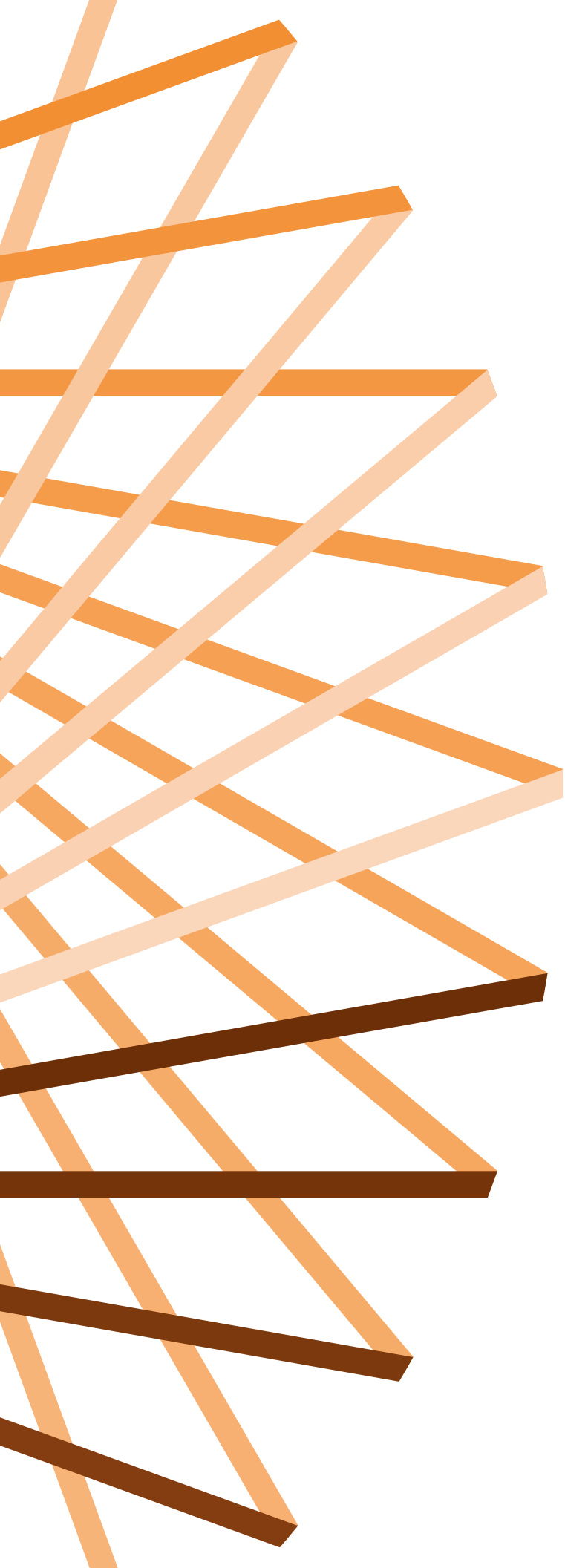
HARNESSING AFRICA'S DIGITAL POTENTIAL:

New tools for
a new age



CHAPTER 5

New frontiers in Africa's digital potential

Njuguna Ndung'u
Former Governor, Central Bank of Kenya

In 2018 and beyond, digitization will provide an important avenue for African economies to leapfrog not only financial development but also development across other sectors of the economy. There are infinite opportunities on the digital platform, and fintechs are working round-the-clock to develop and introduce new products here. However, these changes will benefit only those economies that embrace digitization, invest in the required infrastructure, and introduce commensurate regulatory technology. Digitization is transforming African economies in four major ways: retail payments systems, financial inclusion, sustainable business models, and revenue administration. Given that Kenya has stood out in its success in pursuing and utilizing digitization, the experiences of the country, explored in this essay, shed light on Africa's digitization potential in 2018 and beyond.

Digitization is transforming African economies in four major ways: retail payments systems, financial inclusion, sustainable business models, and revenue administration.

Digitization and retail payments systems: Digitization has revolutionized the retail payments system and the payments infrastructure. Economies are saving billions of dollars per year by using electronic payments and centralizing those payments. The retail payments infrastructure is one of the earliest beneficiaries of mobile-phone based payments and transactions platforms. Electronic payments platforms save on transactions costs in terms of time, travel, and even unit costs. Indeed, this revolution cuts across rich and poor, underserved and unserved, and formal and informal businesses.

Given this transformation, it is time in 2018 for all African economies to join the Better Than Cash Alliance (BTCA)—a global partnership that encourages the shift away from cash and towards digital payments—advocate for electronic retail payments migration, and develop the requisite payments infrastructure so that government payments can be centralized into an electronic payments platform. The potential economy-wide benefits are immense. We expect African economies to benefit from all these developments.

Digitization and financial inclusion: Digitization has become an easier platform to support financial inclusion and female financial empowerment. Obstacles to financing access, such as physical distance, minimum balance requirements, little to no credit, and low-income flows can be circumvented. Savings have increased, micro-savers have opened bank accounts, and banks are now able to price short-term loans. In fact, currently there are over 20 million virtual savings accounts (one bank accounts for 18 million of these virtual savings accounts five years after the product was launched) that have been opened in the last five years compared to about 30 million deposit accounts in the banking sector. Not only has digitization in Africa brought financial services to the doorstep, it has been an important avenue for creating market access. The benefits are clearly widespread and attractive, and new virtual savings products and platforms continue to emerge (see Table 5.1).

TABLE 5.1. VIRTUAL SAVINGS AND SHORT-TERM CREDIT SUPPLY PRODUCTS FOR THE POOR IN EAST AFRICA

New and innovative products for financial inclusion through digitization are popping up around the continent. The four below show the variety and accessibility of these types of products in East Africa.

Product	Country	Launched	Number of accounts	Average savings	Average loan size	Average loan repayment period	Total loans disbursed	Non-performing loans (industry average is 5.3%)	Other notes
M-Shwari	Kenya	November 2012	20.4 million*	$6.00	$31.62	26 days	$2.09 billion	2.30%	67% of users are under age 34
M-Pawa	Tanzania	May 2014	6.5 million (65% active)	$1.51	$16.60	28 days	$63.7 million (2,612 loans per day)	7.4% for scored customers and at 17.2% for randomly selected customers	-
Mokash	Uganda	August 2016	2.71 million	$0.41	$7.75	19 days	$9.2 million (2,761 loans per day)	-	-
Mokash	Rwanda	February 2017	556,202 (100,000 active)	-	$10.25 with average loan fee of 9%	-	$354,000 (1,004 loans per day)	7.7% for scored customers	Customers can borrow up to $500 at an interest rate of 7%

Note: *M-Shwari Lock Savings accounts are flexible fixed deposit accounts offered depending on the customer's purpose of savings. The customers have a target to save. So far, 234,346 accounts are in this Lock Savings product, and the average savings target is $220, with the average lock savings account of $88 over an average period of 3.9 months.

The entry point of digitization has been through the telecommunications sector, given the diverse products available on the mobile phone and its replication capability across countries. Virtual savings and credit supply platforms enable users to apply for loans, better manage fluctuations in their cash flow, and cope with unexpected needs. This combination of savings and affordable credit shortens the savings/investment cycles for the poor, providing a strong avenue for the links among financial inclusion, inclusive growth, and sustainable poverty reduction. Financial inclusion is thus not an end in itself, but rather an enabler of development, a supporter of progress, and a powerful tool to achieve the Sustainable Development Goals. Notably, in those countries that have embraced digital financial services, financial inclusion has improved, and strong banks have emerged as more people are able to open bank accounts. The increasing deposits from these bank accounts have enhanced the capacity of banks to intermediate savings and innovate.

Digital financial services create opportunities beyond financial inclusion. For example, they have supported the formulation of effective and forward-looking monetary policy frameworks; the East Africa region is an important example. The fact that currency outside the banking sector has declined and innovations in the financial system continue to bring more products and participants into the banking sector is important for monetary policy signals. It has become easier to monitor transactions and activities in the financial system, and most countries in Africa continue to improve their anti-money laundering and combating the financing of terrorism regimes significantly.

FIGURE 5.1

Where is innovation highest in Africa?

Innovation "achievers" are countries that have higher than expected Global Innovation Index scores based on their level of economic development. As seen in the map below, many countries in East Africa are leading the way when it comes to innovation. Notably, Kenya, Mozambique, Malawi, Rwanda, Uganda, and Senegal (in West Africa) have consistently outperformed on the index, being classified as innovation achievers at least 5 times in the last six years.

Source: Global Innovation Index, 2017.

Finally, digital payments promote women's economic empowerment by facilitating greater account ownership and asset accumulation, thus increasing women's economic participation. Women can save in platforms and products that cannot be encroached; they are able to borrow and invest. Women in Africa are efficient savers and investors. Digital payments enable confidentiality and convenience. In many cases, this is the first account that a woman has in her own name and under her control. As noted in the 2016 FinAccess survey results for Kenya, formal inclusion among women accelerated between 2009 and 2013 due to considerable adoption of mobile financial services.

Digitization and sustainable business models: Different products have been rolled out on the digital platform to cater to the other sectors of the economy, like energy and agriculture, to better reach a market segment or increase productivity. Digital platform sustainable business models can be developed across the economy to resolve the binding constraints and to support productivity growth in those sectors. Products like M-Akiba for micro-investors in government securities, M-KOPA for solar energy supply, and the One Acre Fund program in agriculture are making a difference outside the financial sector.

The KSh 150.04 million (approximately $1.5 million) uptake of the M-Akiba bond was mainly dominated by small investors who invested less than KSh 10,000 (approximately $100).

- **One Acre Fund:** Small-holder farmers in Africa require financial products that offer flexibility to accommodate their lumpy and seasonal income. One Acre Fund, operating in East Africa, has created a loan product that fits the needs of these farmers. The fund procures high-quality farm inputs (including improved seeds and fertilizer), ensures timely and convenient distribution of those inputs, trains small-holder farmers on the inputs to maximize returns on their investment, and assists in market facilitation to maximize profits. Since 2014, One Acre Fund has enabled farmers in Kenya to make loan repayments digitally using M-Pesa instead of cash. The loan product offers farmers flexible repayments with no repayment schedule on the M-Pesa platform: Borrowers can pay as little or as much as they want at any time and can complete repayment by the final deadline. This flexibility allows farmers to closely match repayments to cash flow and reduce pressure on household finances. The results from One Acre Fund show that a combination of farm inputs (including improved seeds and fertilizer) and convenient and timely delivery has enhanced productivity, increased income per acre by 50 percent and has generated a dollar impact of roughly $135 per farmer.

- **M-Akiba:** Launched in March 2017, M-Akiba is a micro-investment in government securities using the mobile phone payments platform. Notably, it is the world's first mobile-only retail bond. The government aims to borrow KSh 5 billion (approximately $50 million) through the M-Akiba bond to fund government infrastructural development projects with a coupon rate of 10 percent. With M-Akiba, Kenyans can save money and earn interest every six months, with a small initial minimum investment amount per account of KSh 3,000 (approximately $30) and consecutive trades in multiples of KSh 500 (approximately $5). Table 5.2 presents the first intake of the bond after the launch in March 2017. It shows that the KSh 150.04 million (approximately $1.5 million) uptake of the M-Akiba bond was mainly dominated by small investors who invested less than KSh 10,000 (approximately $100). Those who invested the minimum amount of KSh 3,000 constituted 31 percent of the total investors, whereas those who invested between KSh 3,001 and KSh 10,000 constituted 34.5 percent. So far, 5,691 Kenyans have invested in this product at its initial phase. Thus, digitization has made it possible for micro-savers and micro-investors to participate effectively and efficiently in the financial system. In addition, this innovative domestic resource mobilization strategy allowed the government to access a pool of

Rethinking African growth and service delivery: Technology as a catalyst

Rosanna Chan @I_am_rose
Digital Economist and Entrepreneur

The digital internet age is presenting major opportunities in the development space in the 21st century. In every single sector, technology is disrupting the status quo: from financial access to property rights, from health to education, from energy to water, as well as government services, measurement of outcomes, implementation methods, and ways to connect to stakeholders like never before. For the first time in human history, we can theoretically connect to every single stakeholder. Technology can exponentially facilitate the achievement of development goals through rapid scale, and, hopefully, also provide dividends for the world's poorest people.[1]

For the first time in human history, we can theoretically connect to every single stakeholder.

While 20th century development goals remain and the historical challenges to development persist, technology introduces both new tools and new objectives. How is technology re-defining the development space?

Creating a fundamental shift in structure of economies

Modern economies have followed a growth trajectory that transformed economic structure from agriculture to manufacturing to services. The 21st century introduces the next economic structural shift, where value will be driven by digital assets, intellectual and knowledge goods, data, and information. Economies will derive comparative advantages from their ability to transform, utilize, and process digital sources of value. This change poses both opportunities—and threats—to the economic growth of emerging markets and developing economies. On one hand, technology can help countries overcome many barriers to growth across the board very quickly: from online education to maternal health tracking, from food tracking along the value chain to drone delivery of medicines, from the provision of government services through mobiles, to accessing international markets by producers. The success of M-Pesa shows that Africa's large young population are tech savvy and quick to adapt to technological changes.

On the other hand, the digital divide separating economies that can adapt to new technologies to those who cannot can exasperate global inequalities, create poverty traps, and exacerbate vicious cycles of poverty.

Transforming the roles of producer and consumers, employers and self employed

In the digital age, technology has altered what traditional labor looks like. The 21st century saw the advent of consumers selling goods and services to other consumers at a global scale, acting both as producer and consumer. This includes the sale of personal goods online, such as through Amazon, eBay, and Etsy, to the sale of services, such as Airbnb, Uber, and Lyft, to financial services via peer-to-peer lending and crowd funding.

Within internet-facilitated peer-to-peer exchanges, shared economies allow optimization of underutilized resources by sharing access to goods and services among users—introducing an entirely new sector that

1. Schiller, Ben. 2016. "How The Technology Behind Bitcoin Is Going To Change The Lives Of The Bottom Billion." co.exist.

generates additional income-earning opportunities. Shared economies blur the lines between formal versus informal sectors, producers and consumers, and employers and employees.

Not only does this new economic structure blur these lines but it also raises participation in the gig economy—non-permanent employment usually across various tasks such as freelancing, impact sourcing, Uber driving, Samasource.org, Upwork (formerly eLance), and Airbnb. Most recent estimates indicate that as much as about 34 percent of the U.S. workforce participate in the gig economy, and this number is expected to rise to 43 percent by the year 2020.[2]

Now, African countries are already some of the most active participants in international outsourcing platforms such as Upwork, and the Nigerian government launched a "Microwork for Jobs initiative" Naijacloud in 2013.[3] With these increasing global job opportunities, it is an imperative to invest in education, particularly in STEM (science, technology, engineering, and mathematics) and language skills to ensure competitiveness in the future digital global economy.[4]

Rethinking public provision and institutional relationships

Economic growth in 2018 and beyond depends on public sector digital adoption, just as much as on the private sector, to ensure a cohesive digital environment for growth and to maximize human welfare. "Govtech" is a growing area of technology that aims at increasing efficacy and efficiency of government functions. In particular, the internet and blockchain technologies facilitate the growth of decentralized networks that reduce the need for third-party verification and minimize bureaucracy.

Economic growth in 2018 and beyond depends on public sector digital adoption, just as much as on the private sector.

Given that the internet now offers means of communicating like never before, it is changing the way that governments, citizens, and the private sector engage, as well facilitating global action, coordination, and implementation. From citizen engagement on pertinent policy changes, to greater facilitation of global trade, the advent of digital technology offers unprecedented opportunities to re-imagine governing institutions not only to be better adapted to the 21st century, but to better the welfare and opportunities of all people on earth.

2. Gillespie, Patrick. (2017). Intuit: Gig economy is 34% of US workforce. CNN Money. Available at http://money.cnn.com/2017/05/24/news/economy/gig-economy-intuit/index.html
3. Aginam, Emeka. 2014. FG implements Naijacloud initiative in 36 states. *Vanguard*. Available at https://www.vanguardngr.com/2014/09/fg-implements-naijacloud-initiative-36-states/
4. Manlan, Carl. 2017. The gig economy is good but invest in education and SMEs. *The East African*. Available at http://www.theeastafrican.co.ke/oped/comment/Gig-economy-good-but-invest-education-and-SMEs/434750-4083758-pet6pn/index.html

savings that was out of reach before to finance its projects and small savers to earn interest on their funds. The idea that small savers can use their savings to lend money to the government and make investments with good returns marks the success of digitization in Kenya transcending market segments.

TABLE 5.2. THE M-AKIBA UPTAKE

The M-Akiba bond (named after the word for "savings" in Swahili, "Akiba"), launched in March 2017, to great success. In fact, the bond sold out just 13 days after launching. This three-year bond is sold only via mobile phone and goes for as low as $30, opening access to government bonds to low-income and rural citizens.

Amount analysis by band (KSh)	Value (KSh million)	Number of investors	Share in total number of investors (%)
Minimum amount = 3,000	5.31	1,772	31
3,001 - 10,000	13.3	1,963	34.5
10,001 - 20,000	9.74	595	10.5
20,001 – 50,000	25.19	677	12
50,001 – 100,000	28.52	366	6
Above 100,000	67.98	318	6
Total	**150.04**	**5,691**	**100**

Note: As of December 4, 2017, $1 is equal to 103.09 KSh.
Source: The National Treasury, Government of Kenya.

- **Water vending machines:** Providing an adequate supply of water to households remains a challenge for government in several African countries. In Kenya, for example, an estimated 36 percent of the population does not have access to clean drinking water, with the problem acute in arid and semi-arid rural areas and urban slums. In Nairobi's Mathare slums, a public-private partnership between Nairobi Water and Sewerage Company, Safaricom (a telecommunication company), and Grundfos (a Danish water engineering firm) resulted in the installation of water vending machines. To buy clean water, users load points onto smart cards with credit bought on-site or via their mobile phones, then use the cards to access the water vending machines around the slum. With a simple swipe of their smart card, water is released from the main storage and into a waiting container. Through M-Pesa, payments are collected from customers more efficiently, while a cloud-based system receives and publishes all transactional and operational data from each water dispenser, ensuring accountability and reducing service costs. The machines are revolutionizing water availability and distribution to the poor slum dwellers that have long been at the mercy of water cartels. The outcome seems to show that with the introduction of this payments platform, unit costs have declined substantially. The weekly expenditure on water in the slum has been reduced from KSh 250 ($2.5) to KSh 2.50 (2.5 cents)—a 100 percent reduction on water costs. Electronic payments not only increase efficiency and cut out the middlemen, but above all flatten the market segmentation introduced by cartels.

- **M-KOPA Solar:** M-KOPA is an innovative solar power solution program that helps low-income consumers acquire high-quality, affordable energy. The M-KOPA inventors developed a proprietary, patented technology platform that combines an embedded global system for mobile communications and mobile phone payments capabilities to facilitate financing of the solar power

Can technology help leapfrog education in Africa?

Rebecca Winthrop @rebeccawinthrop
Director and Senior Fellow, Center for Universal Education, Global Economy and Development, Brookings Institution

Katie Langford
Research Intern, Center for Universal Education, Global Economy and Development, Brookings Institution

The talent and energy of Africa's young people is being poorly served by many of its underperforming education systems. Across low-income countries, only 8 percent of children are on track to master basic secondary education level skills in such areas as math, language, and critical thinking.[1] According to our analysis, it will take the average student in sub-Saharan Africa almost 100 years to catch up to the average student in high-income countries in terms of how many years of school she will attend and how much she will learn.[2] Given that the numbers of young people in Africa are only set to increase in the coming years, education systems must find new ways of fully supporting their talents.

It will take the average student in sub-Saharan Africa almost 100 years to catch up to the average student in high-income countries in terms of how many years of school she will attend and how much she will learn.

Investing in Africa's young people by giving them the skills they need for the future is perhaps one of the smartest strategies for accelerating progress in the region. Some argue that this education-led growth is the way of the future, particularly when analyzing the changes technology will likely reap on jobs, including transforming many low-skilled jobs into ones that will require more complex, non-routine cognitive and inter-personal tasks. Therefore, the question remains: Can the creativity and innovation that is taking place across Africa be harnessed to help rapidly accelerate education progress?

This is a question we examined in the recent report *Can We Leapfrog? The Potential of Education Innovations to Rapidly Accelerate Progress.* Around the world, Africa is well known as a leader in "leapfrog development," namely accelerating development progress by skipping entire phases of infrastructure- and institution-building. Mobile banking is a successful example. If such rapid, nonlinear progress is possible in these areas, why could the same not be true in education?

It is possible but will require significant shifts in the way education is done.[3] Already, sub-Saharan Africa is ripe with education innovations, making up 23 percent of the catalog. In our study, countries such as Kenya, South Africa, and Uganda are hotspots of education innovations, hosting approximately 60 percent of the innovations from the region.

Kenya, South Africa, and Uganda are hotspots of education innovations, hosting approximately 60 percent of the innovations from the region.

Given the scope and scale of the education challenges we face, well-deployed technology can provide

1. The International Commission on Financing Global Education Opportunity. *The Learning Generation: Investing in education for a changing world.* September 2016.
2. Winthrop, R., & McGivney, E.. *Why wait 100 years? Bridging the gap in global education.* The Brookings Institution. June 2015
3. In our report, *Can We Leapfrog? The Potential of Education Innovations to Rapidly Accelerate Progress*, we lay out a leapfrog pathway for education that centers on four essential domains: learning and teaching, recognizing and learning, people and places, and technology and data. Against this pathway, we have developed and analyzed a catalog of nearly 3,000 education innovations around the globe and identified promising approaches that could help young people leap ahead in their education.

meaningful support to global leapfrogging efforts. In sub-Saharan Africa, innovators are leveraging technology to reach out-of-school children, enhance classroom engagement, disseminate classroom materials, and track student progress, among other things. For example, television and SMS technology are often used to deliver content to children and teachers, and information and communication technology centers, providing materials and training opportunities, are increasing educational access both in and outside of schools.

Most technology-based education innovations in the region utilize existing tools in new ways. Eneza Education, with its reliance on SMS, is one example of such practices. A private sector program operating in Ghana, Kenya, Tanzania, and Zimbabwe, Eneza provides students with mobile access to quizzes connected to the national curriculum. After completing the assessments via text, students receive feedback and mini-lessons targeting areas where they need support. Teachers use their phones to track student progress, identifying students' strengths and weaknesses. The results of such interventions are promising: Internal evaluation results showed that students who used Eneza increased their scores by 5 percent compared to a control group.

Most technology-based education innovations in the region utilize existing tools in new ways.

With an openness to innovation, sub-Saharan Africa shows great promise for leapfrogging in education. Though projects that utilize technology to transform existing education practices are currently outliers in educational innovations, they offer bright examples of the potential to close the 100-year gap. If we are to leapfrog education for learners in Africa and beyond, we must make room for bold new approaches; transformative technology has the potential to support such rapid progress.

equipment. Customers buy the solar home system on an affordable M-KOPA payment plan, with an initial deposit followed by daily payments through their mobile phones for up to one year. After completing payments, customers own the product outright. As of May 2017, M-KOPA had connected over 500,000 homes to affordable solar power with 500 new homes being added every day. The estimates from the M-KOPA solar program show that current customers will save up to $375 million over the next four years on energy costs and enjoy 62.5 million kerosene-free months of lighting.

- **M-TIBA:** The M-TIBA savings product is a mobile phone-based health wallet that enables one to save, send, and spend funds specifically for medical treatment. Money stored in M-TIBA can only be used to pay for treatment and medication at specific clinics and hospitals. M-TIBA uses the internationally recognized "SafeCare" standards to monitor the quality of care available at these facilities. Instead of paying hospital bills for relatives, friends, or staff, it is better to transfer funds from their M-TIBA account. This ensures that they can visit a licensed health care facility of their choice whenever they need to, empowering them to lead a healthy life. M-TIBA's goal of deepening health care inclusion in Kenya is contributing to the realization of the Sustainable Development Goals. Users are encouraged to save as much as possible so that they are able to pay for health care services in full.

The estimates from the M-KOPA solar program show that current customers will save up to $375 million over the next four years on energy costs and enjoy 62.5 million kerosene-free months of lighting.

Digitization will drive better revenue administration and service delivery: The fourth benefit of digitization is improved service delivery and better revenue administration.

Kenya's eCitizen digital platform has reduced bureaucracy and improved access to government services. Through the platform, Kenyans apply for Government to Citizen (G2C) services and pay via mobile money, debit cards, and eCitizen agents. The platform provides portals that enable individuals to access government services such as business licenses, permits, and registrations; obtaining driver's licenses; processing police clearance certificates; searching for official land titles for Nairobi blocks; and applying for passports.

Another lesson from Kenya is that once the whole economy has embraced digitization, it becomes easy to re-examine the payments platform that will support tax design. The principle of an efficient tax system is that it has low costs for collection and less room for evasion. New digital tax payments platforms are efficient and limit physical interaction between the taxpayer and the tax officer.

With increased financial inclusion and more taxpayers having access to banks accounts and financial services touch points, the Kenya Revenue Authority (KRA) introduced electronic banking to expedite payment of taxes through a secure electronic payments platform in 2016. This development, together with the recent launch of iTax, has enabled single-view of a taxpayer window (one does not need to visit several counters/windows for tax assessment), improved reconciliations, matched payment and bank reports online, allowed for real time monitoring of revenue collection, and introduced system checks and audit trails.

Fulfilling Africa's agriculture potential: The role of technology

Jennifer Blanke
Vice President, Agriculture, Human and Social Development, African Development Bank

Martin Fregene @mfregene77
Advisor to the Vice President of Agriculture, Human and Social Development, African Development Bank

Agricultural technologies—improved crop varieties, fertilizers, agro-chemicals, inoculants, and crop management methods—have led to increased global food production of an impressive 3-4 percent on average over the past six decades. In all regions but Africa, crop yields have remained a step ahead of population growth, helping free the world of hunger and famine. Agricultural technologies have also helped dispel a long-held misconception that tropical regions cannot be as productive as the temperate regions of the world. Indeed, new crop varieties adapted to the tropics, combined with good soil science, turned tropical Brazil into one of the major breadbaskets of the world in a few decades. It also led to the green revolutions throughout Asia and other parts of the world. It can safely be said that agriculture as a science sustains agriculture as a business.

Yet decades after the green revolutions in other parts of the world, Africa has not managed to keep up with this trend. Less than a third of African farmers use improved crops, and fertilizer use is the lowest in the world. And the consequences are dire. One in five Africans—160 million people—still go to bed hungry at night, and a large number of children are malnourished, with one-third of Africa children moderately to severely underweight. The power of agricultural technologies to raise productivity and combat malnutrition are desperately needed.

There are some success stories, and the winds of change have started to blow. Efforts in individual countries like Ethiopia, Malawi, and Nigeria show that merely switching to modern crop varieties and modest fertilizer use doubles crop yields and reduces food and nutrition insecurity. Nutrient-dense varieties of crops are also becoming an important part of a powerful arsenal to combat the "hidden hunger" of micronutrient deficiency that robs Africa's children of their future by compromising their immune systems, sight, and cognitive abilities. Simple storage and processing technologies—including hermetically sealed bags and low-cost extruders (machines used in food processing to create uniform outputs such as pasta and breakfast cereals)—eliminate post-harvest losses and add value to the harvest.

More recently, digital technologies have started to transform the lives of small-holder farmers, offering them real-time access to market information and hassle-free direct access to subsidized inputs through efforts such as the e-wallet system, which allows African small-holder farmers to bypass decades of weak public institutions and corruption. Adding market access to these productivity-boosting technologies raises farmers' incomes and improves rural livelihoods.

In an effort to accelerate this positive momentum, the African Development Bank is rolling out efforts to rapidly expand access for small-holder farmers—the majority of whom are women—to 21st century agricultural technologies. By taking a regional and agro-ecology crop approach rather than one dictated by national borders and policies, we can deliver high yield and nutritious crop varieties of rice, maize, wheat, sorghum, millet, and cassava, and improved breeds of sheep, goat, and fish to millions of farmers, as well as combat pests and disease threats.

Ultimately, the goal is a paradigm shift from "agriculture as a way of life" to "agriculture as a business" that will foster the positive feedback loop of increased gainful employment, rising incomes, and better nutrition and quality of life throughout the continent. Technologies hold the key to making this happen.

Moreover, revenue administration through the Integrated Financial Management Information System (IFMIS), which is integrated into the Kenyan Central Bank's G-Pay system, and the use of the eCitizen technological platform has reduced paperwork and ensured direct transmission of money directly from the accounts at Central Bank of Kenya to intended recipients. Digitization has created more efficient revenue administration from the central government to county governments as well as payments to suppliers and for social protection of target groups by the government.

Also in Kenya, electronic payments platforms have supported the government's social protection programs, especially those that focus on social insurance, social assistance, and affirmative action funds targeted at youth, women, and the disabled, as well as devolved funds for constituencies and marginalized areas. The transmission of these funds to the targeted beneficiaries has been made easier by the digital financial system and without leakages.

These are just a few examples of the process of digitization where success is evident. It allows diversity of products and scalability depending on demand.

Mobile phone penetration across the continent has been unparalleled. The time is right for Africa to leverage this mobile platform to harness its digital potential and facilitate inclusive growth, efficiency, and productivity growth across all sectors of the economy. The economic and social benefits of embracing digitization are substantial.

REFERENCES

Leora Klapper and Singer, Dorothe. 2014. *The opportunities of digitizing payments*. Washington, DC : World Bank Group. http://documents.worldbank.org/curated/en/188451468336589650/The-opportunities-of-digitizing-payments.

Why technology will disrupt–and transform–Africa's agriculture sector in a good way

Simeon Ehui @simeonehui
Director, Food and Agriculture, World Bank

Agriculture is critical to some of Africa's biggest development goals. The sector is an engine of job creation: Farming alone currently accounts for about 60 percent of total employment in sub-Saharan Africa, while the share of jobs across the food system is potentially much larger. In Ethiopia, Malawi, Mozambique, Tanzania, Uganda, and Zambia, the food system is projected to add more jobs than the rest of the economy between 2010 and 2025. Agriculture is also a driver of inclusive and sustainable growth, and the foundation of a food system that provides nutritious, safe, and affordable food.

At the same time, Africa's agriculture sector is facing mounting challenges.

While agricultural productivity in Africa has picked up in recent years, it still lags behind other regions, and currently one in four people in sub-Saharan Africa is chronically undernourished. In the coming decades, Africa's food system will be further strained by a population that is projected to rise by 1.3 billion by 2050. And the food security challenge will only grow as climate change intensifies, threatening crop and livestock production. If no adaptation occurs, production of maize—which is one of Africa's staple crops—could decline by up to 40 percent by 2050. Expanding the land that is under cultivation has boosted African agricultural production in the past, but it has come at an environmental cost. Moving forward, the focus must be on intensifying production on agricultural land sustainably without harming the environment.

Clearly, business-as-usual farming is not the right way forward.

Whether it's satellites that provide accurate climate data, Internet of Things devices like smart phones, or cutting-edge innovations like blockchain, technology could be a game changer in boosting agricultural productivity and resilience in a sustainable way. The World Bank is incorporating precision technology into its agriculture projects around the world. We're exploring Internet of Things-enabled smart irrigation devices that combine automated soil water sensors and cloud-based data analytics. These devices can boost crop yields while cutting water use. In Kenya, the World Bank is deploying big data from remote sensing and GIS-enabled technologies to support the implementation of agro-weather analytics that enable accurate weather monitoring. This data will enable small holders to know how and when to apply inputs for optimal results.

All over the African continent, startups and other institutions are leveraging technology in transformative ways.

In Nigeria and Kenya, Hello Tractor is reversing the trend of low mechanization by allowing farmers to hire affordable tractors to work their land, all through their mobile phones. The start-up, which has served 22,500 farmers to date, reports a 200 percent increase in customers' yields. Solar refrigerators are helping dairy farmers in Kenya cool their milk products and reduce spoilage. About 1.2 million farmers in Ethiopia, Ghana, Malawi, and Niger are learning best farming practices through engaging videos from Digital Green—a low-cost way to deliver agriculture extension.

There's more on the horizon. The much-hyped blockchain technology could expand rural finance by making financial transactions more accessible and less expensive, and allow farmers and others throughout the value chain to manage their supply chain more efficiently.

Throughout Africa, technology-led transformation of the agriculture sector is already underway, from farm to fork. And as technology improves and becomes more widely available, disruption in agriculture promises to accelerate.

African entrepreneurship in technology: Challenges and opportunities in 2018

Chika Umeadi @ChikaUmeadi
Co-founder, tiphub

Technology entrepreneurs in Africa enter 2018 in a precarious position. Fortunately, we've seen gradual improvement in key areas. For instance, venture capital activity has grown and there are more transactions: Since 2012, venture capital has grown by a factor of 8.7 ($366,000,086 in 2016)[1] and we've seen a 40 percent year-over-year growth in deals closed.[2]

We need massive investments in decentralized, renewable, and flexible energy solutions to increase access to energy beyond urban areas.

There are also notable improvements in the ease of doing business. According to the World Bank's Doing Business 2018 Report,[3] the following African countries were among the top 10 improved nations across the globe: Nigeria, Malawi, Zambia, and Djibouti. Nigeria moved up 24 spots (from 169 to 145).

Because of the global slowdown in 2016, many African markets looked inward and set a foundation for inclusive and more sustainable growth. Specifically, they focused on macroeconomic reform, supported diversification, and emphasized domestic goods. Certain key indicators of growth have demonstrated healthy progress. Namely, there have been more venture capital deals, increased connectivity between markets and entrepreneurial ecosystems, and their macro conditions are heading in the right direction. There are major challenges, however, that require collective problem-solving to unlock the real power of technology entrepreneurship in Africa.

Increase access to capital for early-stage businesses. Foreign direct investment (FDI), venture capital, and financial products from banks are often distributed to established and later-stage companies. The lack of early-stage "market validation" capital must be addressed so that there are sufficient resources to get companies off the ground. Emerging technologies like artificial intelligence, virtual reality, and blockchain will require significant resources to get started and will lean on early-stage capital to build out teams of specialists, acquire required data, and scale technical infrastructure.

Radical solutions to energy deficiency. There's great work under way by African public and private sector stakeholders to bring energy projects to fruition and improve energy regulations and policy. However, Africa's energy needs are urgent and traditional ways of increasing electricity capacity are inherently slow. We need massive investments in decentralized, renewable, and flexible energy solutions to increase access to energy beyond urban areas and serve as a catalyst for growth in an equitable and sustainable way.

Embrace globalization while protecting indigenous industries. Aging in advanced economies and some parts of emerging Asia is weighing on global economic growth. That reality provides African countries with possibilities for

1. Partech Ventures (2017), VC funding raised by African tech startups totals a record-breaking $366.8 million in 2016. https://goo.gl/cjP5Bm At the time of publication, the total amount of venture capital investment in 2017 had not yet been reported.
2. Partech Ventures (2017), VC funding raised by African tech startups totals a record-breaking $366.8 million in 2016. https://goo.gl/cjP5Bm At the time of publication, the total volume of transactions for 2017 had not been published.
3. World Bank. 2017. Doing Business 2018: Reforming to Create Jobs. World Bank. Available at: www.doingbusiness.org.

growth and global partnerships. African governments will have to balance courting multinationals to do business in their countries while also supporting nascent indigenous technologies and industries.

Vocational and skills-based training can rapidly mobilize the job force necessary for key industries in a short period of time.

Train youth to be globally competitive. Improving access to quality education and professional outcomes is essential for long-term transformation. However, vocational and skills-based training can rapidly mobilize the job force necessary for key industries in a short period of time. Investing in education and practical and transferable skills training is an opportunity to fortify Africa's greatest asset—its people.

In the face of uncertainty and adversity, the African entrepreneur not only finds a way to make it work, but also creates solutions that shape the future of the entire continent.

At tiphub, I have had the chance to work with companies faced with some of the above-mentioned challenges and see opportunities for value creation. Companies like Gebeya prepare young adults in East Africa with 21st century skills like programming, data science, and user interface design—all skills needed to create solutions with emerging technologies. Another company, Scholarx, leverages the African diaspora and innovative financial instruments to make education more affordable for Nigerian students. Aledin Nano and Jamii Africa are two innovative companies taking traditional financial products and leveraging technology to distribute micro-lending and micro-insurance services to the masses. I've met founders who look at the energy deficiency as a massive opportunity to bring renewable and decentralized solutions to market.

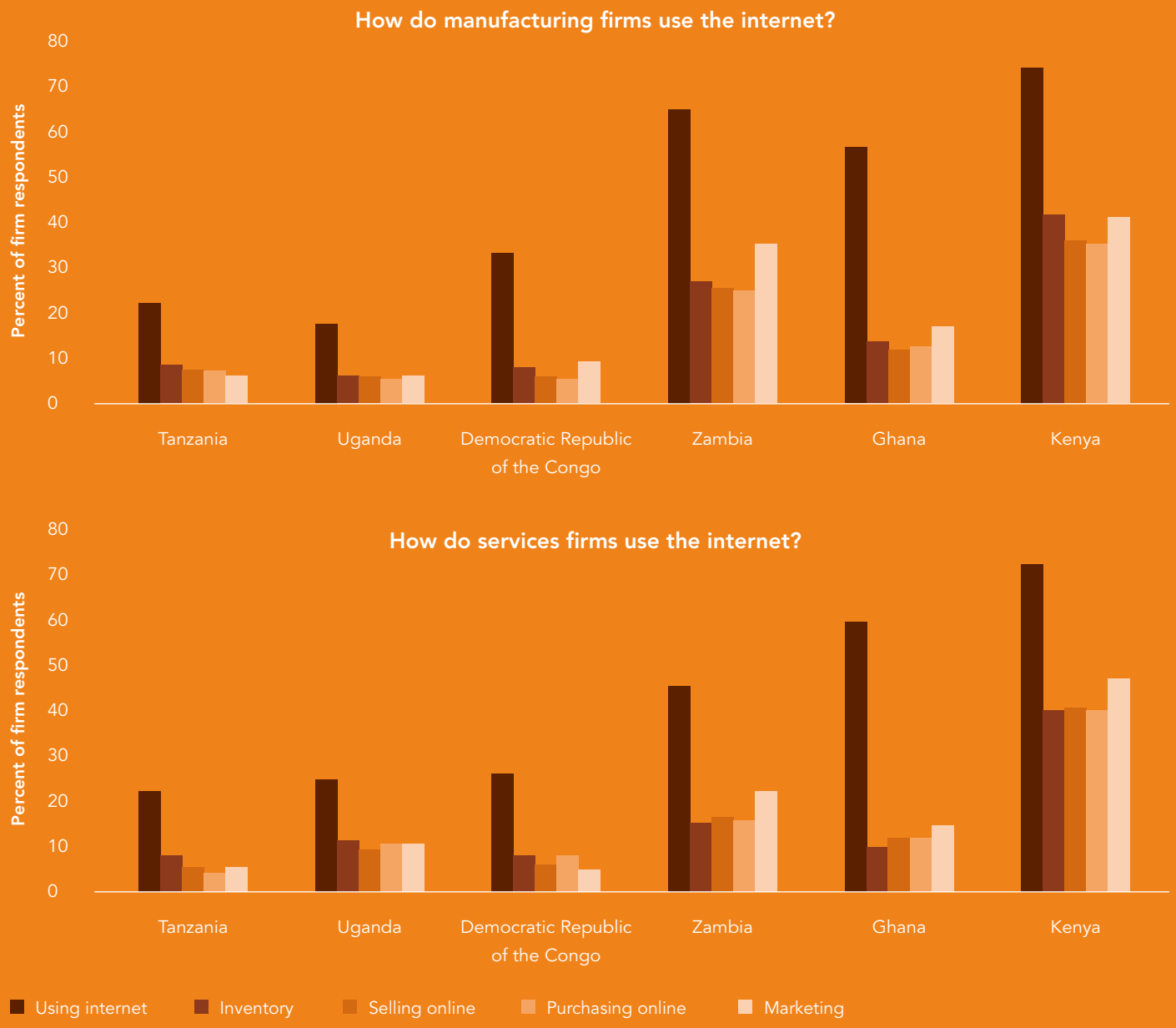
African governments will have to balance courting multinationals to do business in their countries while also supporting nascent indigenous technologies and industries.

Therein lies the key differentiator of the African entrepreneur. In the face of uncertainty and adversity, the African entrepreneur not only finds a way to make it work, but also creates solutions that shape the future of the entire continent. African entrepreneurs have the ingenuity to solve problems and they will continue to do so. Nevertheless, collaboration and coordination among companies and stakeholders like government agencies, multinationals, and non-governmental organizations can accelerate the path forward toward rapid and inclusive growth for all.

FIGURE 5.2

Firms' use of the internet varies among African countries

Both manufacturing and services firms in sub-Saharan Africa are increasingly using the internet to manage more and more tasks. Notably, though, use of the internet doesn't vary much when it comes to the sector nor the task. In fact, the country seems to play a bigger role in determining whether a firm is likely to use this technology. The graphs below show the different tasks African firms in select countries in 2014 performed using the internet.



Note: The figures show the shares of firms in the manufacturing and services sectors with at least five employees that use the internet to manage their inventory, sell their goods or services, and do marketing. The results are based on 2,843 firms (1,458 manufacturing and 1,385 service firms) in these six African countries in 2014.

Source: Cirera, Xavier; Lage, Filipe; Sabetti, Leonard. 2016. ICT Use, Innovation, and Productivity: Evidence from Sub-Saharan Africa. Policy Research Working Paper; No. 7868. World Bank.