

Strengthening the Emerging Digital Technologies Ecosystem in Kenya

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Key Messages

The growth of connected devices and associated emerging digital technologies (EDTs) has led to substantial data generation

Developed countries dominate EDT/x-data based applications hindering their potential to address socio-economic challenges in developing countries like Kenya

Accessibility issues exist for under-represented groups such as persons with disabilities and those in marginalized areas with slow internet connections

Four categories of data collectively referred to as “x-data” are identified: big data, open data, user-generated data, and real-time-data.

Gaps in support systems have created digital divides between developing and developed countries

Challenges in data use persist due to competing sources, data quality, limited awareness and inadequate transformation

Kenya ranks well in Artificial Intelligence (AI) readiness globally and in sub-Saharan Africa.

Context

The rapid increase in devices (mobile phones, computers, sensors, etc) connected to the Internet (and thus to databases) has resulted in exponential growth in data generation and associated EDTs that can “identify patterns in observed data, build explanatory models, and make predictions quicker and with more accuracy than humans” (Pawelke et al., 2017) EDT/x-data-based applications and algorithms are mainly created in the developed countries and often lack transparency arising from intellectual property rights, thus hindering realization of the enormous potential EDT/x-data-based applications have in addressing socio-economic challenges faced by developing countries, including Kenya. Where applications exist, they are often not broadly accessible, especially for persons with disabilities, areas with slow internet connections or members of underrepresented groups.

In this policy brief, the generic term “big data” is unpacked into four overlapping categories of data: big data, open data, user-generated data and real-time data, and are collectively referred as “x-data”. EDTs are taken to include artificial intelligence (AI), blockchain, geographic information systems (GIS), internet of things (IoT), and big data analytics. These methodologies are often used collectively. Gaps in support systems to develop EDT/x-data-based applications have created new digital divides between developing and developed countries. Further, barriers persist in use and take-up of x-data by decision-makers, competing data sources, quality of data, limited awareness of data existence, and inadequate transformation of data into useful information or tailoring to match the decision-makers’ needs (Pawelke et al., 2017). Kenya has recently ranked high in sub-Saharan Africa (4/41 in 2020 and 3/41 in 2021) and fairly well globally (71/172 in 2020 and 78/160 in 2021) on the Government AI Readiness Index (Oxford Insights and IDRC, 2020; 2021). The index evaluates how ready a government is to implement AI in the delivery of public services.

Approach

An in-depth review of literature and policy and regulatory environment was carried out. This was followed by stakeholder engagement through interviews/surveys. From the information gathered, an assessment of the maturity of the EDT ecosystem in Kenya was undertaken to determine the stage of its

development and application. The findings were used to develop policy recommendations. The literature review followed a multi-vocal systematic approach (Ogawa and Malen, 1991; Garousi, Felderer and Mantyla, 2016) of both peer-reviewed academic articles and grey literature covering the development and use of EDTs in Kenya. The grey literature reviewed focused on reports, trade journals and technical articles, books and book chapters. The governance frameworks, embodied in policies, laws, and regulations relevant to EDTs arising from the literature review, were identified and synthesized providing an overview of the regulatory and policy environment and are available in the full report on *A Deep Dive on the Maturity of Emerging Digital Technologies Ecosystems in Kenya and South Africa*.

Maturity or development stage models of an ecosystem provides tools for assessment of where an ecosystem is in its life cycle. They provide insights into the current levels of recognized success factors, essential for the maturity, health, and sustainability of the ecosystem. The emerging technologies ecosystem maturity model, developed by Ogot et al. (2023) was used for this study. It is based on the five fundamental activities of innovation processes framework (Liu and White, 2001): **education**, **research** (basic, developmental, engineering), **implementation** (manufacturing, deployment), **end-use** (customers of the product or process) and **linkages** (bringing together complementary knowledge) (see Table 1).

Table 1 – Indicators used to assess the state of maturity³

EDUCATION: Quality of graduates (measured by quality or availability of hires), New Masters and PhDs, university post-graduate programmes, researchers and professionals engaged in R&D, Africa/global ranking of universities with post-graduate relevant programmes, policies.

RESEARCH: Related Publications, R&D projects, patents, availability of funding for R&D, pilot projects, availability of required equipment, policies

END USE: Government targets, industry targets, demand from government, demand or opportunities in the market, demand or opportunities beyond the borders, policies.

LINKAGES: Technology dedicated workshops and conferences, network size, network intensity, collaboration with academia (or with private sector)

IMPLEMENTATION: New entrants, diversification activities of incumbents; availability of funding (traditional, equity, venture capitalists, angel investors), interest groups, policies

Table 2 – Stages of Maturity in the EDT/X-Data ecosystem

Fundamental Activities	Ideation Stage	Nascent Stage	Growth Stage
Education	<ul style="list-style-type: none"> Few Masters and PhDs Small number of academic departments Small number of researchers engaged in related research 	<ul style="list-style-type: none"> Increased number of Masters and PhDs Small number of academic departments Increasing number of researchers engaged in related research 	<ul style="list-style-type: none"> Large number of Masters and PhDs Increased number of academic departments Increasing number of researchers engaged in related research
Research	<ul style="list-style-type: none"> Few or no patents, Small number of publications Few pilot projects Low R&D funding Few policies supporting R&D 	<ul style="list-style-type: none"> Increased number of patents increased number of publications Increased number of pilot projects Moderate R&D funding Strengthened policies supporting related R&D 	<ul style="list-style-type: none"> Increased number of patents Large number of publications Large number of pilot projects Adequate R&D funding Strengthened policies supporting R&D
End use	<ul style="list-style-type: none"> Insufficient demand and information for potential products and services, market size 	<ul style="list-style-type: none"> Better understanding of and increasing demand for potential products and services, market size 	<ul style="list-style-type: none"> Good understanding of and robust demand for potential products and services, market size
Linkages	<ul style="list-style-type: none"> None or few international collaborations (research) Few linkages No clusters 	<ul style="list-style-type: none"> Small number of international collaborations (research and business) Small number of linkages A few clusters 	<ul style="list-style-type: none"> Moderate international collaborations (research and business) Moderate linkages Moderate clustering
Implementation	<ul style="list-style-type: none"> No/negligible active start-ups or existing businesses that have diversified into the ET space 	<ul style="list-style-type: none"> A few active start-ups or existing businesses that have diversified into the ETs space but are in the early stages Establishment of governance framework Gaps in financing 	<ul style="list-style-type: none"> Moderate number of active start-ups or existing businesses that have diversified into the ETs space Facilitative governance framework Increasing private sector financing

Table 3: Maturity of the different stages in the EDTs ecosystem

Fundamental Activities / Stage	Remarks
Education Growth	<ul style="list-style-type: none"> 52.4% of all universities offer an undergraduate programme providing a strong foundation for those who may go into the workforce related to emerging digital technologies or pursue further studies; Only 12.7% and 6.3% offer related Masters or PhD programmes, respectively, a fraction of the number of undergraduate programmes. Short courses are available in the core areas of EDTs and x-Data
Research Nascent	<ul style="list-style-type: none"> As a fraction of total patents applied for and granted in 2021, emerging digital technologies (excluding GIS) accounted for only 10.75 and 8.3%, respectively; Journal publications, based on locally based research in EDTs were relatively few mainly as a result of small number of researchers working in these areas; Few local research output has been commercialised, however, efforts driven by the Kenya Innovation Agency (KENIA) are supporting universities to commercialise research output.
End use Growth	<ul style="list-style-type: none"> There is a strong market demand for and/or understanding of the potential uses of emerging digital technologies, especially as they have provided opportunities for Kenya to leapfrog legacy systems and offer services leveraging on the extensive mobile penetration. Mobile-based use has strong potential due to familiarisation of most of the population with the devices (135% mobile subscriptions; 72% mobile money penetration; 40% internet penetration).
Linkages Growth	<ul style="list-style-type: none"> Numerous and growing number of formal linkages provided through support from incubators, accelerators, hubs and associations Strong linkages in relevant conferences, workshops and seminars, for example Connected Summit organised by ICT Authority and Ministry in charge of ICT.
Implementation Growth	<ul style="list-style-type: none"> Significant number of start-ups and established businesses offering new services and products based on the EDT/X-Data especially in the agricultural, education, financial, health, manufacturing and transport sectors; Facilitative governance and regulatory framework which has room for improvement in key areas of capacity building, data collection and sharing, incentives and funding, public private partnerships, intellectual property, and sensitisation; Extensive infrastructure (mobile and fibre networks, data centres, under-sea cable connections) supporting deployment of the technologies.

The emerging technologies maturity model defines three developmental stages. The ideation stage is beyond basic research, testing fundamental principles and is characterized by R&D activities with pilots and proof-of-concepts performed on potential commercial applications. The nascent stage embodies early development and formation of the ecosystem. Finally, in the growth stage, the commercial applications of the technology start gaining strong acceptance in the market with increased demand and new entrants; and the ecosystem governance structures are

becoming clearer. Table 2 presents indicators metrics for the three maturity stages.

Summary of Findings

The EDT/X-Data ecosystem in Kenya was assessed to be at the **Growth Stage of maturity**. With reference to Table 3, all the fundamental activities were assessed to be in the **growth stage** except research, assessed to be in the **nascent stage**.

Identified Challenges

- Inadequate funding to support R&D activities in universities and research institutions. Public spending on R&D has particularly been reducing owing to budget cuts towards public institutions.
- Shortage of the necessary infrastructure such as High Performance Computing for processing big data
- Inability to access data coupled with inadequate implementation of the data protection laws and regulations to assure privacy

- (d) Low IP protection resulting from limited awareness and associated costs.
- (e) Inadequate utilization and commercialization research outputs.

- Promote public-private partnerships that support the development and application of EDTs and X-Data, including the development of joint initiatives between government agencies, private sector companies, and civil society organizations, as well as the establishment of regulatory frameworks and standards to guide these partnerships.

Policy Recommendations

- Promote training of individuals in data science and analytics, machine learning, and other related fields is required to build a skilled workforce capable of developing and analysing EDTs/X-Data.
- Regulate the collection, sharing, and use of data, including real-time data, open data, and user-generated data, that ensure compliance with existing data protection laws and regulations to maximize its benefits to stakeholders, while ensuring privacy and confidentiality.
- Incentivize the adoption and use of EDTs and X-Data, including the provision of funding or tax incentives for stakeholders who invest in these technologies, as well as the establishment of prizes or awards for innovation and best practices in the use of EDTs and X-Data.
- Simplify the steps involved in IP protection as well as sensitization of researchers, innovators on the benefits of IP.

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