

BYTE BY BYTE

Policy Innovation for Transforming Africa's Food System with Digital Technologies



Kenya has an advanced digital environment. According to the World Bank's EBA ICT index, Kenya ranks top among African countries on the index. With a score of 7.0 out of 9, Kenya offers a superior system of laws, regulations and policies that promote an enabling environment for the provision and use of ICT services, particularly in rural areas.ⁱ In addition, according to GSMA's Mobile Connectivity Index (MCI), Kenya performs particularly well on the price of handsets, gender equality and network coverage (85 percent of the population has access to 3G coverage). However, owing to weaker network performance, that is, upload and download speeds, Kenya's performance on the MCI scores an average 51.ⁱⁱ Even so, Kenya has the second fastest internet in Africa according to the Worldwide Broadband Speed League (after Madagascar).¹ Nevertheless, as part of its long-term development plan, the government aims to roll out 4G networks across the country to provide faster internet and increase bandwidth capacity.² To date, strong institutional, policy and programmatic developments ensure that Kenya sustains its leadership on digitalization in agriculture across the continent.

Institutional innovation

Kenya's Vision 2030 offers a blueprint for its long-term development pathway, implemented in five-year medium-term plans (MTPs). The prevalence of ICT within its three pillars (Economic and Macro, Social, and Political) and nine foundations for the pillars provides an insight into the importance of

digitalization in achieving Kenya's ambition to become "a newly-industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment."³ Specifically, the information, communications and technology; environment, water and sanitation; and science technology and innovation pillars of Vision 2030 have a bearing on digitalization for agriculture and food security.

The Information and Communication Technology Foundation pillar of Vision 2030 aims to upgrade ICT capacity, and improve public service delivery using ICT, including support for food security through the development of a digital land management system, GIS, mapping of farm productivity, forecasting, digital meteorological systems, market information systems, e-farming, farm produce management systems, agricultural information systems, remote sensing, population management systems, and health and nutrition information systems.⁴

The Environment, Water and Sanitation sector within the Social Pillar emphasized the modernization of meteorological services in five thematic areas: observation network, data exchange network, data processing, analysis and forecasting systems, weather products dissemination and research for development.⁵ By 2018, 88 Automatic Weather Stations (AWS), automatic hydrometeorological stations, upper air observing systems in Garissa and Lodwar, and automatic airport weather observing systems had been installed.⁶

ⁱ The EBA ICT indicator measures laws, regulations and policies that promote an enabling environment for the provision and use of ICT services, particularly in rural areas. The index ranges from 0-9 (9 indicating high performance). An index equal or higher than 4.5 is identified as 'developing' and 'prospering' in the regulatory framework performance and therefore considered as high performers in our cluster.

ⁱⁱ The GSMA Mobile Connectivity Index measures the performance of 163 countries (44 African countries), against the four key enablers of mobile internet adoption - infrastructure, affordability, consumer readiness and content and services. The index ranges from 0-100 with 100 indicating high national capacity to support the adoption of mobile internet.



Finally, the Science, Technology and Innovation Foundation Pillar has led to the development of the Kenya National Innovation Agency (KENIA). Set up as a state corporation under the 2013 Science, Technology and Innovation (STI) Act, No. 28, by the Ministry of Education, KENIA is responsible for leveraging, co-ordination, promotion and regulation of innovation and entrepreneurship, thus institutionalizing linkages between universities, research institutions, the private sector, and the government. KENIA has already supported the development and commercialization of the Ujuzi Kilimo soil kit—an innovative sensor technology connected to a database for analysis of farm data, which enables the farmer to make informed decisions for targeted interventions.⁷

While the Vision 2030 sets out a longer-term ambition for the country, the current administration has included the target of “100 percent food and nutrition security” by 2022 within its own mandate. The government has set out goals to increase the average daily income of farmers, reduce the cost of food as a share of income, create 1,000 jobs in agro-processing, and reduce the number of food insecure people. The government considers innovation and technology a key enabler for delivering on this ambition, via the digitization of land titles and expansion of an e-government services system, expansion of the national fiber optic infrastructure and establishment of national science technology and innovation parks.⁸

With the government implementing ICT programs across all its operations and services, it is providing a clear stimulus to drive digitalization across the country. The key ministries involved in the implementation of digitalization in agriculture, also with impetus from Vision 2030, are the Ministry of Information, Communications and Technology (ICT); the Ministry of Agriculture, Livestock, Fisheries and Irrigation; and the Ministry of Land, Housing and Urban Development.

The Ministry of ICT is leading infrastructure development for the ICT sector, including the migration from analogue to digital broadcasting. Within the Ministry, the State Department of ICT and Innovation is responsible for, among other things, National ICT Policy and innovation, promotion of the software development industry, policy on automation of e-government services (including the roll-out of e-agriculture services), development of national communication capacity and infrastructure (including setting up of County ICT Incubation Hubs), and management of national fiber optic infrastructure.⁹ The aim of e-agriculture is to provide information on soils, crops, and planting as well as data to help farmers make informed decisions and apply methods of precision agriculture and enhance rural development.¹⁰

The ICT Authority—a state corporation under the Ministry of ICT—is mandated to promote e-government services, including supervision of their design, development and implementation; as well as to promote ICT innovation and enterprise.¹¹ The ICT Authority also hosts the Kenya Open Data Portal, which makes government datasets accessible for free to the public in easy reusable formats.¹² The Portal currently hosts several farming and agricultural databases such as Proportion of Households Engaged in Crop Farming, Percentage Distribution of Agricultural Parcels, Proportion of Parcels under Irrigation County Estimates 2005/6,

and county crop statistics—all of which provide rich new insights and data for service design and delivery.¹³

Following the introduction of Vision 2030 in 2008, the Kenyan government wrote and implemented the Kenya Communications (Amendment) Act 2009, as well as the Kenya Information and Communications regulations. This legislation, combined with an open market for foreign investment in telecommunications (infrastructure), were expected to improve competition widening choices of ICT services.¹⁴ However, given Safaricom’s large market share (65.4 percent as of December 2016), the market is not considered highly competitive. Nevertheless, Airtel is disrupting the market by leasing out its own infrastructure to new mobile virtual network operators, which offer less expensive, more flexible consumer plans although at the cost of slower data speeds.¹⁵ At the same time, others in the private sector have been rolling out their own national ICT infrastructure, including in telecommunications, and data infrastructure. This competition has led to a reduction of rates and increased the adoption of mobile phones and internet.¹⁶

The Communications Commission of Kenya was also reformed in 2013 (and renamed Communications Authority of Kenya, CA) to regulate the communications sector in Kenya.¹⁷ Originally established in 1999 by the Kenya Information and Communications Act 1998, CA is responsible for facilitating the development of the information and communications sectors including cybersecurity, multimedia, telecommunications, and electronic commerce.

The Ministry of Agriculture, Livestock, Fisheries and Irrigation (MoALFI) also plays a significant role in advancing digitalization in agriculture in Kenya. Although there is not a directorate or department for digitalization, the Ministry has created several connected policies to enhance the uptake and implementation of ICTs in agriculture. In addition, while implementing MTP II (2014-2018), the government reformed the National Agricultural Research Systems through the Kenya Agricultural and Livestock Research Act 2013 to create the Kenya Agricultural and Livestock Research Organization (KALRO). KALRO has since been restructured to form a more dynamic, innovative and responsive organization to promote, streamline, co-ordinate and regulate agricultural research, as well as expedite equitable access to research information, resources and technology.

Policy and programmatic innovation

Kenya’s Agricultural Sector Transformation and Growth Strategy 2019-2029 outlines nine key areas of intervention—flagships that will be the focus for transforming the agriculture sector in Kenya with the aim of achieving 100 percent food and nutrition security.¹⁸ Four of the nine flagships are relevant for digitalization in agriculture, seeking to reform the national subsidy system for inputs, the Strategic Food Reserve for high-needs Kenyans, extension work, and research and innovation:

- **Flagship 2:** focuses on digitizing the national subsidy system to register 1.4 million high-needs farming households within the first five years to 2024 to enable them to access inputs using an e-voucher system. Following a three-year verification



program by extension agents, US\$50 million will be reallocated to enable farmers to purchase a range of inputs from multiple providers, including private sector agro-dealers.

- **Flagship 5:** calls for digitizing stock and cost management systems in the Strategic Food Reserve. In partnership with the Ministry of Finance, this flagship seeks to introduce competitive bidding for storage, thus enabling the private sector to get access to allocations for these reserves.
- **Flagship 7:** seeks to digitize and update the provision of extension services, including by training 3,000 digitally-enabled youth, small and medium enterprises and public-private partnership officers, as well as project coordinators, and Strategic Food Reserve inventory personnel. Rather than leading this program centrally, MoALFI will encourage uptake at county level by providing a training program and supplementary funding for implementation including from national research organizations. By 2024, it is expected that the flagship will raise the ratio of extension worker to farms to 1:600. This flagship aligns with the National Agricultural Sector Extension Policy (NASEP) 2012 which also encourages increased use of ICTs within Agricultural Knowledge Information Systems. To do this, NASEP seeks to ease access and use of information by establishing an integrated and dynamic database for the sector, investing in capacity building in ICT including creating information points in rural areas, and harmonizing the content and quality of extension messages to make them more user-friendly. NASEP also aims to encourage the private sector to set up and operate rural information centers.¹⁹
- **Flagship 8:** driven by the need for better access to useable and shareable data, as well as raising the investment in research and innovation, this flagship will improve data collection for better analysis and informed decision- and policymaking thus strengthening links between research and activity on the frontline. In this respect, it will digitize existing data held by MoALFI and associated agencies, and feed this into the Kenya Open Data Initiative; use field data for improvised feedback loops, e.g. tracking the performance of the subsidies or recertification of vendors, etc.; and strengthen data laws and set up open data platforms for agriculture. By 2024, it is expected that this flagship will register more than 3.3 million small-scale farmers for more efficient service delivery; and 1,000 farmer service providers will be logged onto digital platforms, which are informed by the latest research and data.²⁰

In addition to the Agricultural Sector Transformation and Growth Strategy, Kenya's Youth Agribusiness Strategy (KYAS) 2017–2021 strongly promotes the role of digital technologies to provide new opportunities for youth in agriculture and its value chains. In order to attract more youth into farming and related activities, to drive agricultural innovation, and research and technology development and deployment, KYAS has allocated nearly US\$20 million for 2017–2021 to building capacity of youth by creating knowledge and information hubs and resource centers at county-level, as well as related tech-labs and ICT centers and mobile apps. Moreover, to provide access to markets for outputs, KYAS supports the formation,

review and integration of structured information platforms and infrastructure.²¹

The above policies and strategies have provided a framework and the impetus to implement transformative and innovative programs in Kenya.

In October 2018, KALRO launched a pilot agricultural observatory platform in partnership with the World Bank. The platform is designed to enhance access to high-resolution geospatial agro-meteorology data to enable better decision-making among farmers. It uses big data, AI, and machine learning to provide more accurate, timely and reliable weather data.²² The US\$1 million program also includes training for scientists at KALRO on predictive analytics and integration into agriculture.²³ Separately, in May 2018 KALRO launched 14 mobile apps to help lower prices for consumers, and contribute to smart agriculture and a potential increase in yields. The apps provide advice on best practices for the rearing of indigenous chicken and the production of range pasture seed and dryland crops. This helps farmers identify and prevent pests and diseases that affect their crops and facilitate farmers' access to markets.²⁴ Based on information shared by Lawrence Mose of KALRO, within a year of their creation, the apps are being actively used by 1,600 users.²⁵

Kenya's propulsion into digitalization leadership came from the conception of M-Pesa, which has transformed the financial sector in Kenya, and to a large extent, globally. Safaricom pioneered M-Pesa—the mobile money transfer business—in 2007, the establishment of which required collaboration with the Central Bank of Kenya and called for modifications in existing banking systems and regulations. M-Pesa has over 23 million subscribers and 160,000 agents within Kenya, and over 13.4 million subscribers in 10 countries outside Kenya.²⁶ In 2018, mobile money transactions in Kenya amounted to US\$38.5 billion, an increase of 10 percent over the previous year. This equates to nearly half of Kenya's GDP. Since its launch, the application of M-Pesa has also expanded from its use as a cash transfer tool to being used by businesses for purchases of goods and services, as well as processing of instant short-term loans.²⁷ Importantly, by providing access to finance for those previously “unbankable,” including smallholder farmers, M-Pesa has increased the annual use of inputs of agricultural households by US\$42, and annual household income of these households by US\$224.²⁸

A thriving digital sector in Kenya has attracted complementary finance stakeholders, many of which include digitalization in agriculture in their portfolio. In addition to grant funding from conventional multilateral donors such as USAID, DfID, World Bank, Enabel (Belgium), and Rockefeller Foundation, there is a growing number of angel investors such as Acumen Fund, Omidyar Network and the Bill & Melinda Gates Foundation, and competitions such as the Apps4Africa, Google Apps Developer Challenge and the Orange African Social Venture Prize—all of which are seeking to achieve maximum returns and impact for innovations. Finally, accelerators and digital hubs are building a landscape of co-working spaces where entrepreneurs, innovators and people with technical skills can convene.^{29,30} In addition, Google Kenya is working in partnership with One Care



Fund to train 100,000 Kenyan smallholder farmers in digital skills through a US\$1 million grant to digitize their agribusiness operations and tasks.³¹

Several other M-services have arisen from M-Pesa, including M-Farm and M-Kilimo. The M-farm software provides weather and market price information across agricultural stakeholder groups including farmers, suppliers and manufacturers. It also helps farmers to connect with each other. In Kinangop District, farmers using the M-Farm application declared that their crop yields had increased, and the cost of fertilizer dropped from approximately US\$40 to about US\$25 as a result of better information on inputs, and overall savings quintupled. Importantly, the increase in savings led to a more diverse diet, and better nutrition including more fruits and animal protein.³²

Digital solutions in Kenya also help to protect the livelihoods of pastoralists and reduce their vulnerability to climate change. The Kenyan government in partnership with the International Livestock Research Institute and the private insurance sector launched the Kenya Livestock Insurance Program (KLIP) in 2015.

KLIP uses satellite technology to monitor the state of vegetation and pasture in remote, arid and drought-prone lowlands of Kenya. When the 'greenness' of the vegetation falls beyond a pre-determined level, the index-based insurance kicks in to release payouts to pastoralists, also through mobile payments (M-Pesa). The program covers more than 90,000 livestock units and has made payouts of more than US\$7 million to 32,000 pastoralists since 2015. An evaluation of the program in 2018 confirmed that this program significantly reduced household food insecurity among those who were signed up to KLIP.^{33,34}

In conclusion, Kenya has a vibrant environment for digitalization in agriculture. Supported by key government-led initiatives, the private sector is leading in innovating and developing solutions designed to address challenges faced by smallholder farmers and pastoralists in the country. However, without a distinct policy and directorate to oversee the development of this sector, benefits and lessons may not always be captured effectively. Nevertheless, having pioneered the M-Pesa, Kenya has built its identity as a digital leader in Africa.

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