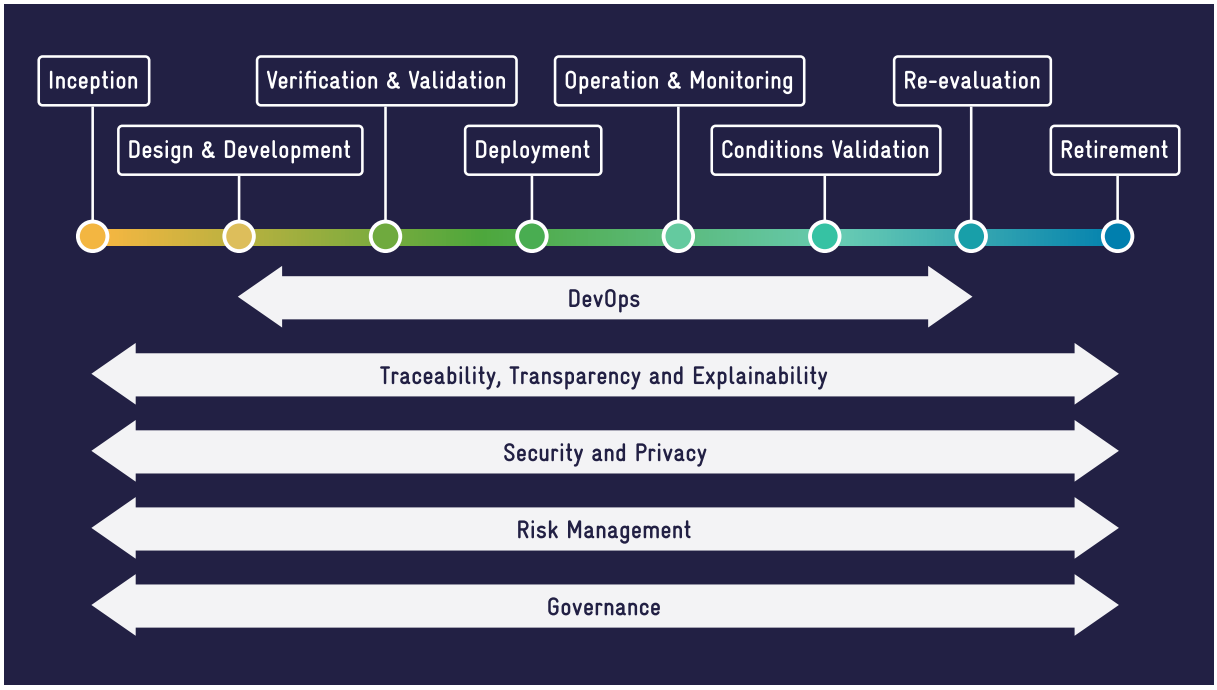

Figure 2: Terms on key processes/steps in the AI system lifecycle

AI System Life Cycle

The evolution of an AI system from inception through retirement.

Bias

Systematic difference in treatment of certain objects, people, or groups compared to others.

Corporate Innovation System (CIS)

A system organized and controlled by a dominant firm but also constituted by a multitude of more or less subordinate firms and knowledge institutions that participate in multiple production and innovation processes (Rikap and Lundvall, 2021, pp.43-63).

Exclusion

This happens when an important data point is left out of the data being used, something that can happen if the modelers do not recognize the data point as consequential.

Innovation

A new or improved product or process (or a combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process) (OECD, 2018, p.1).

Localization of AI

Democratizing products, tools, and services to work in their respective markets. AI can be trained with localized data by collecting and curating data sets that reflect cultures in different markets. One example would be creating a Swahili chat-bot in countries where Swahili is the local language.

Principles of AI Ethics

General best practices, such as AI is not biased, AI is good for people and the planet, AI should not harm citizens, AI is in service of humankind, explainable AI, etc.

Responsible AI

Involves designing, developing, and deploying AI with good intentions to empower all, allowing companies to engender trust and scale AI with confidence. As a standard, it ensures that AI and machine learning models are robust, explainable, ethical, and efficient.

Risk

The effect of uncertainty on objectives that could cause loss or unexpected negative results.

Safety

Freedom from risk that is not tolerable or predictable.

Security

The degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

Transparency

Involves providing visibility to the features, components, and procedures of an AI system and making data, features, models, algorithms, training methods, and quality assurance processes available for external inspection.
A transparent AI system exhibits repeatable, traceable behavior and enables stakeholders to assess the development and operation of the system against the values they wish to see upheld by AI processing. These values can be based on goals of fairness or privacy or derived from a particular stakeholder's ethical worldviews, such as virtue ethics or other global value systems.

2.2 Why Responsible AI?

Responsible AI establishes rules, standards, and governance structures around artificial intelligence. This offers guidance in determining whether and how to go about procuring, designing, building, using, protecting, consuming, and managing AI and other advanced analytics. Thus, responsible AI ensures that AI practitioners create efficient AI systems, can track and mitigate risk and bias in AI models, and can ensure development processes consider ethical, legal, and societal implications. Most importantly, it can prevent/minimize the negative effects of AI.

The Negative Aspects of Artificial Intelligence

As part of promoting and ensuring Responsible AI, practitioners cannot ignore the dangers posed by AI. Some of the negative implications AI may exhibit and that practitioners should consider while building AI systems and programs include:

Opaqueness	Artificial intelligence models can be technically opaque, in that the decision procedures it uses are not easily interpretable by humans. The data and data sources may not be transparent, and as such, the whole system's behavior becomes opaque to an outsider. Given that AI systems are always implemented in the context of organizational practices, such as data collection, management, operationalization of AI results, and system development, where these practices are undisclosed, even an interpretable AI model becomes an opaque system to users and other external stakeholders.
Bias	Bias occurs as a consequence of erroneous assumptions about the Machine Learning process. Literature now shows that bias in AI bias is deeply rooted in individual human, systemic, and even institutional biases as well.
Misapplication of AI systems	AI systems that demonstrate realistic human behavior can be designed to impersonate or emulate human characteristics and behaviors, such as handwriting, voice, and spoken or textual conversations. These technologies can be used to deceive individuals if exercised with ill intent. For example, chatbots and email bots have emulated humans to create the illusion of real human membership in a dating service.
Economic impacts, labor shifts, inequality, and technological unemployment	Even though AI strengthens revenue flow for industry, the economic divide between compliant and non-compliant sectors continues to widen. This has also been witnessed for outsourced firms (typically in the Global South) where gig and other workers employed in data annotation are paid poorly and have poor working conditions. Similarly, manual process workers can become redundant to AI automation.
Lack of emotion	Artificial intelligence today lacks emotional intelligence, thus making it possible that some of the decisions/information it generates may be perceived negatively and not acceptable by human standards.

Case Studies of Human Rights Breaches by AI

1. With the onset of the COVID-19 pandemic, the Chinese Government funded private tech companies to jointly develop an app that determines who needs to quarantine and for how long. The app assigns users one of three colors: green (unrestricted movement), yellow (seven days of quarantine), and red (fourteen days of quarantine). Users must scan a QR code to enter buildings (including their homes), go to the supermarket, or use public transport. Human rights organizations have raised concerns that the app shares data on users' locations with the police and that the app's decisions can be arbitrary and difficult to appeal, leaving some individuals confined to their homes indefinitely (Human Rights Watch, 2020, n.p.). South Korea, Singapore, Germany, France, Australia, and India have also piloted or adopted mobile phone apps to support COVID-19 contact tracing (Huang, Sun, and Sui, 2020, n.p.).
2. In early 2018, Facebook admitted to mishandling data from over 50 million users, allowing political data analytics firm Cambridge Analytica to obtain profile information improperly. Harvesting personal information on where users lived and what pages they liked, Cambridge Analytica built psychological profiles that analyzed characteristics and personality traits later deployed in political campaigns (Insider, 2018, n.p.).
3. On March 23, 2016, Microsoft released its AI-based chatbot, Tay, via Twitter. The bot had been trained to generate responses based on the interactions it had with users. When users started directing offensive tweets toward the bot, Tay began making replies in kind. Consequently, less than a day after the initial release, Microsoft took Tay offline and apologized for the bot's controversial tweets. The bot turned into a racist, sexist hate machine (The Verge, 2016, n.p.).

2.3 Principles of Responsible AI

Responsible AI encompasses three basic ethical principles: respect for persons, beneficence, and justice. These principles serve as the basis for many ethical prescriptions and evaluations of human actions, they are generally accepted in our cultural tradition, and they are particularly relevant to the ethics of research involving human subjects (Ryan et al., 1979, p.3).

These basic ethical principles are described in more detail below:

Respect for Persons

Respect for persons incorporates at least two ethical convictions: first, that individuals should be treated as autonomous agents, and second, that persons with diminished autonomy are entitled to protection. The principle of respect for persons thus divides into two moral requirements: acknowledging autonomy and protecting those with diminished autonomy.

Beneficence

Beneficence is often understood to cover acts of kindness or charity beyond strict obligation. It entails respecting people's decisions, protecting them from harm, and ensuring their well-being. Two general rules have been formulated as complementary expressions of beneficent actions in this sense: (1) do no harm and (2) maximize possible benefits and minimize possible harms.

Justice and Fairness

This principle has two aspects. The first is justice at the macro level—economic and innovation systems. Philosopher Michelle Maiese defines justice as "action in accordance with the requirements of some law" (Maiese, 2003, n.p.). She identifies four types of justice:

- Distributive (economic) justice is "concerned with giving all members of society a "fair share" of the benefits and resources available."
- Procedural justice "is concerned with making and implementing decisions according to fair processes that ensure 'fair treatment.'"
- Retributive justice espouses "the idea that people deserve to be treated in the same way they treat others."
- Restorative justice "is concerned with healing victims' wounds, restoring offenders to law-abiding lives, and repairing harm done to interpersonal relationships and the community."

In Kenya and Africa, distributive justice underpins the most fundamental dilemma faced by decision-makers as they establish the rules to govern AI.

The second aspect of justice is at the micro level. It focuses on bias and responsible AI, which seeks to answer the question, "Who ought to receive the benefits of research and bear its burdens?" This is a question of justice in the sense of "fairness in distribution" or "what is deserved." An injustice occurs when some benefit to which a person is entitled is denied without good reason or when some burden is imposed unduly. Another way of conceiving the principle of justice is that equals should be treated equally.

Several widely accepted formulations of just ways to distribute burdens and benefits exist. These formulations are (1) to each person an equal share, (2) to each person according to individual need, (3) to each person according to individual effort, (4) to each person according to societal contribution, and (5) to each person according to merit (The Belmont Report's Ethical Principles and Guidelines for the Protection of Human Subjects of Research, 1979). Each formulation mentions some relevant property based on which burdens and benefits should be distributed.

Technology rapidly changes lives through economic models, work relationships, and other factors. This disruption brings many opportunities but can also be a source of anxiety, especially for marginalized communities/individuals who are often left behind.

Aside from the basic ethical principles discussed above, AI practitioners must be conversant with the core principles of FAIR AI principles. However, they may vary from one organization to another, including their interpretation and operationalization. The following key principles were widely discussed for this guide and eventually adopted.

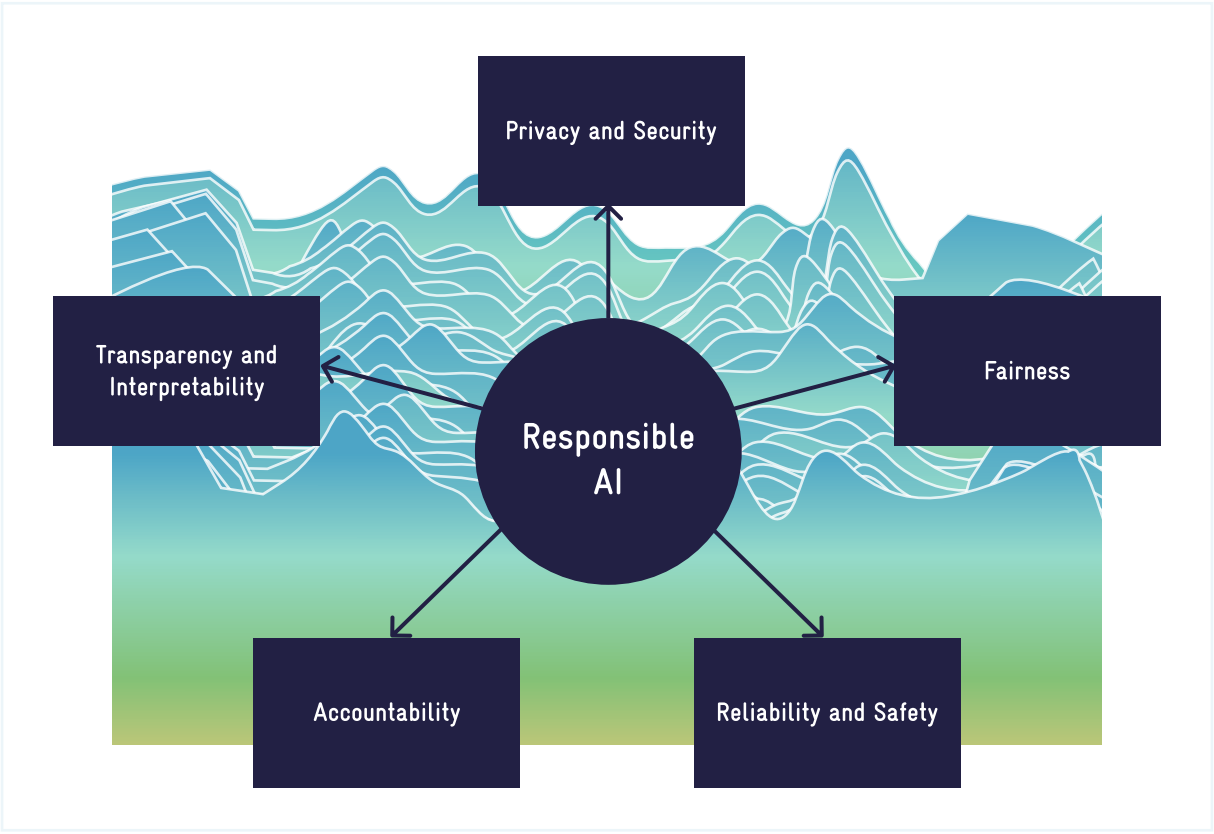

Figure 3 : Responsible AI Principles (Dignum, 2022, n.p.)

2.3.1 Accountability, Transparency, Explainability, and Sustainability

a. AI must be accountable for its decisions. The logic of decision-making must be open to scrutiny and explained by the AI to users.

b. It is important for you as a practitioner to consider if you and your team can explain the overall decision-making process and the individual predictions generated by your AI. Clearly define the roles and responsibilities of individuals accountable for AI development.

2.3.2 Fairness and Accessibility for All

a. AI systems should treat everyone equally and be available to people from all walks of life and diverse accessibility levels.

b. Some of the questions to answer as a practitioner are: Is your AI fair? Is there any bias in training data? Are those responsible for developing AI systems fair-minded?

2.3.3 Surveillance, Privacy, and Civil Liberties

a. AI should avoid the unsolicited observation of one's person, activities, properties, or location.

b. AI systems should be able to protect private information and resist attacks like other technologies.

c. Questions to answer include: Is AI technology violating anyone's privacy? How will your AI system protect and manage privacy? How do you protect data against attacks and confirm the security of your AI?

2.3.4 Diversity and Gender Equality

AI must not promote bias toward persons of a particular gender and other typically excluded demographics (youth, people living with disability, the poor, etc.).

2.3.5 Data capacity, Analytics, Protection, and Governance

a. Data collected for AI use or generated by AI should be collected correctly and governed effectively to prevent loss, damage, and unapproved access.

b. Can you identify the governance models for your AI systems?

2.3.6 Political Manipulation and Computational Propaganda

Practitioners should measure the extent to which an AI is utilized for political manipulation and identify measures to mitigate against consequent effects.

2.3.7 Reliable and Safe AI Systems

a. Follow the principle of trustworthiness and privacy. This requires clearly defining testing and governance criteria to prevent AI systems from being hacked easily

b. Practitioners must conceive and implement, alongside every use case, a protocol to secure the safety of humans against rogue or erratic AI. Key questions include: Is your AI system reliable and stable? How can it cause/be used to cause harm? Does it meet performance requirements and behave as intended? Can you govern and monitor the powerful AI technology?

2.3.8 Human Dignity, Autonomy, and Psychological Impact

a. Identify how human dignity is impacted and how the psychological effect of the loss of autonomy can be mitigated while efficiently harvesting AI's benefits.

b. Practitioners must identify possible outcomes of incorrect predictions, especially when they are automating critical processes that can impact human lives, such as finance, health, transport, etc.

2.3.9 Algorithmic Errors

Measure instances and extent of computational and algorithmic errors committed by AI and the mitigation measures that can be employed.

2.3.10 Carbon Footprint

Machine learning, especially image data-crunching deep learning AI, consumes huge amounts of energy. The resulting carbon footprint ought to be measured and mitigated. Renewable energy may be suitable for high-performance computing devices.

2.3.11 Cultural Sensitivities

An AI must respect the cultural sensitivities of the user community. For instance, some communities do not allow the researcher/developer to collect data directly from women. Therefore, the developer needs to guarantee no bias in terms of gender. Primary sources of ethical and societal concerns include but are not limited to:

- Unauthorized means or measures of collection, processing, or disclosing personal data;
- The procurement and use of biased, inaccurate, or otherwise non-representative training data;
- Opaque machine learning decision-making or insufficient documentation, commonly referred to as lack of explain-ability;
- Lack of traceability;
- Insufficient understanding of the social impacts of technology post-deployment.

2.4 Tools in AI Practice

Aside from conforming to the principles of ethical AI, another best practice in using and deploying AI involves identifying tools that actors can use in the policy process with a focus on AI. Such tools can be applied in the four steps of the policy process model: problem definition, policy formulation, policy implementation, and policy evaluation. Importantly, different tools can be used to address dilemmas at one or more steps of the policy process model, focusing on AI. Some useful tools and steps are the Tony Blair Institute for Global Change's AI Toolkit, 2022, GAEIA Ethical Dilemma Template (GAIEA, 2022, n.p.), Constructions of Public Office Kenya Scenarios, and the Kenya National Action Plan on Business and Human Rights (Office of the Attorney General and Department of Justice, 2020, n.p.).

Examples of Tools

Responsible AI Licenses

Responsible AI Licenses (RAIL) empowers developers to restrict their AI technology's use to prevent irresponsible and harmful applications. RAILs restrict AI and ML software from being used in a specific list of harmful applications, such as surveillance and crime prediction while allowing other applications.

To empower developers to prevent the software they write from being used in harmful applications, there are two sample RAILs: an end-user license (which governs how customers use the software package) and a source license (which allows developers to gain most of the benefits of open source while mitigating the risk of releasing powerful code into the wild for anyone to use). Using the license gives AI and ML developers and tech providers legal rights to prevent any undesired application of their code/software. (Responsible AI Licenses, n.d.)

2.5 Enabling Factors for Good AI Practices

Below are key enabling factors and relevant stakeholders contributing to developing and promoting good AI practices, of which AI practitioners should be cognizant.

- **Data availability and clarity:** Data is at the very core of AI, as it is instrumental in deriving insights. It plays a key role in training and running productive AI algorithms. AI requires high volumes of data, but for effective AI modeling, that data must be clean and well-described, which might require considerable effort in data transparency and cleaning.
- **Skilled talent:** Data science, machine learning, data engineering, data analysis, and project management are key fields for the rise of AI. Increased interest in these areas is evident in the new courses offered in leading higher education institutions, such as certificates and bachelor's and master's degrees in data science. Furthermore, our country's population is predominantly youthful, offering a large pool of workers with the potential for upskilling in AI.
- **AI ecosystem:** The presence in Kenya of key tech players, including government, civil society organizations, academia, development partners, and industry, creates optimal conditions for developing intelligent systems successfully. Because people are at the center of AI, this is possibly the most important enabler.

Stakeholders in the adoption of best practices and principles for ethical AI

AI stakeholders in Kenya have varying and intersecting interests, responsibilities toward the growth of AI, and degrees of impact from AI technologies:

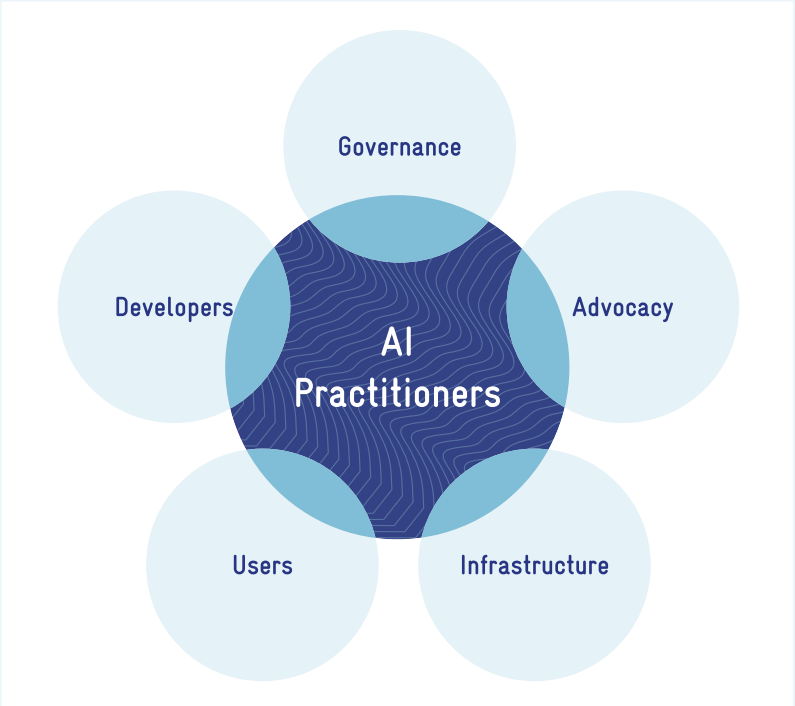

Figure 4: Key AI Practitioners (Authors, 2022)

Stakeholder	Description	Potential Role in the implementation of various principles
Government (Includes The Distributed Ledgers Technology and Artificial Intelligence Taskforce, the Ministry of ICT and all its agencies, the Judiciary, the Office of the Data Protection Commissioner (ODPC), the Central Bank of Kenya, the Commission on Administrative Justice (Ombudsman), The Kenya copyright board, Kenya Industrial Property Institute, and the Competition Authority, Other ministries, departments and agencies, including county governments).		
Tech rulemaking bodies	Regulatory bodies directly oversee the development and use of technologies such as AI.	AI safety
Legislative bodies and representatives	Enacting funds and passing regulations usually require legislative action.	Surveillance, privacy, civil liberties, political manipulation, and computational propaganda
Other ministries, departments, agencies and county governments	They are potential consumers of AI services and solutions	Lead in deploying AI in various health, energy, justice, and agriculture sectors.
Research and advocacy		
Academia	Many strategies strongly focus on developing a burgeoning AI research ecosystem, which requires academic support and engagement.	Human dignity, autonomy, and psychological impact
Civil society organizations	Various organizations advocate for special interests, rights and independent issue research.	Accountability, transparency, explain-ability, sustainability, diversity, and gender equality
General public and individual contributors		
Tech and tech ethics leaders	Impossible to promote/ regulate tech without understanding the current state of play from both the tech-capability perspective and the ethical lens.	Data capacity, analytics, protection, and governance
General public	Most effective democratic rulemaking happens with an open call for public consultation.	Accountability, demand for better AI products

Figure 5: Key AI Practitioners (Authors, 2022)

2.6 Barriers to the Adoption of Good AI Practices

There is a need to define and map out innovation to identify barriers restricting AI best practices and ethical principles adoption. This can be done using an innovation systems approach as a framing device. Generally, innovation systems focus on different aspects such as region, nation, sector, and technology. The key actors in an innovation system include industry, academia, government, and civil society (see the stakeholder diagram in section 2.5).

For each innovation system's actors, the ethical dilemma in AI manifests as an economic trade-off. Typically, the actors will fall into one of two extreme economic categories based on a power asymmetry - unequal distribution of resources (such as money, data/information/knowledge, political authority, trade) across the array of actors involved in governance arrangements - depending on how the rules are framed. Practically, such an economic dilemma plays out when decision-makers establish rules to govern AI, resulting in high-power and low-power actors. This dilemma is underpinned by the principle of justice, as discussed in section 4.

A recent concept in innovation systems is the corporate innovation system (Rikap and Lundvall, 2021 pp. 43-63). Using this approach, AI practitioners can frame ethical dilemmas as a struggle between intellectual monopolies as high-power actors and users as low-power actors. This framing looks at the actors involved in innovation within the context of an innovation system and explores the ethical dimensions they face.

Three illustrative barriers affect the actors involved in a corporate innovation system: innovation/trade challenges, lack of local AI talent, and processing intellectual property rights.

2.6.1 Innovation/Trade Challenges

Amid the growth in funding for African startups, of the $13.6 billion in funding raised in Africa since 2012, only $3.2 billion went to companies with at least one black co-founder (Baah, 2022, n.p.). That's just 24 percent of funding on the continent. Seventy percent of startups in Kenya that received a million dollars or more of venture capital investment in 2018 were led by a white expatriate founder, though the expatriate community makes up only 0.15 percent of the population. (Musse, 2020, n.p.)

2.6.2 Lack of Local AI Talent

Many industries are scrambling for AI talent, which seemingly is not growing fast enough. As a practitioner, how would you rate your company's/entity's current skills gap in meeting the needs of the AI projects you are running? There is a need to identify and establish strategies for the growth and retention of local AI talent and for forging better partnerships between the AI ecosystem and local industry.

2.6.3 Processing Intellectual Property Rights

A recurrent and prevalent issue for innovators is the tedious process of applying for patents, copyrights, and trademarks. This process deters many and can lead to idea theft by jurisdictions that process intellectual property rights relatively quickly. A seamless process shall encourage more innovation to be Kenyan owned.

2.7 Risks and Harms of AI

AI can operate unfairly, particularly when trained with biased or inappropriate data or where the model or algorithm is not fit for purpose. The values embedded in algorithms and the choice of problems AI systems and applications are used to address can be intentionally or inadvertently shaped by developers' and stakeholders' worldviews and cognitive biases. The main risks and harms prominent in the use and deployment of AI include:

2.7.1 AI Bias in Machine Learning

AI was expected to offer neutral, scientific, and objective outcomes that aren't plagued by inaccuracies and human prejudice. This has turned out to be a fallacy. Various studies have found rampant discrimination perpetuated by AI against certain groups of people. For instance, a mortgage algorithm charged Black and Latina borrowers higher interest rates, and there are numerous cases of recruiting algorithms exacerbating bias against hiring women. Several facial recognition software programs have also been found to misidentify darker-skinned women more often than those who are light-skinned (Best, 2021, n.p.). It is, therefore, important for practitioners to be aware of their systems' hidden, unfair practices.

There are various ways that bias can be introduced into a machine learning system. Common scenarios or types of bias include the following:

- **Algorithm bias** occurs when there's a problem within the algorithm that performs the calculations that power the machine learning computations.
- **Sample bias** happens when there's a problem with the data used to train the machine-learning model. In this type of bias, the data used is either not large or representative enough to teach the system. For example, training data that features only female teachers will train the system to conclude that all teachers are female.
- **Prejudice bias** occurs when the data used to train the system reflects existing prejudices, stereotypes, and/or faulty societal assumptions, thereby introducing those same real-world biases into the machine learning itself. For example, data about medical professionals that includes only female nurses and male doctors would perpetuate a real-world gender stereotype about healthcare workers in the computer system.
- **Measurement bias** arises due to underlying problems with the accuracy of the data and how it was measured or assessed. A trained system to precisely assess weight will be biased if the weights contained in the training data are consistently rounded up.
- **Exclusion bias** happens when an important data point is left out of the data being used — something that can happen if the modelers don't recognize the data point as consequential.

How can you prevent bias?

Awareness and good governance can help prevent machine learning bias. An organization that recognizes the potential for bias can then implement and institute best practices to combat it that include the following steps:

- Select training data that is appropriately representative and large enough to counteract common types of machine learning bias, such as sample bias and prejudice bias.
- Test and validate to ensure the results of machine learning systems don't reflect bias due to algorithms or data sets.
- Monitor machine learning systems as they perform their tasks to ensure biases don't creep in overtime as the systems continue to learn.
- Use additional resources, such as Google's What-if Tool or IBM's AI Fairness 360 Open Source Toolkit, to examine and inspect models.

Adopting measures that prevent bias helps in manifold ways. For example, it protects your users from discrimination, protects your company or organization from brand or reputation damage, and prevents the likelihood of lost revenues and any associated regulatory fines and penalties.

2.7.2 Social Manipulation

Social media has become highly impactful in target marketing by employing algorithms. It is now very easy to identify a person and their preferences. The power of AI to propagate social manipulation may increase the spread of propaganda and influence decision-making en-masse by targeting individual users of platforms and services that deploy AI and the wildfire spreading of all disinformation, in whatever format. A good display of this was the Cambridge Analytica scandal mentioned earlier, in which the firm used the data of millions of Facebook users to interfere with and sway elections in several countries, including the United States and Kenya (Guardian, n.d.).

AI-supported deep fake technology has also propelled social manipulation and bad-actor intervention. It is being used to swap faces and images in videos and digital content to make fake videos look real, thereby creating alternative narratives which are difficult to distinguish from the truth. This form of AI uses deep learning algorithms, an ML algorithm that allows its users to solve problems by creating services/products using large datasets.

2.7.3 Invasion of Privacy

AI makes it easy to track and analyze users' every move online as they carry on with their day-to-day life. Facial recognition algorithms can identify people, and the presence of cameras everywhere means this tracking is almost seamless. This kind of watching can turn into social oppression and negatively impact other fundamental rights and freedoms, such as freedom of expression.

2.7.4 Socioeconomic Inequality

The increasing reliance on artificial agents has fueled the rapid automation of jobs, including jobs that would seem to rely heavily on human intelligence, such as journalism and radiology. Artificial intelligence will inevitably shift the global workforce, causing job losses across many industries. (West and Allen, 2018, n.p.) A 2019 Brookings Institution study found that automation would primarily impact low-wage earners, especially those in food service, office management, and administration. (Nova and Schoen, 2019, n.p.)

2.8 Recommendations

AI is undoubtedly transforming our industries and will continue to help businesses solve global social and economic problems. However, we need to be alive to the risks posed and responsibilities given by AI's use cases and possibilities. So, does AI pose a catastrophic threat? Yes. However, practitioners can challenge and counter these risks and harms and advance ethical and trustworthy AI principles in various ways:

- Equipping systems that rely on automated decision-making to audit the causal factors behind the decisions of the AI systems (Osoba and Welser, 2017 p. 23).
- Training and diversifying algorithm developers to help improve the sensitivity to potential differing impact problems.
- Identifying the critical services and systems or subsystems that require human intervention, such as high-risk systems.
- Adopting standardized disclosure practices that are used to inform stakeholders of instances when decisions that affect them are algorithmically generated.
- Using digital dividends as payback to society from a portion of companies' profits derived from AI.

The journey toward Responsible AI: A practical guide for organizations

- Review projects, products, or services that are benefitting or could potentially benefit from AI.
- Define the specific ways the projects, products, or services are applying or could apply AI and for what purpose.
- Define the opportunities, benefits, losses, harms, or risks arising from the application of AI in the projects, products, or services.

CHAPTER 3 /
THE LEGAL LANDSCAPE FOR ARTIFICIAL INTELLIGENCE IN KENYA

The existing legal and regulatory framework in Africa does not anticipate or adequately address the surge in innovations brought about by development in technological trends. For instance, currently, there is no definitive or express legal basis for adopting AI in Kenya.

Although the Government has yet to enact a national AI legislative or regulatory framework, various legal provisions touch on digital technologies and the adoption of AI. However, the lack of regulation creates risks in privacy and data protection. It further raises the specter of social inequalities due to automation and weaponization, which may lead to human rights violations and redundancy.

Therefore, to regulate emerging technological trends, there is a need for community engagement and policy discussions aimed at identifying various development aspects requiring control, regulation, attention, or monitoring.

3.1 AI Regulation Groundwork in Kenya

The Government of Kenya has taken steps to enact regulatory frameworks that support the ethical and responsible use and application of AI across various sectors of the economy. Below is a breakdown of the milestones achieved so far:

YEAR	MILESTONE	IMPACT
2018	Establishment of the Distributed Ledgers Technology and Artificial Intelligence Taskforce	Created a strategy to encourage the developing and adopting new technologies such as blockchain and AI. Provided recommendations on how the Government can leverage new technologies in Kenya (Kenyan Wall Street, 2018).
2019	Enactment of the Data Protection Act 2019	Established the legal framework for responsible processing of personal data in Kenya.
2020	Digital Rights Policy Discussions	Brought about developments in technology laws.
2021	Gazettement of Data Protection Regulations Draft Licensing and Shared Spectrum Framework for Community Networks	Established an implementation framework for the Data Protection Act 2019. Lowered barriers and licensing fees for community network operators to boost broadband connectivity in underserved areas.
2022	Rollout of the requirement for registration of data processors and data controllers Launch of The Kenya National Digital Master Plan 2022 - 2032 The Ministry of ICT partnered with Huawei in a bid to develop digital infrastructure by investment in 43,000km of fiber optic cables (Benjamindada.com, 2022).	Resulted in the regulation of sector players using data-driven technologies. The Master Plan identifies Emerging Technologies as one of the foundational and cross-cutting themes for the ICT ecosystem growth and development Improving internet connection and digital literacy through initiatives such as DigiSchool.

Figure 6: AI Regulation Groundwork (Author, 2022)

Despite the strides made, practitioners need to note that Kenya continues to face hurdles in adopting AI technology at the legislative and regulatory levels. These challenges require legislative and regulatory tools, as well as policy guidelines, taking into account innovation.

In formulating legislation to govern AI, the government must balance protecting its citizens with promoting innovation. Practitioners should position themselves strategically to participate in the process of regulation of AI.

3.2 Legislative, Regulatory, and Ethical Environment

Kenya has segmented laws and regulations on AI. In 2018, the Distributed Ledgers Technology and Artificial Intelligence Taskforce was established under the Ministry of Information, Communications and Technology to review the AI environment and provide policy recommendations and directions.

A key recommendation from the taskforce was the development of policies promoting AI and human rights. Despite the lack of specific legislation, legal provisions on digital technologies and the possible adoption of AI are addressed under various laws highlighted below:

3.2.1 The Constitution of Kenya, 2010

The Constitution is a guardrail from AI's potential risks and harms. It guarantees rights and fundamental freedoms; in the context of AI, these rights are classified as digital rights.

Constitutional Provision	Constitutional Impact
Article 11(2) (c): Intellectual property rights	**Lays a foundation for assessing the impact of AI on IP.** AI and digital technologies shall respect and promote the intellectual property rights of the people of Kenya. Practitioners must therefore be vigilant in upholding IP rights such as copyright, patents, and trademarks while using and deploying AI systems and programs.
Article 27: The right to equality and freedom from discrimination	**Safeguards against inequality and discrimination of any kind.** AI has the potential to perpetuate discriminatory practices. For instance, algorithms can be used in the immigration sector to deny visas to Africans (Study International, 2022). In the past, people of color have been denied jobs because of their descent and racial identity rather than their qualifications (Zapata, 2021). Black people have also experienced bias in access to health care through algorithms that were less likely to refer black people than white people to health care programs (Ledford, 2019). The provision lays a strong foundation for the protection of persons against the design and deployment of AI systems that would discriminate on any basis.
Article 31: Right to privacy	**Guarantees the right to privacy, including the right not to be searched in person, property or at home, possessions seized, family or private information unnecessarily required or revealed, or privacy of communications infringed.** AI technologies can be used by indiscriminate facial recognition technologies, mass interception of communications, mass hacking, smart policing, biometric technology, and intelligent video surveillance by state actors. These practices encourage indiscriminate monitoring, tracking, and surveillance of citizens and systematically interfere with the right to privacy and all other rights that it bears, such as the right to human dignity, freedom of expression, freedom of association, and freedom of assembly. The provision safeguards against AI and digital technologies infringing on these rights.

Constitutional Provision	Constitutional Impact
Article 33: Right to freedom of expression	**The provision guarantees freedom of expression to the extent permissible.** AI and digital technologies shall facilitate every person to seek, receive, or impart information, as well as respect freedom of artistic creativity and academic freedom.
Article 35: Right to Access of Information	**The provision guarantees every citizen the right of access to information held by a public or private entity, and which is required to exercise/protect any right or fundamental freedom; and to the correction or deletion of any information that is misleading or incorrect affecting the person.** AI driven technologies can ensure a more efficient delivery of public services to the citizenry, given they can access public information and services almost immediately.
Article 46: Consumer rights	**Consumers of products and services are afforded protection.** Under this provision, practices and market conduct that are predatory and disenfranchise bargaining positions in the market are frowned upon and are actionable. AI and digital technologies shall be of reasonable quality and should provide consumers the necessary information to gain full benefit from the services. AI and digital technologies should compensate for loss or injury arising from defects in services.

Figure 7: Key Constitutional Provisions (Authors, 2022)

3.2.2 The Data Protection Act, 2019

The Data Protection Act 2019 ("DPA 2019") provides a legal framework for enforcing the right to privacy and standards for data protection in Kenya. AI relies on sensitive and personal data, usually in large volumes, making its regulation necessary to mitigate AI risks. Processing personal data using AI systems by data controllers and processors shall comply with legal bases under Section 30 (consent of the data subject, legitimate interests, legal obligation, and public interest).

AI developers are required to take into consideration principles of data protection, including:

- **Specified purposes** (prohibits repurposing of data beyond the original scope of collection), as is usually the case with training a machine learning model (CIPL, 2020, p.14).
- **Accuracy** is a prerequisite for data processing activities and requires personal data to be accurate and kept up to date. Automated systems lacking major human involvement should be designed to consider accuracy as a fundamental principle (CIPL, 2020, p.18).
- Processing in accordance with the right to **privacy, lawful** processing, and **transparency**.
- Collection of only **adequate** and **relevant** personal data, and **storage limitation**, where data controllers and processors are required to keep personal data for no longer necessary.

Data protection impact assessment addresses risks occasioned by the automated processing of personal data. Section 35 of the DPA defines automated decision-making as the ''ability to make decisions by technological means without human involvement," giving consumers the right to refuse to be subjected to harmful automated decisions. According to Section 31, AI-driven processes risk perpetuating discriminatory practices and thus require regulation.

Therefore, AI practitioners need to take measures to ensure that where automated decisions affect the rights and would impact the users of their systems/platforms, they need to inform such users and provide avenues for human intervention. It is also important to maintain an audit mechanism of the system to track the factors affecting the decisions being generated.

Where AI technologies are used in data processing and are likely to result in a high risk to the rights and freedoms of individuals, a data protection impact assessment is necessary. These assessments equip AI practitioners to identify and mitigate risks to people affected by their data processing activities.

The risk element has been explicitly addressed under Section 41(4) which provides that "the data controller or data processor shall consider measures such as — (a) to identify reasonably foreseeable internal and external risks to personal data under the person's possession or control; (b) to establish and maintain appropriate safeguards against the identified risks; (e) to verify that the safeguards are effectively implemented; and (f) to ensure that the safeguards are continually updated in response to new risks or deficiencies'.

Other provisions of the Data Protection Act relevant to AI practitioners include:

Section 28(3)	A data controller or data processor shall collect, store or use personal data for a purpose which is lawful, specific and explicitly defined. This provision reiterates the fact that information that may be held by a public entity must not be misused and must be used only for legally permissible reasons and purpose
Section 30 (1) (a)	A data controller or data processor shall not process personal data unless — (a) the data subject consents to the processing for one or more specified purposes. The import of this provision is that where public bodies deploy AI to collect personal information for services offered by such bodies, the consent of such applicants must be recorded and the purpose for which the information is collected made explicit.
Section 72(1)	A data controller who, without lawful excuse, discloses personal data in a manner incompatible with the purpose for which the data was collected commits an offense.
Section 72(2)	A data processor who, without lawful excuse, discloses personal data processed by a data processor without prior authority of the data controller commits an offense.
Section 72(3) (a)	Obtaining access to personal data/information without prior authority of the data controller or data processor is an offense.
Section 72(3) (b)	Disclosure of personal data to a third party without prior authority of the data controller or data processor is an offense.
Section 72(6)	Advertising the sale of personal data obtained unlawfully constitutes an offense.

All these provisions safeguard against unfair and unlawful data processing practices, and AI practitioners must always consider the impact of the provisions.

Furthermore, Section 21(7) requires AI practitioners handling data and processing it for various reasons to register as data controllers and/or processors. To the extent that AI practitioners are data controllers or data processors, they are required to register as such with the Office of the Data Protection Commissioner.

3.2.3 Data Protection Regulations, 2021

The Regulations (Data Protection - General - Regulations 2019) amplify the data protection principles stipulated in the Act, including transparency, fairness, accuracy, storage limitation, purpose limitation, etc. They provide structures for conducting data protection impact assessments where there is a risk of violation of human rights, as well as the requirements to satisfy data protection by design and default when developing systems.

The Regulations provide standards on automated decision-making, placing a responsibility on the data controller or processor to inform the data subject when engaging in automated processing. There is a requirement to provide a legitimate objective for automated decision-making.

Further, they provide for the rights of data subjects by requiring data controllers and processors to establish avenues for access to data, rectification of data, deletion of data, restriction of processing, and object to data processing.

Rights of a data subject

To be informed of the use to which their personal data is put; to access their personal data in the custody of a data controller or processor; to object to the processing of all or part of their personal data; to request the correction and deletion of false or misleading data about them (Section 26).

3.2.4 Kenya Information and Communications Act, 1998

The Act established the Communications Authority ("CA") to regulate industry practices in the information and communication technologies sector. Furthermore, the Act regulates electronic commerce and telecommunication services. The CA also regulates electronic transactions, requiring a license for operations involving electronic certification systems.

AI practitioners are affected by provisions of the Act in so far as they develop, operate, engage in the processing of information, and are involved in the information and communication technologies sector through the adoption of various technologies. The licensing requirement should be considered, as offenses under the Act emanate from certification licensing.

Relevant provisions of the Act include Section 29, on improper use of a system; Section 30, on modification of or interference with messages; Section 31, on interception and disclosure (messages); and Section 32, on tampering with telecommunication plants. These provisions can be enforced against AI practitioners where there is proof of the commission of the offenses, and under other such laws, including the Computer Misuse and Cybercrimes Act.

3.2.5 Computer Misuse and Cybercrimes Act, 2018

The Act contains provisions on confidentiality, integrity, and availability of computer systems, programs, and data. It seeks to facilitate the prevention, detection, investigation, prosecution, and punishment of cybercrimes. The National Computer and Cybercrimes Co-ordination Committee is the advisory organ to the Government on security-related aspects of block chain technology, critical infrastructure, and mobile money and trust accounts.

AI practitioners need to be aware of the offenses laid out in the Act, which include interference or interception of computer systems programs or data, false publication of data, cyber harassment, cybersquatting, cyber terrorism, identity theft and impersonation, phishing, computer fraud, computer forgery, unauthorized disclosure of passcodes, fraudulent use of electronic data, and issuance of false e-instructions, among others. The provisions of the penal code relating to criminal offenses, have also been used in the regulation of the blogosphere.

3.3 National Policy Frameworks

Technological and digital transformation in Kenya continue to attract the state's intervention in a bid to harness the benefits and promise of digitization. The following instruments are drivers of tech adoption:

3.3.1 The Digital Economy Blueprint, 2019

This framework as drafted, recognizes the impact of digital technologies, including AI, on how we live and work. The blueprint advocates harnessing AI to tap into and grow the digital economy. The blueprint identifies the capital expenditure required to adopt AI as a challenge. The blueprint further recognizes the need for advanced information and communication technologies skills and prioritizes training efforts, including on the use of AI. AI is anticipated to particularly impact health care, education, retail, and agriculture.

AI practitioners can utilize the blueprint to establish and identify governance standards and structures within their organizations that relate to AI. This can be done through the adoption of the blueprint's five core pillars: digital business, infrastructure, innovation-driven entrepreneurship, digital skills, and values. Consequently, through these pillars, practitioners can strengthen privacy and data protection, enable new business models, and strive for digital technology research to support the ecosystem.

3.3.2 The National Broadband Strategy 2018–2023

The strategy incorporates technological and industry developments by focusing on fast, secure, and affordable broadband connectivity. It seeks to propel Kenya into a globally competitive economy. Implementation of the strategy will impact the adoption of AI, as data-driven technologies require effective broadband services and products.

3.3.3 National Information Communications and Technology Policy Guidelines, 2020

The guidelines aim to create an enabling environment to realize the digital economy's potential through infrastructure development. This includes access to and development of relevant skills to encourage innovation and position the country to take advantage of emerging trends, such as AI.

AI practitioners in Government can use AI to build, deploy, operate, and manage locally built back and front-end systems to deliver public services. Further, practitioners can utilize AI to establish structures for, among other uses, coordinating and cooperating with international systems and global platforms and creating an inclusive information and communications technology environment that ensures gender equality and accessibility by persons with disabilities.

3.3.4 The Kenya National Digital Master Plan, 2022–2032

This national plan is built around four pillars (Digital Infrastructure, Digital Government services and products, digital skills and digital innovation and entrepreneurship) to facilitate the provision of digital services to citizens, the private sector, and stakeholders. It recognizes the adoption of AI as a necessary emerging technology to successfully deliver such services. AI is identified as a cross-cutting pillar (emerging economies) item that should permeate all of government services.

3.3.5 Distributed Ledgers Technology and Artificial Intelligence Taskforce Report

The Ministry of Information, Communications, and Technology requested this report to document AI policy implications in Kenya. It provides case applications for AI and acknowledges the potential of AI in the country. The report also highlights the potential harms of AI and digital technologies. Additionally, it makes recommendations for responsible AI in Kenya, including land titling, lowering transaction costs, promotion of financial inclusion, growth of the shared economy, and public service delivery.

3.4 Institutional Framework for Artificial Intelligence in Kenya

Figure 8: Key Public Sector Stakeholders.

Another institution relevant to AI is the Kenya Bureau of Standards (KEBS). The Kenya Bureau of Standards (KEBS) is the National Standards Body in Kenya, with an overall mandate to promote standardization in industry and trade through standards development, conformity assessment, testing and metrology. It aims at providing standards-based solutions that deliver quality and confidence to consumers.

Standardization provides the foundation on which technology innovation is based. It enables more complex solutions to be developed at a better cost structure. Standards drive technological innovation, fuel growth of global markets, expand consumer choice, support interoperability and help protect workers‘ and general public health and safety. Relevant standards will facilitate responsible AI, enable effective governance within the industry, as well as policy enforcement for and by AI practitioners.

KEBS participates in Standards development through formation of technical committees. The technical committees are made up of experts from the relevant industry, but also from consumer associations, academia, NGOs and government. The standards development process is rooted in consensus, due process, openness, right to appeal and balance.

Standards are created by the people who use them. Taking part in standardization through KEBS Technical Committees is an open and continuous process and anyone can get involved in this process through applying on the KEBS website:

KEBS, through Technical Committee 94 (TC94) on Software engineering, Artificial Intelligence and IT service Management is participating in global standardization through membership in ISO Subcommittee 42 of the Joint International technical Committee on Information Technology. KEBS has published a number of Kenyan standards on AI and ML and has several other ISO standards under review for adoption.

KEBS also provides assistive services to government and public bodies to frame codes of practice. The KEBS stamp induces universal acceptance, enhances policy enforcement, conformity assessment and decision-making in national commerce, and facilitates quality assurance (QA) and testing services for AI.

KEBS is in the process of establishing a standardization agreement with IEEE SA. This global community is at the forefront of developing accessible and sustainable solutions for the practical application of Artificial Intelligence system principles and frameworks.

The Senate and National Assembly Committees further constitute critical players in legislative and policy interventions.

3.5 Ethical Frameworks on AI in Kenya

There has been no codification of imperatives for the ethical use of AI in Kenya. However, the provisions of various laws lead us toward human-centered and responsible AI. For example, Article 10 of the Constitution of Kenya provides national values and principles that can be adapted for the governance of AI in Kenya. These include human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination, protection of the marginalized, good governance, integrity, transparency and accountability, and sustainable development.

Furthermore, the Distributed Ledgers Technology and Artificial Intelligence Taskforce report acknowledges the importance of upholding human rights when using AI systems. The report notes the potential impact of these technologies on the right to privacy and recommends policies to ensure citizens' rights are protected in both the short- and long-term use of AI. The taskforce highlights the general risk of unethical AI applications.

3.6 Regional AI Policy Frameworks

3.6.1 Artificial Intelligence for Africa Blueprint

This collaborative framework by the Smart Africa Alliance seeks to shape policies for strong and ethical AI in Africa and foster AI expertise and solutions "made in Africa for Africa." Additionally, it aims to create an enabling environment for open data to boost Africa-wide AI exchange, innovation to create markets, and secure investment to make AI ready for markets. It further outlines five key dimensions to consider when implementing a national AI strategy: human capital; from lab to market, which encourages innovation toward the growth of the private sector and efficiency in delivering public services; networking; infrastructure; and regulation.

The blueprint acknowledges the agility of technology and the difficulty this poses to regulating AI. Instead of focusing on stringent regulation of AI, it encourages the establishment of regulatory sandboxes, increasing participation of African delegates in international and regional technical committees for AI-related standards, and promoting public sector adoption of AI toward efficient public services.

3.6.2 African Union Data Policy Framework

This policy maximizes the benefits of a data-driven economy by creating an enabling policy environment for the private and public investments necessary to support data-driven value creation and innovation. It seeks to consolidate the data environment and harmonize data governance to enable free and secure data flow while safeguarding human rights. To enable data sharing, the policy also recommends that the African Union (AU) and regional institutions support the development of regional and continental data infrastructure to host advanced data-driven technologies such as AI.

Importantly, the policy champions data justice and recommends the protection of personal data through actions such as ensuring transparency, accountability, and oversight in using personal data. This is to safeguard basic human rights in the digital age and to ensure that the reliance on data does not perpetuate historical injustices and inequalities.

3.6.3 African Commission on Human and People's Rights Resolution 473

The AU recognizes that emerging technologies present risks and opportunities for promoting and protecting human and people's rights in Africa. Thus, in 2021, the AU adopted Resolution No. 473, which addresses the need to study human and people's rights and AI, robotics, and other emerging technologies in Africa. The resolution highlights the need for sufficient consideration of African norms, ethics, and values, such as Ubuntu, the communitarian ethos, freedom from the domination of one people by another, and freedom from racial and other forms of discrimination when framing global AI governance frameworks. The resolution emphasizes the need for meaningful human control, data protection, and African states' participation. The resolution is significant in creating AI policies relevant to the African context.

3.6.4 European Union AI Act

The act provides for the regulation of AI and seeks to codify the requirements of AI to be legal, ethical, and robust while respecting democratic values, human rights, and the rule of law. It combines a risk-based approach on a pyramid of most critical to least critical AI systems with a modern enforcement mechanism. The act advocates the promotion of AI, with safeguards to mitigate harm.

AI applications with minimal risks face lighter enforcement mechanisms. In contrast, those with unacceptable risks, such as those exploiting vulnerabilities of specific groups (e.g., the young or elderly, persons with disabilities), which leads to unjustified and disproportionate detrimental treatment, are prohibited. Specific use cases such as deep fakes, chatbots, and other AI systems made for human interaction are required to pass the test of transparency, ensuring that consumers know they are interacting with manipulated content. These considerations apply to citizens of Kenya and foreign companies and/or individuals and companies interacting with EU citizens or Kenyans.

3.6.5 UNESCO Recommendation on the Ethics of Artificial Intelligence

This recommendation provides a universal framework of values, principles, and actions to guide states in the formulation of legislation and other instruments regarding AI. It recommends values and principles for adoption in AI systems:

Values

Respect for human rights

Protection and promotion of human rights

Diversity

Inclusion

Sustainability and protection of the environment throughout AI life cycle

Principles

Fairness and non-discrimination

Proportionality and do no harm

Safety and security

Right to privacy and data protection

Transparency and explain-ability

3.6.6 Organization for Economic Cooperation and Development (OECD) AI Principles

The OECD identifies five complementary values-based principles for the responsible stewardship of trustworthy AI:

- AI should benefit people and the planet by driving inclusive growth, sustainable development, and well-being;
- AI systems should be designed in a way that respects the rule of law, human rights, democratic values, and diversity, and they should include appropriate safeguards — for example, enabling human intervention where necessary — to ensure a fair and just society;
- There should be transparency and responsible disclosure around AI systems to ensure that people understand AI-based outcomes and can challenge them;
- AI systems must function in a robust, secure, and safe way throughout their life cycles, and potential risks should be continually assessed and managed; and
- Organizations and individuals developing, deploying, or operating AI systems should be held accountable for their proper functioning in line with the above principles.

The OECD principles provide sound policy guidance for Governments and other stakeholders around the world and encourage the advancement of responsible and human-centered AI that fosters research and preserves economic incentives to innovate. The development of these principles was participatory and incorporated input from experts from numerous stakeholder groups and disciplines.

3.7 Regulatory Considerations

To promote compliance, strive for the enforcement of good AI practices, and conform to ethical and trustworthy AI principles, practitioners need to adopt strategies of governance and advocacy.

3.7.1 AI Governance

This kind of governance involves practitioners actively monitoring AI-related activities to ensure that human rights are promoted and protected and that the rule of law is upheld. It aims to promote the growth and development of AI while mitigating the harms associated with its deployment and use.

AI governance practices include creation of a **national AI strategy**; establishing mechanisms to **monitor and evaluate the social, cultural, and environmental impacts** of AI; ensuring **public participation** in the creation of AI policies; upholding **values and principles of AI**, providing **human oversight** for AI systems; and providing **redress** for individuals whom AI has negatively impacted.

3.7.2 AI Advocacy

AI presents risks such as bias, discrimination, data privacy concerns, and the violation of human rights. In this regard, AI practitioners need to come together to speak against these harms caused to the public and serve as independent overseers to ensure that the designing and deployment of AI systems is accountable and oversight mechanisms exist, and all stakeholders hold responsibilities for the development of systems.

Use Cases Highlighting AI Regulatory Considerations

AI for Government Services (Finland's AuroraAI Program)

In 2020, Finland's Ministry of Finance launched the AuroraAI program to enable the public administration to better anticipate and provide personalized solutions for citizens' future needs, as well as provide 24-hour digital services (Finland Ministry of Finance, 2020).

The project aims to proactively offer services to support its citizens according to their life events. For example, people changing jobs will be offered public, private, and third-party services to smoothly transition from one job to another.

Public Participation in AI (Think AI Initiative in the United Arab Emirates)

The United Arab Emirates (UAE) set up a national program that provides a comprehensive and consolidated compilation of resources highlighting AI and robotics advances. In 2019, the Ministry of Intelligence launched the Think AI initiative to develop legislation, policies, and initiatives for the responsible and efficient adoption of AI within the private sector.

The goal was to catalyze comprehensive dialogues and ideas to support the country's adoption of AI in key sectors such as governance and infrastructure (Emirates News Agency, 2019). UAE offers free courses for residents to raise awareness and understanding of AI.

Application of AI in Strategic Sectors (Mauritius)

Mauritius's national AI strategy strikes a balance between embodying global best practices while acknowledging the existing structural inequalities in Africa and keenly responding to its citizens' local needs and demands.

It anticipates technology for growth, productivity, and improvement in quality of life. Key pillars include manufacturing, textiles, health care and biotechnology, fintech, agriculture, ocean economy, and transport, and the strategy outlines how AI can be used to steer these sectors even further.

3.8 International Best Practice

International trends in the adoption of effective AI systems have identified the following components as crucial:

i. Safeguarding human rights;
ii. Cooperating to create data-driven technologies that benefit the African people;
iii. Promoting policies that will lead to the development of digital trade among the African countries;
iv. Promoting interoperability of data to enable data sharing; and
v. Promoting portable data to enhance competition and consumer protection.

Furthermore, there is a need for collaboration in policy development to ensure inclusivity and adherence to international best practices, the creation of data environments that are open, the creation of data lakes that will foster the sharing of data infrastructure and enable the development of machine learning products; and maintaining a public-private partnership in the development of AI solutions and resources.

CHAPTER 4 / CONCLUSION

"Small companies of today are the big techs of tomorrow." —Dr. Nderu

Undoubtedly, great promise lies ahead for AI practitioners, and there are numerous opportunities for all sectors and capabilities. Kenya's local capacity and skill sets are an asset and continue developing. Funding opportunities are ramping up, as are the supporting infrastructure, data, and access to these resources.

Despite significant hurdles (lack of a robust legal framework, data bias, lack of sufficient skills in the workforce, and infrastructure), AI solutions are being deployed successfully and at scale. Opportunities abound not just for the users of AI technologies and infrastructure but for the owners and creators of AI technologies, because they possess knowledge of the local context and can tap into the creativity of Kenyans. Key policy recommendations/opportunities include:

4.1 Collective Rights

AI policies should strive to provide for the rights of both individuals and communities, for example, neighborhoods; social network connections (both online and offline); families; people connected by affinity, identity, or shared traits; and formal organizations such as tribes, clans, villages, and other Indigenous communities.

4.2 Innovation

Governments should encourage AI innovation by implementing policies that promote the establishment of regulatory sandboxes, provide tax incentives on AI investment, and provide scholarships to AI training institutions.

4.3 Public Participation

There is a need for consultations, e.g., through public surveys, to find out possible areas of AI use and the impact of AI on citizens, and encourage workshops, public debates, and training with multiple AI experts and stakeholders.

4.4 National Strategies

There is a need to develop a national AI strategy to serve as a guide and model for the adoption and implementation of AI activities. Without effective strategies, tracking the potential and progress of adopting AI is impossible.

4.5 Redress for People Impacted by AI

AI policies should provide for the rights of individuals and remedies for persons whose rights are violated due to AI systems, who miss out on opportunities and access to fundamental services, and who are generally negatively impacted by AI systems.

4.6 African Standards Strategy for the Fourth Industrial Revolution

There is a need to consider the import of this strategy, which seeks to provide standardization for the well-being of the African people and close the gap between the physical and digital worlds. The strategy's objectives include:

- Balanced standardization policies and collaboration by state and non-state actors;
- Balanced data policies;
- Capacity building and skill development to enhance productivity;
- Continuous experimentation for cyber-physical systems;
- Integration of measurements, learning, reporting, and information dissemination.

AI practitioners should understand the legal implications of ownership of their creations/contributions, including putting in place contractual arrangements to safeguard interests of players. All relevant stakeholders, including practitioners, Government, and activists, should persist in concerted measures to stimulate innovation and improve data protection, research, and the development of AI.

This guide concludes that, first, the key ingredient for the success of AI lies in the efficient implementation of current strategies and policies. There is an apparent need for policies and a legislative framework for the governance of AI. Governance of AI should cover existing gaps, such as digital skills and infrastructure, and the establishment of an independent human oversight body. That notwithstanding, Kenya has an-AI ready environment, with potential for growth and development.

International policy frameworks and regulatory responses must be tailored to the practice environment in Kenya, rather than adopted wholesale. AI practitioners, especially those tasked with policymaking, should use these best practices only as a guide when developing policy. Kenya should enact laws favorable to its context, population, and potential for implementation.

Furthermore, best practices have been highlighted as well as the current barriers to entry that may impede research, advocacy, design, and deployment of AI. Practitioners need to take note of the statutory requirements on access to information and data protection both regionally and in Kenya. Practitioners should ensure that monopolistic data practices, killer acquisitions, exploitative labor inventions on AI, human rights abuses, and cybercrimes are not perpetuated in practice.

There is an opportunity to engage in legal reform to develop comprehensive AI regulation and institutional harmonization in Kenya. Further, the guide provides insights for AI startups on a path to compliance: as they build on data, they will not infringe on intellectual property rights. In addition, policymakers, legislators, and technology communities need to explore regulatory sandboxes and strategies that allow tolerance for trial and error and are conducive to innovation, as well as other guard-railed environments where testing can be done.

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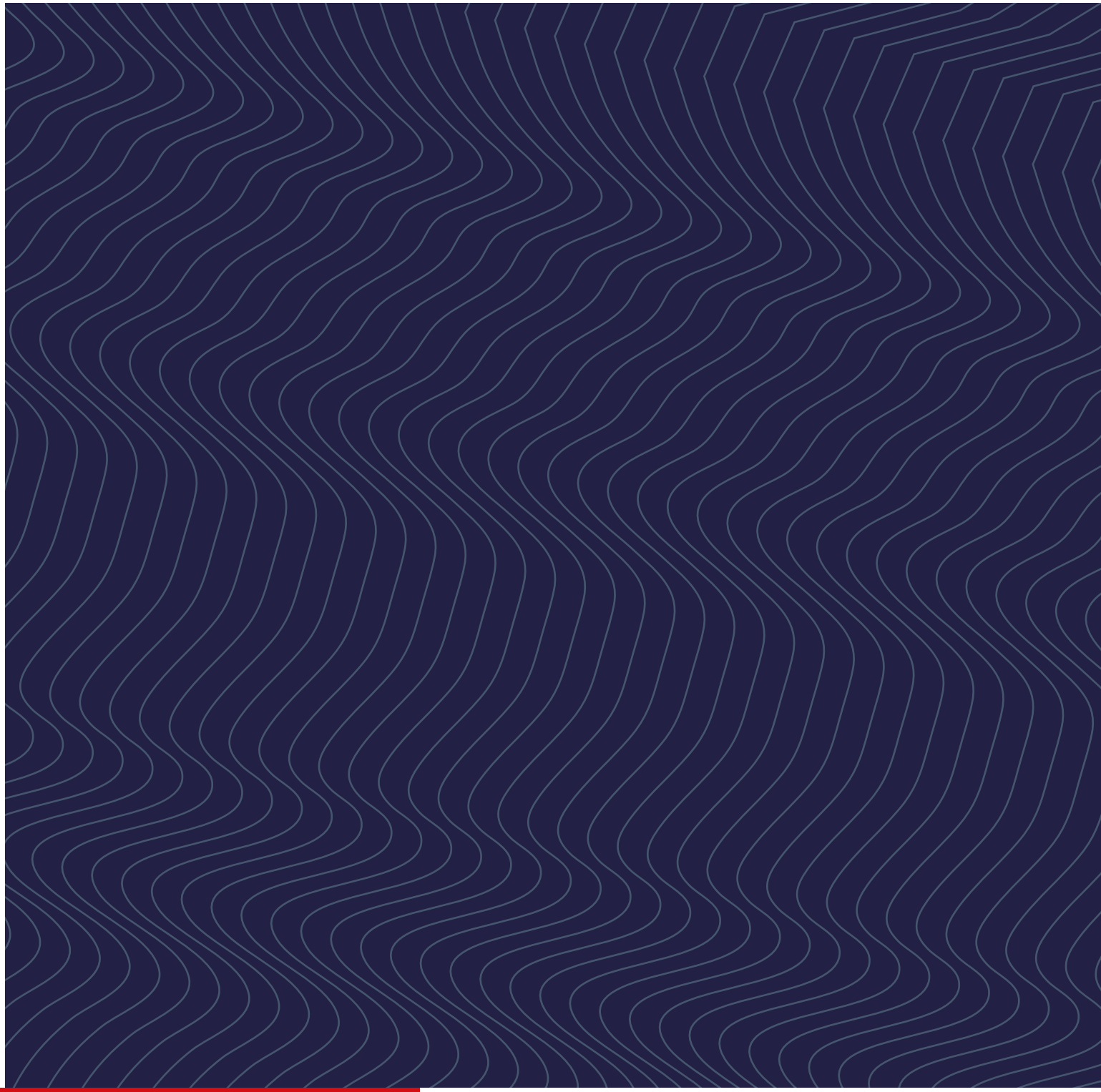

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1 - 5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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